U.S. SILICA HOLDINGS, INC.
Form 10-K
February 20, 2019

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

ý ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the Fiscal Year Ended December 31, 2018
OR
¨ TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
Commission file number 001-35416

U.S. Silica Holdings, Inc.
(Exact name of registrant as specified in its charter)

Delaware	26-3718801
(State or other jurisdiction of Incorporation or Organization)	(I.R.S. Employer Identification No.)

24275 Katy Freeway, Suite 600
Katy, Texas 77494
(Address of Principal Executive Offices) (Zip Code)
(281) 258-2170
(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Securities Act:

Title of each class:	Name of each exchange on which registered:
Common Stock, par value $0.01 per share	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Securities Act: None

Indicate by a check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes þ No ¨

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15 (d) of the Act. Yes ¨ No þ

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes þ No ¨

Indicate by check mark whether the registrant has submitted electronically and posted on its website, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes þ No ¨

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) is not contained herein, and will not be contained, to the best of the registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ¨

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	ý	Accelerated filer	¨
Non-accelerated filer	¨	Smaller reporting company	¨
		Emerging growth company	¨

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ¨

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ¨ No þ

The aggregate market value of the outstanding common stock held by non-affiliates of the registrant as of June 29, 2018, the last business day of the registrant's most recently completed second fiscal quarter, was $1,933,539,379 based on the closing price of $25.69 per share, as reported on the New York Stock Exchange, on such date.

As of February 14, 2019, 73,152,701 shares of common stock, par value $0.01 per share, of the registrant were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Certain sections of the Proxy Statement for the 2019 Annual Meeting of Shareholders for U.S. Silica Holdings, Inc. (the "2019 Proxy Statement") are incorporated by reference in Part III of this Annual Report on Form 10-K.

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Forward Looking Statements

This Annual Report on Form 10-K contains forward-looking statements within the meaning of Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act") and Section 27A of the Securities Act of 1933, as amended (the "Securities Act"). All statements other than statements of historical fact included in this Annual Report on Form 10-K are forward-looking statements. Forward-looking statements give our current expectations and projections relating to our financial condition, results of operations, plans, objectives, future performance and business. You can identify forward-looking statements by the fact that they do not relate strictly to historical or current facts. These statements may include words such as "anticipate," "estimate," "expect," "project," "plan," "intend," "believe," "may," "will," "can have," "likely" and other words and terms of similar meaning in connection with any discussion of the timing or nature of future operating or financial performance or other events. For example, all statements we make relating to our estimated and projected costs; reserve and finished products estimates; anticipated expenditures, cash flows, growth rates and financial results; our plans and objectives for future operations, growth or initiatives; strategies and their anticipated effect on our performance and liquidity; and the expected outcome or impact of pending or threatened litigation are forward-looking statements. All forward-looking statements are subject to risks and uncertainties that may cause actual results to differ materially from those that we expect, including:

- fluctuations in demand for commercial silica, diatomaceous earth, perlite, clay and cellulose;
- the cyclical nature of our customers' businesses;
- operating risks that are beyond our control, such as changes in the price and availability of transportation, transload network access, natural gas or electricity; unusual or unexpected geological formations or pressures; pit wall failures, underground roof falls or rock falls; or unanticipated ground, grade or water conditions;
- our dependence on five of our plants for a significant portion of our sales;
- the level of activity in the natural gas and oil industries;
- fluctuations in demand or prices for frac sand or the development of either effective alternative proppants or new processes to replace hydraulic fracturing;
- federal, state and local legislative and regulatory initiatives relating to hydraulic fracturing and the potential for related regulatory action or litigation affecting our customers' operations;
- our rights and ability to mine our properties and our renewal or receipt of the required permits and approvals from governmental authorities and other third parties;
- our ability to implement our capacity expansion plans within our current timetable and budget and our ability to secure demand for our increased production capacity, and the actual operating costs once we have completed the capacity expansion;
- our ability to succeed in competitive markets;
- loss of, or reduction in, business from our largest customers;
- operational, regulatory and other risks as a result of our international sales and operations;
- increasing costs or a lack of dependability or availability of transportation services and transload network access or infrastructure;
- extensive regulation of trucking services;
- our ability to recruit and retain truckload drivers;
- increases in the prices of, or interruptions in the supply of, natural gas and electricity, or any other energy sources;
- increases in the price of diesel fuel;
- diminished access to water;
- our ability to successfully complete acquisitions or integrate acquired businesses;
- our ability to make capital expenditures to maintain, develop and increase our asset base and our ability to obtain needed capital or financing on satisfactory terms;
- our substantial indebtedness and pension obligations;

- restrictions imposed by our indebtedness on our current and future operations;
- our ability to comply with contractual obligations that require us to deliver minimum amounts of frac sand, sometimes with certain quality specifications, or purchase minimum amounts of services;
- the accuracy of our estimates of mineral reserves and resource deposits;
- a shortage of skilled labor and rising costs in the mining industry;
- our ability to attract and retain key personnel;
- our ability to maintain satisfactory labor relations;
- our reliance on patents, trade secrets, trademarks, and contractual restrictions to protect our proprietary rights;
- our significant unfunded pension obligations and post-retirement health care liabilities;
- our ability to maintain effective quality control systems at our mining, processing and production facilities;
- seasonal and severe weather conditions;
- fluctuations in our sales and results of operations due to seasonality and other factors;
- interruptions or failures in our information technology systems, due to cybersecurity breaches or for other reasons;
- the impact of a terrorist attack or armed conflict;
- extensive and evolving environmental, mining, health and safety, licensing, reclamation, climate change and other regulation (and changes in their enforcement or interpretation);
- silica-related health issues and corresponding litigation;
- our ability to acquire, maintain or renew financial assurances related to the reclamation and restoration of mining property;
- the impact of the above factors and other future events on the market price and trading volume of our common stock; and
- other factors included and disclosed in Part I, Item 1A. Risk Factors, Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations and elsewhere in this Annual Report on Form 10-K.

We derive many of our forward-looking statements from our operating budgets and forecasts, which are based on many detailed assumptions. While we believe that our assumptions are reasonable, we caution that it is very difficult to predict the impact of the known factors described above, and it is impossible for us to anticipate all factors that could affect our actual results. As a result, forward-looking statements are not guarantees of future performance, and you should not place undue reliance on any forward-looking statements we make. All written and oral forward-looking statements attributable to us, or persons acting on our behalf, are expressly qualified in their entirety by these cautionary statements as well as other cautionary statements that are made from time to time in our other filings with the Securities and Exchange Commission (the "SEC"), and our other public communications. You should evaluate all forward-looking statements made in this Annual Report on Form 10-K in the context of these risks and uncertainties.

We caution you that the important factors referenced above may not contain all of the factors that are important to you. In addition, we cannot assure you that we will realize the results or developments we expect or anticipate or, even if substantially realized, that they will result in the consequences or affect us or our operations in the way we expect. The forward-looking statements included in this Annual Report on Form 10-K are made only as of the date hereof. We undertake no obligation to update or revise any forward-looking statement as a result of new information, future events or otherwise, except as otherwise required by law.

PART I

ITEM 1. BUSINESS

Unless we state otherwise, or the context otherwise requires, the terms “we,” “us,” “our,” “U.S. Silica,” “the Company,” “our business,” “our company” refer to U.S. Silica Holdings, Inc. and its consolidated subsidiaries as a combined entity.

Our Company

Business Overview

We are a performance materials company and one of the largest domestic producers of commercial silica, a specialized mineral that is a critical input into a variety of end markets. Through our acquisition of EP Minerals, LLC and its affiliated companies ("EPM"), we are an industry leader in the production of industrial minerals, including diatomaceous earth, clay (calcium bentonite and calcium montmorillonite) and perlite used as filter aids, absorbents and functional additives for a variety of industries.

During our 119-year history, we have developed core competencies in mining, processing, logistics and materials science that enable us to produce and cost-effectively deliver over 400 diversified product types to customers across our end markets. As of December 31, 2018, we operate 27 production facilities across the United States. We control 627 million tons of reserves of commercial silica, which can be processed to make 297 million tons of finished products that meet American Petroleum Institute ("API") frac sand specifications, and 56 million tons of reserves of diatomaceous earth, perlite, and clays.

Our operations are organized into two reportable segments based on end markets served and the manner in which we analyze our operating and financial performance: (1) Oil & Gas Proppants and (2) Industrial & Specialty Products. We believe our segments are complementary because our ability to sell to a wide range of customers across end markets in these segments allows us to maximize recovery rates in our mining operations, optimize our asset utilization and reduce the cyclicality of our earnings.

Acquisitions

On May 1, 2018, we completed the acquisition of all of the outstanding capital stock of EP Acquisition Parent, Inc., a Delaware corporation (“EPAP”), and the ultimate parent of EPM. Contemporaneous with the merger, EPAP was renamed EP Minerals Holdings, Inc. ("EPMH"). The consideration paid consisted of $743.2 million of cash, net of cash acquired of $19.1 million, including $0.5 million of post-closing adjustments. EPM's industrial minerals are used as filter aids, functional additives, catalysts, adsorbents and absorbents for a variety of industries including food and beverage, biofuels, automotive retail, recreational water, oil refining, edible oil, farm and home, landscape, paint and coatings, agriculture, plastics, pharmaceuticals, and insecticides. The acquisition of EPM increased our industrial materials product offering in our Industrial & Specialty Products segment.

On August 16, 2017, we completed the acquisition of Mississippi Sand, LLC ("MS Sand"). MS Sand is a frac sand mining and logistics company based in St. Louis, Missouri.

On April 1, 2017, we completed the acquisition of White Armor, a product line of cool roof granules used in industrial roofing applications.

On August 22, 2016, we completed the acquisition of Sandbox Enterprises, LLC ("Sandbox") as a “last mile” logistics solution for frac sand in the oil and gas industry.

On August 16, 2016, we completed the acquisition of New Birmingham, Inc. (“NBI”), the ultimate parent company of NBR Sand, LLC (“NBR”), a regional sand producer located near Tyler, Texas. The acquisition of NBI increased our regional frac sand product offering in our Oil & Gas Proppants segment.

See Note E - Business Combinations to our Consolidated Financial Statements in Part II, Item 8. of this Annual Report on Form 10-K for more information.

Corporate History

U.S. Silica Holdings, Inc. was incorporated under the laws of the State of Delaware on November 14, 2008. U.S. Silica Company, which has been a domestic producer of commercial silica for 119 years, became a wholly-owned subsidiary of the Company on November 25, 2008. On January 31, 2012, we completed our initial public offering of our common stock.

Our Strengths

We attribute our success to the following strengths:

- Large-scale producer with a diverse and high-quality reserve base. Our 27 geographically dispersed operating production facilities control an estimated 627 million tons of reserves, including API size frac sand and large quantities of silica with distinct characteristics, and an estimated 56 million tons of reserves of diatomaceous earth, perlite, and clays. These reserves give us the ability to sell over 400 product types to customers in both our Oil & Gas

Proppants segment and Industrial & Specialty Products segment. We believe our large-scale production, logistics capabilities and long reserve life make us a preferred supplier to our customers. Our consistent, reliable supply of reserves gives our customers the security to customize their production processes around our products.

Furthermore, our relatively large scale and wide product portfolio provide us earnings diversification and the ability to reach broader market segments.

- Geographically advantaged footprint with intrinsic transportation advantages. We believe the strategic location of our facilities and our logistics capabilities, including those obtained through strategic acquisitions discussed elsewhere in this Annual Report on Form 10-K, contribute to our customer retention rates and our ability to reach broader market segments. In our Oil & Gas Proppants segment, our network of frac sand production facilities with access to Class I rail either onsite or by truck, combined with the strategic locations of our transloads, enable us to serve every major U.S. shale basin. Additionally, our acquisition of SandBox extends our delivery capability directly to our customers' wellhead locations. We believe we are one of the few frac sand producers capable of cost-effectively delivering API grade frac sand to most of the major U.S. shale basins by on-site rail.

Additionally, due to the high weight-to-value ratio of many silica products in our Industrial & Specialty Products segment, the proximity of our facilities to our customers' facilities often results in us being their sole supplier. This advantage has enabled us to enjoy strong customer retention in this segment, with our top five Industrial & Specialty Products segment customers purchasing from us for an average of over 50 years.

Diatomaceous earth, clay, and perlite facilities are located near major highways and export corridors to optimize the cost of operations and shipment. Products can be shipped via bulk truck, rail or packaged. We utilize experienced in-house international logistics operations using a broad base of steamship partners to enable efficient and cost-effective exports to approximately 100 countries.

- Low-cost operating structure. We focus on building and operating facilities with low delivered cost to enable us to better manage through market downturns. We believe the combination of the following factors contributes to our goal of having a low-cost structure and high margins:
  - our ownership of the vast majority of our reserves, resulting in mineral royalty expense that was less than 0.1% of our sales in 2018;
  - the optimal positioning of our mines and their respective processing plants, enabling cost-efficient and highly automated production processes;
  - our processing expertise, which enables us to create over 400 product types with unique characteristics while minimizing waste;
  - our integrated logistics management expertise and geographically advantaged facility network, which enables us to reliably ship products by the most cost-effective method available, whether by truck, rail or barge, to meet the needs of our customers, whether at in-basin transload locations or directly at wellhead locations via our Sandbox operations, whether domestic or overseas;
  - our large customer base across numerous end markets, which allows us to maximize our mining recovery rate and asset utilization; and
  - our large overall and plant-level operating scale.
- Strong reputation with our customers and the communities in which we operate. We believe we have built a strong reputation during our 119-year operating history. We have a long track record of timely delivery of our products according to customer specifications, which we believe contributes to a reputation for dependability and high-quality, innovative products. We also have an extensive network of technical resources, including materials science and petroleum engineering expertise, which enables us to collaborate with our customers to develop new products and improve the performance of their existing applications. We also believe we are known in the communities in which we operate as a preferred employer and a responsible corporate citizen, which generally serves us well in hiring new employees and securing difficult to obtain permits for expansions and new facilities.
- Commitment to innovation. Our team is dedicated to continuing to develop patentable products through research and development. The acquisition of EPM has accelerated our team's research and development efforts by providing additional expertise and testing equipment, such as experience with filtration and with high temperature manufacturing processes.
- Experienced management team. The members of our senior management team bring significant experience to the dynamic environment in which we operate. Their expertise covers a range of disciplines, including industry-specific operating and technical knowledge as well as experience managing high-growth businesses. We believe we have

assembled a flexible, creative and responsive team that can quickly adapt to the rapidly evolving unconventional oil and natural gas landscape.

Our Business Strategy

The key drivers of our growth strategy include:

- Increase our presence and product offering in specialty products end markets. Our research and business development teams work to enhance our existing products, develop new products and pursue opportunities to acquire new product offerings through business acquisitions, which we expect will increase our presence and market share in certain specialty products end markets and allow us to enter new markets. We manage a robust pipeline of new products in various stages of development. On May 1, 2018, we completed the acquisition of EPM, a global producer of industrial minerals, including diatomaceous earth, clay and perlite, which increased our industrial materials product offerings.
- Optimize product mix and further develop value-added capabilities to maximize margins. We continue to actively manage our product mix at each of our plants as we seek to maximize our profit margins. This requires us to use our proprietary expertise in balancing key variables, such as mine geology, processing capacities, transportation availability, customer requirements and pricing. We expect to continue investing in ways to increase the value we provide to our customers by expanding our product offerings, improving our supply chain management, upgrading our information technology, and enhancing our customer service model.
- Effectively position our Oil & Gas Proppants facilities to optimally serve our customers. We continuously execute initiatives to increase the effectiveness and efficiency of our frac sand production facilities. Our mix of Northern White, regional, and local in-basin mines are positioned to provide a full range of frac sand products to our customers. We are also constantly undergoing continuous improvement efforts to reduce production costs at our facilities.
- Optimize our supply chain network and leverage our logistics capabilities to meet our customers' needs. We continue to strategically position our supply chain in order to deliver sand according to our customers' needs, whether at a plant, a transload or the wellhead. We believe that our supply chain network and logistics capabilities are a competitive advantage that enables us to provide superior service for our customers.

    Our acquisition of Sandbox extends our delivery capability directly to our customers' wellhead locations, which increases efficiency and provides a lower cost logistics solution for our customers. Sandbox has operations in the major United States oil and gas producing regions, including Texas, New Mexico, Oklahoma, the Rocky Mountains and the Northeast, where their largest customers are located.

We manage our transload network through partnerships rather than owned transloads because we believe this approach enables us to receive high quality service from our specialized transloading partners without the significant capital investment related to owning the assets. As of December 31, 2018, we have storage capacity at 51 transloads located near all of the major shale basins in the United States.

- Evaluate both Greenfield and Brownfield expansion opportunities and other acquisitions. We expect to continue leveraging our reputation, processing capabilities and infrastructure to increase production, as well as explore other opportunities to expand our reserve base and sell new products.

We have completed several Greenfield projects that became operational in 2018. In May 2017, we purchased a Greenfield site in Crane County, Texas, which became operational during the first quarter of 2018 and which we expect will eventually produce approximately 4 million tons of annual frac sand capacity. Additionally, in July 2017, we purchased a Greenfield site near Lamesa, Texas, which became operational during the third quarter of 2018 and which we expect will eventually produce approximately 6 million tons of annual frac sand capacity.

We are continuing to actively pursue acquisitions to grow. Our primary objective is to acquire value adding products in our Industrial & Specialty Products segment, and assets that are complementary to our current offering for our Oil & Gas Proppants segment. We prioritize acquisitions that provide opportunities to realize synergies, including entering new geographic markets, acquiring attractive customer contracts and improving operations. For example, on December 31, 2018, we completed our acquisition of a manufacturing facility located in Millen, Georgia. This facility has a kiln, which will allow for the production of specialty industrial products that require high temperature heat treatments. See the descriptions of other recent and notable acquisitions under "Business Overview-Acquisitions" above. See the risk factors disclosed in Item 1A of Part I of this Annual Report on Form 10-K for a description of certain risks related to our acquisition activities.

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Maintain financial strength and flexibility. We intend to maintain financial strength and flexibility to enable us to better manage through industry downturns and pursue acquisitions and new growth opportunities as they arise. In connection with the EPM acquisition, on May 1, 2018, we entered into a Third Amended and Restated Credit Agreement (the "Credit Agreement") with BNP Paribas, as administrative agent, and the lenders named therein. The Credit Agreement increased our then existing senior debt by establishing a new $1.380 billion senior secured credit facility, consisting of a $1.280 billion term loan (the “Term Loan”) and a $100 million revolving credit facility (the “Revolver”) (collectively the "Credit Facility) that may also be used for swingline loans or letters of credit, and we may elect to increase the term loan in accordance with the terms of the Credit Agreement. For more information on the Credit Agreement see Note K - Debt to our Consolidated Financial Statements in Part II, Item 8 of this Annual Report on Form 10-K. As of December 31, 2018, we had $202.5 million of cash on hand and $95.2 million of availability under the Revolver.

Our Products and Services

In order to serve a broad range of end markets, we produce and sell a variety of commercial silica, diatomaceous earth, clay and perlite products. We also offer services including transportation, equipment rental and contract labor.

Whole Grain Silica Products—We sell whole grain commercial silica products in a range of shapes, sizes and purity levels. We sell whole grain silica that has a round shape and high crush strength to be used as frac sand in connection with oil and natural gas recovery. We also sell whole grain silica products in a range of size distributions, grain shapes and chemical purity levels to our customers involved in the manufacturing of glass products, including a low-iron whole grain product sold to manufacturers of architectural and solar glass applications. In addition, we sell several grades of whole grain round silica to the foundry industry and provide whole grain commercial silica to the building products industry. Sales of whole grain commercial silica products accounted for approximately 64%, 72%, and 81% of our total sales for 2018, 2017, and 2016, respectively.

Ground Silica Products—Our ground commercial silica products are inherently inert, white and bright, with high purity. We market our ground silica in sizes ranging from 40 to 250 microns for use in plastics, rubber, polishes, cleansers, paints, glazes, textile fiberglass and precision castings. We also produce and market fine ground silica in sizes ranging from 5 to 40 microns for use in premium paints, specialty coatings, sealants, silicone rubber and epoxies. Our milling technology allows us to offer some of the smallest particle size ground silica products in the United States. Sales of ground silica products accounted for approximately 6%, 6%, and 12% of our total sales for 2018, 2017, and 2016, respectively.

Performance Material Products—We sell engineered performance materials made from diatomaceous earth (DE), clay and perlite. DE is used in filtration for foods and beverages, pharmaceuticals and swimming pools. DE is also used as a functional additive for paint and coatings, plastics and rubber, and agriculture. Perlite (hydrated volcanic glass) is used mainly for filtration. Calcium bentonite clay from Mississippi is used for bleaching, catalysis and adsorption in edible oil processing, aromatics purification, and industrial and chemical applications. Sales of our performance material products accounted for approximately 8% of our total sales for 2018. We had no sales of performance material products in 2017 and 2016.

Industrial Mineral Products—We also produce and sell certain other industrial mineral products, such as aplite, magnesium silicate and aggregates made with DE and clay. Aplite is a mineral used to produce container glass and insulation fiberglass and is a source of alumina that has a low melting point and a low tendency to form defects in glass. Magnesium silicate is a highly selective adsorbent made from a mixture of silica and magnesium, used extensively in preparative and analytical chromatography. DE and clay aggregates are mainly used as an absorbent for automotive, industrial and sports turf applications. Sales of our other industrial mineral products accounted for approximately 3%, 3%, and 1% of our total sales for 2018, 2017, and 2016, respectively.

Services—We offer services through the provision of transportation, equipment rental and contract labor services, primarily through SandBox, to companies in the oil and gas industry. Sales of our Services accounted for approximately19%, 19%, and 6% of our total sales for 2018, 2017, and 2016, respectively.

Our Industry

The commercial silica industry consists of businesses that are involved in the mining, processing and distribution of commercial silica. Commercial silica, also referred to as “silica,” “industrial sand and gravel,” “sand,” “silica sand” and “quartz

sand," is a term applied to sands and gravels containing a high percentage of silica (silicon dioxide, SiO_2) in the form of quartz. Commercial silica deposits occur throughout the United States, but mines and processing facilities are typically located near end markets and in areas with access to transportation infrastructure. Other factors affecting the feasibility of commercial silica production include deposit composition, product quality specifications, land-use and environmental regulation, including permitting requirements, access to electricity, natural gas and water and a producer's expertise and know-how. New entrants face hurdles to establish their operations, including the capital investment required to develop a mine and build a plant, a lack

of industry-specific mining knowledge and experience, the difficulty of obtaining operating permits, and the difficulty of assembling a diverse portfolio of customers to optimize operations.

EPM's diatomaceous earth, perlite, montmorillonite clay and bentonite clay products are sold globally, where they are used in hundreds of applications for filtration, functional additives, absorbents and adsorbents. The largest industries for these products include food and beverage, wine, beer, paint and coatings, biofuel, pharmaceuticals, chemical, oil and gas, plastics and rubber, automotive and agriculture.

Extraction Processes

Commercial silica deposits are formed from a variety of sedimentary processes and have distinct characteristics that range from hard sandstone rock to loose, unconsolidated dune sands. While the specific extraction method utilized depends primarily on the deposit composition, most silica is mined using conventional open-pit bench extraction methods and begins after clearing the deposit of any overlaying soil and organic matter. The silica deposit composition and chemical purity also dictate the processing methods and equipment utilized. For example, broken rock from a sandstone deposit may require one, two or three stages of crushing to liberate the silica grains required for most markets. Unconsolidated deposits may require little or no crushing, as silica grains are not tightly cemented together.

We conduct only surface mining operations and do not operate any underground mines, although we do lease underground reserves at our Festus, Missouri, operation, which are being mined underground by a contractor. Mining methods at our facilities include conventional hard rock mining, hydraulic mining, surface or open-pit mining of loosely consolidated silica deposits and dredge mining. Hard rock mining involves drilling and blasting in order to break up sandstone into sizes suitable for transport to the processing facility by truck, slurry or conveyor. Hydraulic mining involves spraying high-pressure water to break up loosely consolidated sandstone at the mine face. Surface or open-pit mining involves using earthmoving equipment, such as bucket loaders, to gather silica deposits for processing. Lastly, dredging involves gathering silica deposits from mining ponds and transporting them by slurry pipelines for processing. We may also use slurry pipelines in our hydraulic and open-pit mining efforts to expedite processing. Silica mining and processing typically has less of an environmental impact than the mining and processing of other minerals, in part because it uses fewer chemicals. Our processing plants are equipped to receive the mined sand, wash away impurities, eliminate oversized or undersized particles and remove moisture through a multi-stage drying process. Our 27 production facilities are located primarily in the eastern half of the United States, with operations in Alabama, Illinois, Louisiana, Michigan, Mississippi, Missouri, Nebraska, Nevada, New Jersey, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia and Wisconsin. Our acquired subsidiary, EPM, operates plants and/or mines in Nevada, Oregon, Nebraska, Tennessee, Mississippi and Arizona. Each of our facilities operates year-round, typically in shift schedules designed to optimize facility utilization in accordance with market demand. Our facilities receive regular preventative maintenance, and we make additional capital investments in our facilities as required to support customer volumes and internal performance goals. For more information related to our production facilities, see Item 2. Properties.

Freshwater diatomaceous earth (DE) deposits were formed from the compression of diatoms (single-celled algae skeletons) that are a unique species with superior characteristics for filtration and for use as functional additives. The DE is usually layered with volcanic ash and tephra and overlaid with basalt. We use conventional open-pit bench extraction methods that begin after clearing the overlaying soil and organic matter. DE may require a crushing stage before processing to remove moisture through a multi-stage drying process.

Clay deposits may contain volcanic ash, calcareous concretions, sand, or silt that are removed during mining and processing. We use conventional open-pit bench extraction methods that begin after clearing the overlaying soil and organic matter.

We believe we have broad and high-quality mineral reserves due to our strategically located mines and facilities. At December 31, 2018, we estimate that we had approximately 683 million tons of proven and probable mineral reserves. The quantity and nature of the mineral reserves at each of our properties are estimated by our mining engineers. Our mining engineers update our reserve estimates annually, making necessary adjustments for reserve usage at each location during the year and additions or reductions due to property acquisitions and dispositions, quality adjustments and mine plan updates. Before acquiring new reserves, we perform surveying, drill core analysis and other tests to

confirm the quantity and quality of the to-be acquired reserves. In some instances, we acquire the mineral rights to reserves without actually taking ownership of the properties.

Production Processes

After extracting silica ore, the silica is washed with water to remove fine impurities such as clay and organic particles. In some deposits, these fine contaminants or impurities are tightly bonded to the surface of the silica grain and require attrition scrubbing to be removed. Other deposits require the use of flotation to collect and separate contaminants from the silica. When

these contaminants are weakly magnetic, special high intensity magnets may be utilized in the process to improve the purity of the final commercial silica product. After the silica has been washed, most output is dried prior to sale.
The next step in the production process involves the classification of commercial silica products according to their chemical purity, particle shape and particle size distribution. Generally, commercial silica is produced and sold in either whole grain form or ground form. Whole grain silica generally ranges from 12 to 140 mesh. Mesh refers to the number of openings per linear inch on a sizing screen. Whole grain silica products are sold in a range of shapes, sizes and purity levels to be used in a variety of industrial applications, such as oil and natural gas hydraulic fracturing proppants, glass, foundry, building products, filtration and recreation. Some whole grain silica is further processed to ground silica of much smaller particle sizes, ranging from 5 to 250 microns. A micron is one-millionth of a meter.
After extracting diatomaceous earth (DE) ore, the DE is crushed and fed into a continuous production process consisting of wet end drying and classification, calcination through a rotary kiln, and finished end sizing. Clay undergoes a multi-step process that could include crushing, calcining, drying, screening/sizing, acid activation, flash drying, classification, milling, and roller/compaction.

Quality Control

We maintain quality standards in all of our mining and processing facilities, some of which include International Organization for Standardization ("ISO") 9001-registered quality systems. We use automated process control systems that efficiently manage the majority of the mining and processing functions, and we monitor the quality and consistency of our products by conducting hourly tests throughout the production process to detect variances. All of our major facilities operate a testing laboratory to evaluate and ensure the quality of our products and services. We also provide customers with documentation verifying that all products shipped meet customer specifications. These quality assurance functions are designed to ensure that we deliver quality products to our customers and maintain customer trust and loyalty.
In addition, we have certain company-wide quality control mechanisms. We maintain a company-wide quality assurance database that facilitates easy access and analysis of product and process data from all plants. We also have fully staffed and equipped corporate laboratories that provide critical technical expertise, analytical testing resources and application development to promote product value and cost savings. The labs consist of different departments: a foundry lab, a paint and coatings lab, an analytical lab, a minerals-processing lab and an oil and gas lab. The foundry lab is fully equipped for analyzing foundry silica based on grain size distribution, acidity, acid demand value and turbidity, which is a measure of silica cleanliness. The paint and coatings lab provides formulation, application, and testing of paints, coatings and grouts for end use in fillers and extenders as well as building products. The analytical lab performs various analyses on products for quality control assessment. The minerals processing lab models plant production processes to test variations in deposits and improve our ability to meet customer requirements. The oil and gas lab performs testing and provides in-depth analysis of all types of hydraulic fracturing proppants to verify products meet specifications, such as API size and crush strength specifications.
EPM also implemented control standards and processes that are suited for its industrial minerals production activities. For example, it has a separate team dedicated to quality that works with the research & development team and directly with plants to constantly test incoming ores and finished products.
EPM's diatomaceous earth and perlite products are classified as “Generally Recognized as Safe (GRAS)" by the United States Food and Drug Administration ("FDA") when they are used in food processing as filtration media. To best position ourselves with certain end-users, EPM filter aids and functional additives comply with the respective specifications of the U.S. Food Chemical Codex (FCC). This regulatory body focuses on food safety by maintaining strict standards on diatomaceous earth and perlite products that come in contact with food and beverage goods, and according to customer specifications.

Distribution

We ship our commercial silica products direct to our customers by truck, rail or barge and through our network of in-basin transloads. Recent trends in the oil and gas market and the expansion of our logistics footprint have resulted in more of our product volumes being transported by high-efficiency unit trains over the past two years. During 2018, we shipped 421-unit trains to both our transload sites and our customers. Our 2016 acquisition of Sandbox extended our delivery capability directly to our customers' wellhead locations, which increases efficiency and provides a lower

cost logistics solution for certain of our customers. Sandbox has operations in the major United States oil and gas producing regions, including Texas, New Mexico, Oklahoma, the Rocky Mountains and the Northeast, where their largest customers are located.

For bulk commercial silica, transportation cost represents a significant portion of the overall product cost. Generally, we utilize trucks for shipments of 200 miles or less from our plant sites and to distribute our bagged products. Given the weight-to-value ratio of most of our products, the majority of our shipments outside this 200-mile radius are by rail or barge. As a result, facility location is one of the most important considerations for producers and customers. Generally, our plant sites are

strategically located to provide access to rail and/or barge, which enables us to cost effectively send product to each of the strategic basins in North America.

We continually look to optimize our network to position product close to the point of end use. This approach is designed to allows us to provide strong customer service and positions us to take advantage of opportunistic spot market sales. As of December 31, 2018, we have 51 transload facilities strategically located in or near all major shale basins in the United States. For more information related to our transload facilities, see Item 2. Properties.

Both we and our customers lease a significant number of railcars for shipping purposes, as well as to facilitate the short-term storage of our products, particularly our frac sand products. As of December 31, 2018, we leased a fleet of 7,823 railcars, of which 1,461 cars were in storage.

In addition to bulk shipments, commercial silica products can be packaged and shipped in 50- to 100-pound bags or bulk super sacks. Bag shipments are usually made to smaller customers with batch operations, warehouse distributor locations or for ocean container shipments made overseas. The products that are shipped in bags are often higher value products, such as ground and fine.

Diatomaceous earth, clay, and perlite facilities are located near major highways and export corridors to optimize the cost of operations and shipment. Products can be shipped via bulk truck and rail. Products can also be packaged and shipped in jugs, 25- to 50-pound bags or bulk super sacks. Packaged shipment can be made via common carriers for the North/South American markets and intermodal carriers to ports for shipment overseas. We utilize experienced in-house international logistics operations using a broad base of steamship partners to enable efficient and cost-effective exports to approximately 100 countries.

Primary End Markets

The special properties of commercial silica-chemistry, purity, grain size, color, inertness, hardness and resistance to high temperatures-make it critical to a variety of industries. Commercial silica is a key input in the well completion process, specifically, in the hydraulic fracturing techniques used in unconventional oil and natural gas wells. In the industrial and specialty products end markets, stringent quality requirements must be met when commercial silica is used as an ingredient to produce thousands of everyday products, including glass, building and foundry products and metal castings, as well as certain specialty applications such high-performance glass, specialty coatings, polymer additives and geothermal energy systems. Due to the unique properties of commercial silica, we believe it is an economically irreplaceable raw material in a wide range of industrial applications.

High quality diatomaceous earth (DE) possesses superior characteristics for filtration and for functional additives. The perlite (hydrated volcanic glass) is used for filtration, lightweight construction, horticulture and insulation. The calcium
bentonite clay from Mississippi and calcium montmorillonite clay from Tennessee are thermally processed to produce powder and granular products for bleaching clays, absorbents, catalysis, and adsorbents.

Our major end markets include:

Oil and Gas Proppants

Commercial silica is used as a proppant for oil and natural gas recovery in conventional and unconventional resource plays. Unconventional oil and natural gas production requires hydraulic fracturing and other well stimulation techniques to recover oil or natural gas that is trapped in the source rock and typically involves horizontal drilling. Frac sand is pumped down oil and natural gas wells at high pressures to prop open rock fissures in order to increase the flow rate of hydrocarbons from the wells. Proppants are also used in the "refracturing" process where older wells are restimulated using newer technologies and additional frac sand as a viable and lower-cost alternative to drilling new wells. Oil and gas horizontal rig count in North America increased during 2017 and 2018, leading to more well completion activity.

Glass

Commercial silica is a critical input into and accounts for 55% to 75% of the raw materials in glass production. The glassmaking markets served by commercial silica producers include containers, flat glass, specialty glass and fiberglass. Demand typically varies within each of these end markets.

The container glass, flat glass and fiberglass end markets are generally mature end markets. Demand for container glass has historically grown in line with population growth, and we expect similar growth in the future. Flat glass and

fiberglass tend to be correlated with construction and automotive production activity. To the extent construction and domestic automotive production activity grow in the coming years, we expect that demand in these end markets will continue to increase. Some of the anticipated growth in the glass markets may be offset through the use of recycled glass.

Building Products

Commercial silica is used in the manufacturing of building products for commercial and residential construction. Whole grain commercial silica products are used in flooring compounds, mortars and grouts, specialty cements, stucco and roofing shingles. Ground commercial silica products are used by building products manufacturers in the manufacturing of certain fiberglass products and as functional extenders and to add durability and weathering properties to cementious compounds. In addition, geothermal wells,an alternative energy source, require specialized ground silica products in their well casings for effectiveness. The market for commercial silica used to manufacture building products is driven primarily by the demand in the construction markets. The historical trend for this market has been one of growth, especially in demand for cementious compounds for new construction, renovation and repair. We have seen an increase in permits and housing starts since 2012, and those gains continued in 2018. To the extent the housing market growth continues in the coming years, we expect that demand in this end market will increase.

Foundry

Commercial silica products are used in the production of molds for metal castings and in metal casting products. In addition, commercial whole grain silica is sold to coaters of foundry silica, or coated internally, who then sell their product to foundries for cores and shell casting processes. The demand for foundry silica primarily depends on the rate of automobile and light truck production, construction and production of heavy equipment such as rail cars. Over the past decade, there has been some movement of foundry supply chains to Mexico and other offshore production areas. We have experienced increases in foundry demand since 2011. During 2018, several of the foundry markets continued to see growth. To the extent production levels continue to strengthen in the coming years, we expect that demand in this end market will increase.

Chemicals

Both whole grain and ground silica products are used in the manufacturing of silicon-based chemicals, such as sodium silicate, that are used in a variety of applications, including food processing, detergent products, paper textile, specialty foundry applications and as inputs for some precipitated silicas. This end market is driven by the development of new products by the chemical manufacturers, including specialty coatings and polymer additives as well as the growth of “green” tires. We expect this end market to grow if and to the extent these manufacturers continue their product and applications development.

Fillers and Extenders

Commercial silica products are sold to producers of paints and coating products for use as fillers and extenders in architectural, industrial and traffic paints and are sold to producers of rubber and plastic for use in the production of epoxy molding compounds and silicone rubber. The commercial silica products used in this end market are most often ground silica, including finer ground classifications. The market for fillers and extenders is driven by demand in the construction and automotive production industries as well as by demand for materials in the housing remodeling industry. We have experienced increases in demand in these sectors since 2011. To the extent these industries continue to grow in the coming years, we expect demand to increase.

Filtration

Diatomaceous earth and perlite filter aid products are used to filter and purify unwanted solids from a variety of liquids including wine, beer, juice, pharmaceuticals, biofuels, swimming pools and edible oil.

Absorbents

Diatomaceous earth and montmorillonite clay are used for absorbent products used for small floor spills,large scale industrial accidents, hazardous waste spills, pet litter and in the automotive industry.

Functional Additives

A broad portfolio of diatomaceous earth, perlite, cellulose and blends of specialty minerals and fibers are used around the world as functional additives in hundreds of applications including animal feed, catalysts, cosmetics, paper mills, plastic molders, and paint and coatings.

Agriculture / Insecticide

We offer a wide variety of natural agricultural products used by farmers and ranchers. Our natural diatomaceous earth and montmorillonite clay products are mined and specifically produced for agricultural use, including fertilizer carrier, soil amendment, animal feed additive, and a range of seed-coating products to provide strength and carry nutrients.

We also offer insecticide diatomaceous earth products effective for use on crops, orchards, gardens, plants, and around the house, apartment buildings, hotels, farms, ranches, animal stalls, animal bedding, stored grains and insulation. These insecticides are effective treatments for the control of fleas and ticks, mites and other pests on pets, poultry and livestock.

Sportsfield

We offer high-performance super calcined clay solutions for sportsfields, such as a patent-pending premier infield conditioner, a drying agent and mound clay..

Bleaching Clays

Our bleaching clay products are well known for oil bleaching, color removal and purification of any edible oil including canola, soybean, coconut, palm, fish and sunflower oils, and tallow. These clays can also be effectively used for metal removal from biodiesel obtained via renewable, eco-friendly technologies.

Adsorbents

Our adsorbent products are for the purification of hydrocarbon streams to industrial gases. The comprehensive product portfolio includes adsorbent technologies for applications in industries such as chemical, gas processing, petrochemical, dimerization, and refining.

Catalytic Solutions

We produce bentonite clays that are used effectively as catalysts. A catalyst is a material that increases a chemical reaction rate without sustaining any permanent change. Solid acid catalysts are environmentally-friendly products that eliminate the need for liquid acid. These products are used in the oil and gas and chemical industries.

Our Customers

We sell our products to a variety of end markets. Our customers in the oil and gas proppants end market include major oilfield services companies and exploration and production companies that are engaged in hydraulic fracturing. Sales to the oil and gas proppants end market comprised approximately 75%, 82%, and 65% of our total sales in 2018, 2017 and 2016, respectively.

During most of our 119-year history, our primary markets have been core industrial end markets with customers engaged in the production of glass, building products, foundry products, chemicals and fillers and extenders. Our diverse customer base drives high recovery rates across our production. We also benefit from strong and long-standing relationships with our customers in each of the industrial and specialty products end markets we serve. Through our acquisition of EPM, we also serve a variety of industrial mineral markets including pool filtration, paints and plastics, absorbents and food and beverage. Sales to our industrial and specialty products end markets comprised approximately 25%, 18%, and 35% of our total sales in 2018, 2017 and 2016, respectively.

Sales to one customer in the Oil & Gas Proppant end market accounted for 15% of our total sales in 2018. Sales to two of our largest customers in the Oil & Gas Proppant end market accounted for 15% and 12% of our total sales in 2017. Sales to one of our largest customers in the Oil & Gas Proppant end market accounted for 13% of our total sales in 2016. No other customers accounted for 10% or more of our total sales in 2018, 2017 and 2016.

Competition

Both of our reportable segments operate in highly competitive markets that are characterized by a small number of large, national producers and a larger number of small, regional or local producers. According to a January 2018 publication by the United States Geological Survey, in 2017, there were 200 producers of commercial silica with a combined 340 active operations in 35 states within the United States. Competition for both of our reportable segments is based on price, consistency and quality of product, site location, distribution capability, customer service, reliability of supply, breadth of product offering and technical support. Because transportation costs are a significant portion of the total cost to customers of commercial silica (in many instances transportation costs can represent more than 50% of delivered cost), the commercial silica market is typically local, and competition from beyond the local area is limited. Notable exceptions to this are the frac sand and fillers and extenders markets, where certain product characteristics are not available in all deposits and not all plants have the requisite processing capabilities, necessitating that some products be shipped for extended distances. We compete with national producers such as Covia Holdings Corporation, Hi-Crush Partners LP and Emerge Energy Services LP. Because the markets for our products are typically local, we also compete with smaller, regional or local producers in each of the regions in which we operate. For more information regarding competition, see Item 1A. Risk Factors.

Seasonality

Our business is affected to some extent by seasonal fluctuations in weather that impact our production levels and our customers' business needs. For example, during the second and third quarters we sell more commercial silica

to our customers in the building products and recreation end markets due to increased construction activity resulting from more favorable

weather. In the first and fourth quarters, we can experience lower sales, and sometimes production levels, largely from adverse weather hampering logistical capabilities and general decreased customer activity levels.

Intellectual Property

Other than operating licenses for our mining and processing facilities, there are no third-party patents, licenses or franchises material to our business. Our intellectual property primarily consists of trade secrets, know-how and trademarks, including our name US SILICA® and products with trademarked names such as OTTAWA WHITE®, MIN-U-SIL®, MYSTIC WHITE II®, Q-ROK®, SIL-CO-SIL®, PREMIUM HICKORY®, US SILICA WHITE®, InnoProp, EP Minerals® and SANDBOX® among others. We own patents and have patent applications pending related to Sandbox, our "last mile" logistics solution. Most of the issued patents have an expiration date after August 20, 2027 with a majority of issued patents expiring after December 21, 2031. With respect to our other products, we principally rely on trade secrets, rather than patents, to protect our proprietary processes, methods, documentation and other technologies, as well as certain other business information. Although we do seek patents from time to time, patent protection requires a costly and uncertain federal registration process that would place our confidential information in the public domain. As a result, we typically utilize trade secrets to protect the formulations and processes we use to manufacture our products and to safeguard our proprietary formulations and methods. We attempt to protect our trade secrets indefinitely through the use of confidentiality agreements and other security measures, but these efforts could prove to be ineffective. See Item 1A. Risk Factors for more information.

Condition of Physical Assets and Insurance

Our business is capital intensive and requires ongoing capital investment for the replacement, modernization and/or expansion of equipment and facilities. For more information, see Part II, Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations - Liquidity and Capital Resources of this Annual Report on Form 10-K.

We maintain insurance policies against property loss and business interruption and insure against other risks that are typical in the operation of our business, in amounts that we believe to be reasonable. Such insurance, however, contains exclusions and limitations on coverage, particularly with respect to environmental liability and political risk. There can be no assurance that claims would be paid under such insurance policies in connection with a particular event. See Item 1A. Risk Factors for more information.

Commercial Team

Our commercial team consists of approximately 293 individuals responsible for all aspects of our sales process, including pricing, marketing, transportation and logistics, product development and general customer service. This necessitates a highly organized staff and extensive coordination between departments. For example, product development requires the collaboration of our market development team, sales team, our production facilities and our corporate laboratories. Our sales team interacts directly with our customers in determining their needs, our production facilities fulfill the orders and our corporate laboratories are responsible for ensuring that our products meet those needs.

Our commercial team can be divided into five units:

- Sales—Our sales team is organized by both region and end market. We have an experienced group of dedicated sales team members for the oil and gas proppants and the industrial and specialty products end markets. Our oil and gas proppants team is led out of our Katy and Houston offices and is regionally positioned in the major oil and gas markets across the United States. This staff consists of experienced experts in the use of frac proppants in the oil and gas industry. Our industrial and specialty products sales team is strategically located across the county and overseas near our major customers. As we make decisions to enter or expand our presence in certain end markets or regions, we expect we will continue to add dedicated team members to support that growth.
- Marketing—Our marketing team coordinates all of our new and existing customer outreach efforts and identifies emerging market trends and new product opportunities. This includes producing exhibits for trade shows and exhibitions, manufacturing product overview materials, participating in regional industry meetings and other trade associations and managing our advertising efforts in trade journals.
- Transportation and Logistics—Our transportation and logistics team manages domestic and international shipments and wellhead deliveries of frac sand by directing inbound and outbound rail, barge, ocean vessel and truck traffic,

supervising equipment maintenance, coordinating with freight carriers to ensure equipment availability, ensuring compliance with shipping regulations and strategically planning for future growth.

Technical—Our technical team is anchored by our industrial & specialty products laboratory in Berkeley Springs, West Virginia and our research and development laboratory in Reno, Nevada. At these facilities, we perform a variety of analyses including:

- analytical chemistry by X-Ray Fluorescence ("XRF") and Inductively Coupled Plasma ("ICP") spectroscopy;
- particle characterization by sieve, SediGraph, Brunauer, Emmett and Teller ("BET") surface area and microscopy;
- ore evaluation by mineral processing, flotation and magnetic separation;
- API frac sand evaluation, including crush resistance; and
- American Foundry Society ("AFS") green sand evaluation by various foundry sand tests.

Many other product analyses are performed locally at our 27 production facilities to support new product development, plant operations and customer quality requirements.

We also have a variety of other technical competencies including process engineering, equipment design, facility construction, maintenance excellence, environmental engineering, geology and mine planning and development. We believe effective integration of these capabilities has been a critical component of our business success and has allowed us to establish and maintain our reserve base, maximize the value of our reserves by producing and selling a wide range of products, optimize processing costs to provide strong value to customers and prioritize operating in a safe and environmentally sustainable manner.

In addition, our Reno, Nevada research and development laboratory is fully equipped with state-of-the-art research instruments. R&D and technical experts provide the following capabilities for customers:

Expert geologists and engineers for desirable ore-body and processing evaluations;

Material analysis and formulation assistance by Ph.D. chemists; and

An array of testing capabilities

Customer Service—Our customer service team is dedicated to creating an exceptional customer experience and making it easy to do business with our company. Our customer service team aims to accomplish this by consistently exceeding our customers' expectations, continually improving our performance, offering efficient and timely responses to customer needs, being available to our customers 24/7 and providing customers with personal points of contact on whom they can rely.

Employees

As of December 31, 2018, we employed a workforce of approximately 2,812 employees, the majority of whom are hourly wage plant workers living in the areas surrounding our mining facilities. The majority of our hourly employees are represented by labor unions that include the Teamsters Union; United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union; Laborers International Union of North America; Glass, Molders, Pottery, Plastics and Allied Workers International Union; Cement, Lime, Gypsum and Allied Workers' Division of International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers; and International Union of Operating Engineers A.F.L. - C.I.O. We believe that we maintain good relations with our workers and their respective unions and have not experienced any material strikes or work stoppages since 1987.

Our employees average approximately seven years of tenure with us, and we have an annual employee turnover rate of 29%, excluding the impact of reductions in workforce as part of our restructuring actions during market downturns. We believe this represents a relatively stable workforce in our industry, and that this stable workforce has directly contributed to improved process efficiencies and safety, which in turn help drive cost reductions. We believe our labor rates compare favorably to other mining and manufacturing facilities in the same geographic areas. We maintain workers' compensation coverage in amounts required by law and have no material claims pending. We also offer all full-time employees a competitive package of employee benefits, which includes medical, dental, life and disability coverage.

Regulation and Legislation

Mining and Workplace Safety

Federal Regulation

The U.S. Mine Safety and Health Administration (“MSHA”) is the primary regulatory organization governing the commercial silica industry. Accordingly, MSHA regulates quarries, surface mines, underground mines and the industrial mineral processing facilities associated with quarries and mines. The mission of MSHA is to administer the provisions of the Federal Mine Safety and Health Act of 1977 (the "Mine Act") and to enforce compliance with mandatory safety and health standards. MSHA works closely with the Industrial Minerals Association, a trade association in which we have a significant leadership role, in pursuing this mission. As part of MSHA’s oversight, representatives perform at least two unannounced inspections annually for each above-ground facility. For additional information regarding mining and workplace safety, including MSHA safety and health violations and assessments in 2018, see Item 4. Mine Safety Disclosures.

We also are subject to the requirements of the U.S. Occupational Safety and Health Act (“OSHA”) and comparable state statutes that regulate the protection of the health and safety of workers. In addition, the OSHA Hazard Communication Standard requires that information be maintained about hazardous materials used or produced in operations and that this information be provided to employees, state and local government authorities and the public. OSHA regulates the customers and users of commercial silica and provides detailed regulations requiring employers to protect employees from overexposure to silica bearing dust through the enforcement of permissible exposure limits and the OSHA Hazard Communication Standard.

Internal Controls

We adhere to a strict occupational health program aimed at controlling exposure to silica bearing dust, which includes dust sampling, a respiratory protection program, medical surveillance, training and other components. Our safety program is designed to ensure compliance with the standards of our Occupational Health and Safety Manual and MSHA regulations. For both health and safety issues, extensive training is provided to employees. We have safety committees at our plants made up of salaried and hourly employees. We perform annual internal health and safety audits and conduct annual crisis management drills to test our plants’ abilities to respond to various situations. Health and safety programs are administered by our corporate health and safety department with the assistance of plant Environmental, Health and Safety Coordinators.

Motor Carrier Regulation

Our trucking services are regulated by the U.S. Department of Transportation ("DOT"), the Federal Motor Carrier Safety Administration ("FMCSA") and by various state agencies. These regulatory authorities have broad powers, generally governing matters such as authority to engage in motor carrier operations, as well as motor carrier registration, driver hours of service, safety and fitness of transportation equipment and drivers, transportation of hazardous materials and periodic financial reporting. In addition, each driver is required to have a commercial driver’s license and may be subject to mandatory drug and alcohol testing. We may be audited periodically by these regulatory authorities to ensure that we are in compliance with various safety, hours-of-service, and other rules and regulations.

The transportation industry is subject to possible other regulatory and legislative changes (such as the possibility of more stringent environmental, climate change, security and/or occupational safety and health regulations, limits on vehicle weight and size and a mandate to implement electronic logging devices) that may affect the economics of our trucking services by requiring changes in operating practices or by changing the demand for motor carrier services or the cost of providing truckload or other transportation or logistics services.

Environmental Matters

We and the commercial silica industry in general are subject to extensive governmental regulation on, among other things, matters such as permitting and licensing requirements, plant and wildlife protection, hazardous materials, air and water emissions and environmental contamination and reclamation. A variety of state, local and federal agencies enforce this regulation.

Federal Regulation

At the federal level, we may be required to obtain permits under Section 404 of the Clean Water Act from the U.S. Army Corps of Engineers for the discharge of dredged or fill material into waters of the United States, including wetlands and streams, in connection with our operations. We also may be required to obtain permits under Section 402 of the Clean Water Act from the U.S. Environmental Protection Agency ("EPA") (or the relevant state environmental agency in states where the permit program has been delegated to the state) for discharges of pollutants into waters of the United States, including

discharges of wastewater or storm water runoff associated with construction activities. Failure to obtain these required permits or to comply with their terms could subject us to administrative, civil and criminal penalties as well as injunctive relief.

The federal Safe Drinking Water Act (the "SDWA") regulates the underground injection of substances through the Underground Injection Control Program (the "UIC Program"). Hydraulic fracturing generally has been exempt from federal regulation under the UIC Program, and the hydraulic fracturing process has been typically regulated by state or local governmental authorities. The EPA, however, has taken the position that certain aspects of hydraulic fracturing with fluids containing diesel fuel may be subject to regulation under the UIC Program, specifically as "Class II" UIC wells. In February 2014, the EPA released an interpretive memorandum to clarify UIC Program requirements under the SDWA for underground injection of diesel fuels in hydraulic fracturing for oil and gas extraction and issued technical guidance containing recommendations for EPA permit writers to consider in implementing these UIC "Class II" requirements. Among other things, the memorandum and technical guidance clarified that any owner or operator who injects diesel fuels in hydraulic fracturing for oil or gas extraction must obtain a UIC "Class II" permit before injection.

In 2012 the EPA issued final rules that included the first federal air standards for natural gas and oil wells that are hydraulically fractured, along with other requirements for several other sources of pollution in the oil and gas industry that had not been regulated at the federal level. Building on the 2012 rules, the EPA announced in May 2016 additional regulations to reduce methane and smog-forming emissions from new, modified or reconstructed sources in the oil and natural gas industry. In June 2017, the EPA issued two proposals to stay certain of these requirements and reconsider the entirety of the 2016 rules; however, the rules currently remain in effect. Also in May 2016, the EPA finalized rules regarding criteria for aggregating multiple small surface sites into a single source for air-quality permitting purposes applicable to the oil and natural gas industry.

Additionally, the EPA published in May 2014 an advance notice of proposed rulemaking regarding Toxic Substances Control Act reporting of the chemical substances and mixtures used in hydraulic fracturing. In June 2016, the EPA finalized effluent limit guidelines that waste water from shale resource extraction operations must meet before discharging to publicly owned wastewater treatment plants. Subsequently, compliance dates for certain sources have been extended by the EPA.

In 2011, a committee of the U.S. House of Representatives (the "House") and a subcommittee of the Secretary of Energy Advisory Board (the "SEAB") of the U.S. Department of Energy ("US DOE") each undertook inquiries related to the practices and effects of hydraulic fracturing, with each concluding that hydraulic fracturing created regulatory concerns and, in addition to regulations already discussed, could potentially spur further regulation of hydraulic fracturing under the SDWA or otherwise. In December 2016, the EPA issued a final assessment of the potential environmental effects of hydraulic fracturing on drinking water and groundwater that found hydraulic fracturing may in some cases result in impacts to drinking water resources. Additionally, from time to time, legislation is introduced before the U.S. Congress to provide for federal regulation of hydraulic fracturing under the SDWA and to require disclosure of the chemicals used in the hydraulic fracturing process. If this or similar legislation becomes law, the legislation could establish an additional level of federal regulation that may lead to additional permitting requirements or other operating restrictions, making it more difficult to complete natural gas and oil wells in shale formations. This could increase our customers' costs of compliance and doing business or otherwise adversely affect the hydraulic fracturing services they perform, which may negatively impact demand for our frac sand products.

In March 2015, the federal Bureau of Land Management ("BLM") published a final rule that established new or more stringent standards for hydraulic fracturing on federal and Indian land. After several rounds of litigation, BLM rescinded this rule in December 2017; however, the rescission is currently being challenged in court. BLM also issued final rules to reduce methane emissions from venting, flaring, and leaks during oil and gas operations on public lands in November 2016; however, in December 2017, BLM postponed compliance requirements for certain provisions of the 2016 methane venting rule. BLM's December 2017 delay decision is also currently being challenged in court.

The U.S. Clean Air Act and comparable state laws regulate emissions of various air pollutants through air emissions permitting programs and the imposition of other requirements. These regulatory programs may require us to install expensive emissions abatement equipment, modify our operational practices and obtain permits for our existing

operations, and before commencing construction on a new or modified source of air emissions, such laws may require us to reduce emissions at existing facilities. As a result, we may be required to incur increased capital and operating costs because of these regulations. We could be subject to administrative, civil and criminal penalties as well as injunctive relief for noncompliance with air permits or other requirements of the U.S. Clean Air Act and comparable state laws and regulations.

As part of our operations, we utilize or store petroleum products and other substances such as diesel fuel, lubricating oils and hydraulic fluid. We are subject to applicable requirements regarding the storage, use, transportation and disposal of these substances, including the relevant Spill Prevention, Control and Countermeasure requirements that the EPA imposes on us. Spills or releases may occur in the course of our operations, and we could incur substantial costs and liabilities as a result of such spills or releases, including those relating to claims for damage or injury to property and persons.

Additionally, some of our operations are located on properties that historically have been used in ways that resulted in the release of contaminants, including hazardous substances, into the environment, and we could be held liable for the remediation of such historical contamination. The Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), also known as the Superfund law, and comparable state laws impose joint and several liability, without regard to fault or legality of conduct, on classes of persons who are considered to be responsible for the release of hazardous substances into the environment. These persons include the owner or operator of the site where the release occurred and anyone who disposed or arranged for the disposal of a hazardous substance released at the site. Under CERCLA, such persons may be subject to liability for the costs of cleaning up the hazardous substances, for damages to natural resources, and for the costs of certain health studies. In addition, it is not uncommon for neighboring landowners and other third parties to file claims for personal injury and property damage allegedly caused by the hazardous substances released into the environment.

In addition, the Resource Conservation and Recovery Act ("RCRA") and comparable state statutes regulate the generation, transportation, treatment, storage, disposal and cleanup of hazardous and non-hazardous wastes. Under the auspices of the EPA, the individual states administer some or all of the provisions of RCRA, sometimes in conjunction with their own, more stringent requirements. In the course of our operations, we generate industrial solid wastes that may be regulated as hazardous wastes.

Our operations may also be subject to broad environmental review under the National Environmental Policy Act ("NEPA"). NEPA requires federal agencies to evaluate the environmental impact of all "major federal actions" significantly affecting the quality of the human environment. The granting of a federal permit for a major development project, such as a mining operation, may be considered a "major federal action" that requires review under NEPA. Therefore, our projects may require review and evaluation under NEPA. As part of this evaluation, the federal agency considers a broad array of environmental impacts, including, among other things, impacts on air quality, water quality, wildlife (including threatened and endangered species), historical and archaeological resources, geology, socioeconomics and aesthetics. NEPA also requires the consideration of alternatives to the project. The NEPA review process, especially the preparation of a full environmental impact statement, can be time consuming and expensive. The purpose of the NEPA review process is to inform federal agencies' decision-making on whether federal approval should be granted for a project and to provide the public with an opportunity to comment on the environmental impacts of a proposed project. While NEPA requires only that an environmental evaluation be conducted and does not mandate a result, a federal agency could decide to deny a permit, or impose certain conditions on its approval, based on its environmental review under NEPA, or a third party may challenge the adequacy of a NEPA review.

Federal agencies granting permits for our operations also must consider impacts to endangered and threatened species and their habitat under the Endangered Species Act. We also must comply with and are subject to liability under the Endangered Species Act, which prohibits and imposes stringent penalties for the harming of endangered or threatened species and their habitat. Federal agencies also must consider a project's impacts on historic or archaeological resources under the National Historic Preservation Act, and we may be required to conduct archaeological surveys of project sites and to avoid or preserve historical areas or artifacts.

State and Local Regulation

Because our operations are located in numerous states, we are also subject to a variety of different state and local environmental review and permitting requirements. Some states in which our projects are located or are being developed have state laws similar to NEPA; thus, our development of new sites or the expansion of existing sites may be subject to comprehensive state environmental reviews even if they are not subject to NEPA. In some cases, the state environmental review may be more stringent than the federal review. Our operations may require state law based permits in addition to federal permits, requiring state agencies to consider a range of issues, many the same as federal agencies, including, among other things, a project's impact on wildlife and their habitats, historic and archaeological sites, aesthetics, agricultural operations and scenic areas. Some states also have specific permitting and review processes for commercial silica mining operations, and states may impose different or additional monitoring or mitigation requirements than federal agencies. The development of new sites and our existing operations also are subject to a variety of local environmental and regulatory requirements, including land use, zoning, building and transportation requirements.

As demand for frac sand in the oil and natural gas industry has driven a significant increase in current and expected future production of commercial silica, some local communities have expressed concern regarding silica sand mining operations. These concerns have generally included exposure to ambient silica sand dust, truck traffic, water usage and blasting. In response, certain state and local communities have developed or are in the process of developing regulations or zoning restrictions intended to minimize dust from getting airborne, control the flow of truck traffic, significantly curtail the amount of practicable area for mining activities, provide compensation to local residents for potential impacts of mining activities and, in some cases, ban issuance of new permits for mining activities. To date, we have not experienced any material impact or disruption to our existing mining operations or planned capacity expansions as a result of these types of concerns.

We have a long history of positive engagement with the communities that surround our existing mining operations. We believe our relatively stable workforce and strong relationship with our employees help foster good relations with the communities in which we operate. Although additional regulatory requirements could negatively impact our business, financial condition and results of operations, we believe our existing operations may be less likely to be negatively impacted by virtue of our good community relations.

Planned expansion of our mining and production capacity in new communities could be more significantly impacted by increased regulatory activity. Difficulty or delays in obtaining or inability to obtain new mining permits or increased costs of compliance with future state and local regulatory requirements could have a material negative impact on our ability to grow our business. In an effort to minimize these risks, we continue to be engaged with local communities in order to grow and maintain strong relationships with residents and regulators.

Costs of Compliance

We may incur significant costs and liabilities as a result of environmental, health and safety requirements applicable to our activities. Failure to comply with environmental laws and regulations may result in the assessment of administrative, civil and criminal penalties, imposition of investigatory, cleanup and site restoration costs and liens, the denial or revocation of permits or other authorizations and the issuance of injunctions to limit or cease operations. Compliance with these laws and regulations may also increase the cost of the development, construction and operation of our projects and may prevent or delay the commencement or continuance of a given project. In addition, claims for damages to persons or property may result from environmental and other impacts of our activities.

The process for performing environmental impact studies and reviews for federal, state and local permits for our operations involves a significant investment of time and monetary resources. We cannot control the permit approval process. We cannot predict whether all permits required for a given project will be granted or whether such permits will be the subject of significant opposition. The denial of a permit essential to a project or the imposition of conditions with which it is not practicable or feasible to comply could impair or prevent our ability to develop a project. Significant opposition and delay in the environmental review and permitting process also could impair or delay our ability to develop a project. Additionally, the passage of more stringent environmental laws could impair our ability to develop new operations and have an adverse effect on our financial condition and results of operations We do not expect any material capital expenditures due to current regulatory compliance obligations.

Availability of Reports; Website Access; Other Information

Our Internet address is http://www.ussilica.com. Through “Investors” — “SEC Filings” on our home page, we make available free of charge our annual reports on Form 10-K, our quarterly reports on Form 10-Q, our proxy statements, our current reports on Form 8-K, SEC Forms 3, 4 and 5 and any amendments to those reports filed or furnished pursuant to Sections 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after we electronically file such material with, or furnish it to, the SEC. Our reports filed with the SEC are also available on its website at http://www.sec.gov.

Stockholders may also request a free copy of these documents from: U.S. Silica Holdings, Inc., attn.: Investor Relations, 24275 Katy Freeway, Suite 600, Katy, Texas 77494 or view them on our website at http://www.ussilica.com/investors.

Executive Officers of the Registrant

Bryan A. Shinn, age 57, has served as our President since March 2011 and as our Chief Executive Officer and a member of the Board since January 2012. Prior to assuming this position, Mr. Shinn was our Senior Vice President of Sales and Marketing from October 2009 to February 2011. Before joining us, Mr. Shinn was employed by the E. I. du Pont de Nemours and Company from 1983 to September 2009, where he held a variety of key leadership roles in operations, sales, marketing and business management, including Global Business Director and Global Sales Director. Mr. Shinn earned a B.S. in Mechanical Engineering from the University of Delaware.

Donald A. Merril, age 54, has served as an Executive Vice President since July 2016 and as our Chief Financial Officer since January 2013. He had previously served as our Vice President of Finance from October 2012 until his appointment as Chief Financial Officer. Previously, Mr. Merril had served as Senior Vice President and Chief

Financial Officer of Myers Industries Inc. from January 2006 through August 2012. Prior to serving at Myers Industries, Mr. Merril held the role of Vice President and Chief Financial Officer, Rubbermaid Home Products Division at Newell Rubbermaid Inc. from 2003 through 2005. Mr. Merril has a B.S. in Accounting from Miami University.

Michael L. Winkler, age 54, has served as an Executive Vice President since July 2016 and as our Chief Operating Officer since December 2013. He served as a Vice President from June 2011 until July 2016 and as our Vice President of Operations from June 2011 until December 2013. Before joining us, Mr. Winkler was Vice President of Operations for Campbell Soup Company from August 2007 to June 2011 and held various positions with Mars Inc. from 1996 to August 2007, including Plant Manager-Columbus Plant and Director of Industrial Engineering. Mr. Winkler earned a B.S. in Industrial Engineering from the University of Wisconsin-Platteville and an M.B.A. from the University of North Texas.

Bradford B. Casper, age 44, has served as an Executive Vice President since July 2016 and as our Chief Commercial Officer since May 2015. He served as our Vice President of Strategic Planning from May 2011 until his promotion to Chief Commercial Officer in May 2015. Before joining us, Mr. Casper was at Bain & Company, Inc., where he held various positions from 2002 to May 2011 in the United States, Australia and Hong Kong, most recently serving as a Principal from July 2010 to May 2011. Mr. Casper earned a B.S. in Accounting from the University of Illinois at Urbana-Champaign and an M.B.A. from the Wharton School at the University of Pennsylvania.

David D. Murry, age 57, has served as a Senior Vice President since July 2016 and as our Chief Human Resources Officer since October 2011. He served as our Vice President of Talent Management from October 2011 until July 2016. Prior to joining us, Mr. Murry was the Director of Human Resources and Talent Management for Arkema, a diversified chemicals company, from October 2005 to October 2011. He has held positions of increasing leadership with Armstrong, Dell, and Alcoa. Mr. Murry earned a B.S. in Mining Engineering from Texas A&M University and a Master of Science in Management from Antioch University.

John P. Blanchard, age 45, has served as our Senior Vice President and President, Industrial & Specialty Products since July 2016, having served as Vice President and General Manager, Industrial & Specialty Products from September 2011 until July 2016. Mr. Blanchard possesses over 20 years' experience in a variety of industries, including nonwovens, composites, building materials and pharmaceuticals. Prior to joining us, Mr. Blanchard held various positions of increasing responsibility with Johns Manville from 2005 to September 2011, including Global Business Director from December 2010 to September 2011 and Global Business Manager from February 2008 to December 2010. Mr. Blanchard earned a B.S. in Chemical Engineering from Michigan Technological University and an M.B.A. from the University of Michigan.

Billy Ray Smith, age 48, has served as a Senior Vice President and President, Oil & Gas since January 2018, having served as Vice President of Oil & Gas since joining us in March 2017. Before joining us, Mr. Smith had held various positions of increasing responsibility with Halliburton Company, a global energy services company, since 1995 including as North America Technology Director from October 2015 to March 2017, Director of North America Operations from September 2014 to October 2015, Global Technical Sales and Marketing Manager from April 2014 to September 2014 and Senior Business Development Manager of Halliburton Australia from May 2012 to April 2014. Mr. Smith earned his B.S. in Petroleum Engineering from Texas Tech University.

W. Andrew Macan, age 46, was appointed U.S. Silica's Senior Vice President, General Counsel and Corporate Secretary in October 2018. Mr. Macan oversees all aspects of U.S. Silica's legal, compliance and ethics functions. Previously, he served in roles of increasing responsibility with Axalta Coating Systems, LLC, from October 2013 until October 2018, most recently as General Counsel and Chief Compliance Officer, Americas, and The Chubb Corporation, from October 2003 until October 2013, including as Vice President, Corporate Counsel and Secretary for over 8 years. Mr. Macan began his career in private practice at Ballard Spahr LLP and Dechert LLP. Mr. Macan earned a B.A. in Government from Franklin & Marshall College and his J.D. from Emory University School of Law with distinction and Order of the Coif.

ITEM 1A. RISK FACTORS

Our operations and financial results are subject to various risks and uncertainties, including those described below and elsewhere in this Annual Report on Form 10-K. You should carefully consider the risk factors set forth below as well as the other information contained in this Annual Report on Form 10-K in connection with evaluating our business and our securities. The categorization of risks set forth below is meant to help you better understand the risks facing our business and is not intended to limit consideration of the possible effects of these risks to the listed categories, nor is it meant to imply that one category of risks is more material than another. Any adverse effects related to the risks discussed below may, and likely will, adversely affect many aspects of our business.

Additional risks and uncertainties not currently known to us or that we currently deem to be immaterial may also materially and adversely affect our stock price, business, results of operations or financial condition. Certain statements in these risk factors are forward-looking statements.

Operational Risks

Our operations are subject to the cyclical nature of our customers' businesses, and we may not be able to mitigate that risk.

The substantial majority of our customers are engaged in industries that have historically been cyclical, such as glassmaking, building products, foundry and oil and natural gas recovery. During periods of economic slowdown, our customers often reduce their production and also reduce capital expenditures by deferring or canceling pending projects. Such developments occur even among customers that are not experiencing financial difficulties.

Demand in many of the end markets for our products is driven by cyclical industries, such as construction and automotive. For example, the flat glass market depends on the automotive and commercial and residential construction and remodeling markets. The market for commercial silica used to manufacture building products is driven primarily by demand in the construction markets. The demand for foundry silica depends on the rate of automobile, light truck and heavy equipment production as well as construction. The demand for frac sand is driven by demand for oil and natural gas. When oil and natural gas prices decrease, as they did throughout 2015 and into 2016, as well as during the second half of 2018, exploration and production companies may reduce their exploration, development, production and well completion activities. The reduced level of such activities could result in a corresponding decline in the demand for frac sand and an oversupply of frac sand. In periods where sources of supply of frac sand exceed market demand, market prices for frac sand may decline and our results of operations and cash flows may decline or be volatile or otherwise adversely affected. In addition, given that silica transportation represents one of our customers' largest costs, if, in response to economic pressures, our customers choose to move their production offshore, the increased logistics costs could reduce demand for our products. Continued weakness in the industries we serve has had, and may in the future have, an adverse effect on sales of our products and our results of operations. The demand for DE, perlite, clay and cellulose is driven by agricultural, food and beverage, chemical industries, filtration, catalyst and absorbent applications. A continued or renewed economic downturn in one or more of the industries or geographic regions that we serve, or in the worldwide economy, could cause actual results of operations to differ materially from historical and expected results.

Our operations are subject to operating risks, some of which are beyond our control, that could adversely affect production levels and costs, and such risks may not be covered by insurance.

Our mining, processing and production facilities are subject to risks normally encountered in the commercial silica and earth minerals industries, many of which are not in our control. These risks include [confirm]:

- changes in the price and availability of transportation and transload network access;
- changes in the price and availability of natural gas or electricity;
- changes in the price and availability of water;
- unanticipated ground, grade or water conditions;
- unusual or unexpected geological formations or pressures;
- pit wall failures, underground roof falls or surface rock falls;
- inclement or hazardous weather conditions, including flooding, and the physical impacts of climate change;
- environmental hazards;
- industrial accidents;
- physical plant security breaches;
- changes in laws and regulations (or the interpretation thereof) related to the mining and hydraulic fracturing industries, silica dust exposure or the environment;
- nonperformance of contractual obligations;
- inability to acquire or maintain necessary permits or mining or water rights;
- restrictions on blasting operations;
- inability to obtain necessary production equipment or replacement parts;
- technical difficulties or key equipment failures;
- labor disputes, including union strikes;
- cybersecurity breaches;
- late delivery of supplies;

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- fires, explosions or other accidents; and
- facility shutdowns in response to environmental regulatory actions.

Any of these risks could result in damage to, or destruction of, our mining properties or production facilities, personal injury, environmental damage, delays in mining or processing, losses or possible legal liability. Any prolonged downtime or shutdowns at our mining properties or production facilities could have a material adverse effect on us. Not all of these risks are reasonably insurable, and our insurance coverage contains limits, deductibles, exclusions and endorsements. Our insurance coverage may not be sufficient to meet our needs in the event of loss and any such loss may have a material adverse effect on us.

Our operations are dependent on our rights and ability to mine our properties and on our having renewed or received the required permits and approvals from governmental authorities and other third parties.

We hold numerous governmental, environmental, mining and other permits, water rights and approvals authorizing operations at each of our facilities. A decision by a governmental agency or other third party to deny or delay issuing a new or renewed permit or approval, or to revoke or substantially modify an existing permit or approval, could have a material adverse effect on our ability to continue operations at the affected facility. Expansion of our existing operations is also predicated on securing the necessary environmental or other permits, water rights or approvals, which we may not receive in a timely manner or at all. In addition, our facilities are located near existing and proposed third-party industrial operations that could affect our ability to fully extract, or the manner in which we extract, the mineral deposits to which we have mining rights.

Increasing costs, a lack of dependability or availability of transportation services, transload network access or infrastructure or an oversupply of transportation services could have a material adverse effect on our business.

Because of the relatively low cost of producing commercial silica, transportation and related costs including freight charges, fuel surcharges, transloading fees, switching fees, railcar lease costs, demurrage costs and storage fees, tend to be a significant component of the total delivered cost of sales. The high relative cost of transportation related expense tends to favor manufacturers located in close proximity to the customer. In addition, when we expand our commercial silica production, we need increased transportation services and transload network access. We contract with truck, rail and barge services to move commercial silica from our production facilities to transload sites and our customers, and increased costs under these contracts could adversely affect our results of operations. In addition, we bear the risk of non-delivery under our contracts. Labor disputes, derailments, adverse weather conditions or other environmental events, an increasingly tight railcar leasing market and changes to rail freight systems could interrupt or limit available transportation services. A significant increase in transportation service rates, a reduction in the dependability or availability of transportation or transload services, or relocation of our customers' businesses to areas farther from our plants or transloads could impair our ability to deliver our products economically to our customers and to expand our markets. Further, reduced demand for commercial silica could result in railcar over-capacity, requiring us to pay railcar storage fees while, at the same time, continuing to incur lease costs for those railcars in storage, which could have a material adverse effect on our business, financial condition, results of operations, cash flows and prospects.

Seasonal and severe weather conditions could have a material adverse impact on our business.

Our business could be materially adversely affected by weather conditions. Severe weather conditions may affect our customers' operations, thus reducing their need for our products. Weather conditions may impact our operations, resulting in weather-related damage to our facilities and equipment or an inability to deliver equipment, personnel and products to job sites in accordance with contract schedules. In addition, climate change may lead to the increased frequency and severity of extreme weather events. Any such interference with our operations could force us to delay or curtail services and potentially breach our contractual obligations or result in a loss of productivity and an increase in our operating costs.

Our production process consumes large amounts of natural gas and electricity. An increase in the price or a significant interruption in the supply of these or any other energy sources could have a material adverse effect on our financial condition or results of operations.

Energy costs, primarily natural gas and electricity, represented approximately 3%, 3% and 5% of our total sales in 2018, 2017 and 2016. Natural gas is the primary fuel source used for drying in the commercial silica production

process and, as such, our profitability is impacted by the price and availability of natural gas we purchase from third parties. The price and supply of natural gas are unpredictable and can fluctuate significantly based on international, political and economic circumstances, as well as other events outside our control, such as changes in supply and demand due to weather conditions, actions by OPEC and other oil and natural gas producers, regional production patterns and environmental concerns. In addition, potential climate change regulations or carbon or emissions taxes could result in higher production costs for energy, which may be passed on to

us in whole or in part. In the past, the price of natural gas has been extremely volatile, and we believe this volatility may continue. In order to manage this risk, we may hedge natural gas prices through the use of derivative financial instruments, such as forwards, swaps and futures. However, these measures carry risk (including nonperformance by counterparties) and do not in any event entirely eliminate the risk of decreased margins as a result of natural gas price increases. A significant increase in the price of energy that is not recovered through an increase in the price of our products or covered through our hedging arrangements or an extended interruption in the supply of natural gas or electricity to our production facilities could have a material adverse effect on our business, financial condition, results of operations, cash flows and prospects.

Increases in the price of diesel fuel may adversely affect our results of operations.

Diesel fuel costs generally fluctuate with increasing and decreasing world crude oil prices, and accordingly are subject to political, economic and market factors that are outside of our control. Our operations are dependent on earthmoving equipment, railcars and tractor trailers, and diesel fuel costs are a significant component of the operating expense of these vehicles. We use earthmoving equipment in our mining operations, and we ship the vast majority of our products by either railcar or tractor trailer. To the extent that we perform these services with equipment that we own, we are responsible for buying and supplying the diesel fuel needed to operate these vehicles. To the extent that these services are provided by independent contractors, we may be subject to fuel surcharges that attempt to recoup increased diesel fuel expenses. To the extent we are unable to pass along increased diesel fuel costs to our customers, our results of operations could be adversely affected.

Diminished access to water may adversely affect our operations.

The mining and processing activities in which we engage at a number of our facilities require significant amounts of water, and some of our facilities are located in areas that are water-constrained. We have obtained water rights that we currently use to service the activities on our various properties, and we plan to obtain all required water rights to service other properties we may develop or acquire in the future. However, the amount of water that we are entitled to use pursuant to our water rights must be determined by the appropriate regulatory authorities in the jurisdictions in which we operate. Such regulatory authorities may amend the regulations regarding such water rights, increase the cost of maintaining such water rights or eliminate our current water rights, and we may be unable to retain all or a portion of such water rights. These new regulations, which could also affect local municipalities and other industrial operations, could have a material adverse effect on our operating costs and effectiveness if implemented. Such changes in laws, regulations or government policy and related interpretations pertaining to water rights may alter the environment in which we do business, which may negatively affect our financial condition and results of operations.

Certain of our contracts contain provisions requiring us to deliver minimum amounts of frac sand, sometimes with certain quality specifications, or purchase minimum amounts of services. Noncompliance with these contractual obligations may result in penalties or termination of the agreement.

In certain instances, we commit to deliver products or purchase services, under penalty of nonperformance. These obligations can require that we deliver or purchase minimum quantities of products or services, and can also require that we deliver products that meet certain specifications that a customer may designate. Our inability to meet these contract requirements may permit the counterparty to terminate the agreements, return products that fail to meet a customer’s quality specifications, or require us to pay a fee equal to the difference between the minimum amount contracted for and the amount delivered or purchased. Further, we may not be able to sell some of our products developed for one customer to a different customer because the products may be customized to meet specific customer quality specifications requirements, and even if we are able to sell these products to another customer, our margin on these products may be reduced. Moreover, any inability to deliver products that meet customer requirements could harm our relationships with these customers and our reputation generally. In such events, our business, financial condition and results of operations may be materially adversely affected.

Inaccuracies in our estimates of mineral reserves and resource deposits could result in lower than expected sales and higher than expected costs.

We base our mineral reserve and resource estimates on engineering, economic and geological data assembled and analyzed by our mining engineers, which are reviewed periodically by outside firms. However, commercial silica reserve estimates are necessarily imprecise and depend to some extent on statistical inferences drawn from available

drilling data, which may prove unreliable. There are numerous uncertainties inherent in estimating quantities and qualities of commercial silica reserves and non-reserve commercial silica deposits and costs to mine recoverable reserves, including many factors beyond our control. Estimates of economically recoverable commercial silica reserves necessarily depend on a number of factors and assumptions, all of which may vary considerably from actual results, such as:

•geological and mining conditions and/or effects from prior mining that may not be fully identified by available data or that may differ from experience;

•assumptions concerning future prices of commercial silica products, operating costs, mining technology improvements, development costs and reclamation costs; and
•assumptions concerning future effects of regulation, including the issuance of required permits and taxes by governmental agencies.

Any inaccuracy in our estimates related to our mineral reserves and non-reserve mineral deposits could result in lower than expected sales and higher than expected costs.

Failure to maintain effective quality control systems at our mining, processing and production facilities could have a material adverse effect on our business and operations.

The performance, quality and safety of our products are critical to the success of our business. These factors depend significantly on the effectiveness of our quality control systems, which, in turn, depends on a number of factors, including the design of our quality control systems, our quality-training program and our ability to ensure that our employees adhere to the quality control policies and guidelines. Any significant failure or deterioration of our quality control systems could have a material adverse effect on our business, financial condition, results of operations and reputation.

Our business and operations could suffer in the event of cybersecurity breaches, information technology system failures, or network disruptions.

We rely on our information technology systems to process transactions, summarize our operating results and manage our business. Our information technology systems are subject to damage or interruption from power outages, computer and telecommunications failures, computer viruses, cyber-attack or other security breaches, catastrophic events, such as fires, floods, earthquakes, tornadoes, hurricanes, acts of war or terrorism, and usage errors by our employees. If our information technology systems are damaged or cease to function properly, we may have to make a significant investment to fix or replace them, and we may suffer loss of critical data and interruptions or delays in our operations.

We may be the target of attempted cyberattacks, computer viruses, malicious code, phishing attacks, denial of service attacks and other information security threats. To date, cyberattacks have not had a material impact on our financial condition, results or business; however, we could suffer material financial or other losses in the future and we are not able to predict the severity of these attacks. Our risk and exposure to these matters remains heightened because of, among other things, the evolving nature of these threats, the current global economic and political environment, the outsourcing of some of our business operations, the ongoing shortage of qualified cybersecurity professionals, and the interconnectivity and interdependence of third parties to our systems.

The occurrence of a cyberattack, breach, unauthorized access, misuse, computer virus or other malicious code or other cybersecurity event could jeopardize or result in the unauthorized disclosure, gathering, monitoring, misuse, corruption, loss or destruction of confidential and other information that belongs to us, our customers, our counterparties, third-party service providers or borrowers that is processed and stored in, and transmitted through, our computer systems and networks. The occurrence of such an event could also result in damage to our software, computers or systems, or otherwise cause interruptions or malfunctions in our, our customers', our counterparties' or third parties' operations. This could result in significant losses, loss of customers and business opportunities, reputational damage, litigation, regulatory fines, penalties or intervention, reimbursement or other compensatory costs, or otherwise adversely affect our business, financial condition or results of operations. We have systems designed to prevent, but also seek to detect security incidents, but in some cases we may be unaware of an incident or its magnitude and effects. The theft, unauthorized use or publication of our intellectual property and/or confidential business information could harm our competitive position, reduce the value of our investment in research and development and other strategic initiatives or otherwise adversely affect our business.

The reliability and capacity of our information technology systems is critical to our operations and the implementation of our growth initiatives. Any material disruption in our information technology systems, or delays or difficulties in implementing or integrating new systems or enhancing current systems, could have an adverse effect on our business, and results of operations.

Mine closures entail substantial costs, and if we close one or more of our mines sooner than anticipated, our results of operations may be adversely affected.

We base our assumptions regarding the life of our mines on detailed studies that we perform from time to time, but our studies and assumptions do not always prove to be accurate. If we close any of our mines sooner than expected, sales will decline unless we are able to increase production at any of our other mines, which may not be possible. The closure of an open pit mine also involves significant fixed closure costs, including accelerated employment legacy costs, severance-related

obligations, reclamation and other environmental costs and the costs of terminating long-term obligations, including energy contracts and equipment leases. We accrue for the costs of reclaiming open pits, stockpiles, tailings ponds, roads and other mining support areas over the estimated mining life of our property. If we were to reduce the estimated life of any of our mines, the fixed mine closure costs would be applied to a shorter period of production, which would increase production costs per ton produced and could materially and adversely affect our results of operations and financial condition.

Applicable statutes and regulations require that mining property be reclaimed following a mine closure in accordance with specified standards and an approved reclamation plan. The plan addresses matters such as removal of facilities and equipment, re-grading, prevention of erosion and other forms of water pollution, re-vegetation and post-mining land use. We may be required to post a surety bond or other form of financial assurance equal to the cost of reclamation as set forth in the approved reclamation plan. The establishment of the final mine closure reclamation liability is based on permit requirements and requires various estimates and assumptions, principally associated with reclamation costs and production levels. If our accruals for expected reclamation and other costs associated with mine closures for which we will be responsible were later determined to be insufficient, our business, results of operations and financial condition would be adversely affected.

Risks Related to Market, Competition, & Sales

The demand for commercial silica, diatomaceous earth (DE), perlite, clay and cellulose fluctuates, and changes in demand mix among our products could impact our profitability, all of which could adversely affect our results of operations.

Demand for our products, as well as the demand in the end markets served by our customers is influenced by many factors, including the following:

- demand for oil, natural gas and petroleum products;
- fluctuations in energy, fuel, oil and natural gas prices and the availability of such fuels;
- our ability to successfully implement price increases and surcharges;
- fluctuations in currency;
- the use of alternative proppants, such as ceramic proppants, in the hydraulic fracturing process;
- global and regional economic, political and military events and conditions;
- changes in residential and commercial construction demands, driven in part by fluctuating interest rates and demographic shifts;
- demand for automobiles and other vehicles;
- substitution for diatomaceous earth, perlite and clay;
- inclement or hazardous weather conditions, including flooding, and the physical impacts of climate change;
- the substitution of plastic or other materials for glass;
- changes in trade agreements and/or tariffs for qualifying imports and exports;
- the use of recycled glass in glass production;
- competition from offshore producers of glass products;
- changes in demand for our products due to technological innovations, including the development and use of new processes for oil and gas production that do not require proppants;
- changes in laws and regulations (or the interpretation thereof) related to the mining and hydraulic fracturing industries, silica dust exposure or the environment;
- overall tax rate of the business, which may be affected by a number of factors, including the use of tax attributes and the financial results of our international subsidiaries;
- prices, availability and other factors relating to our products; and
- increases in costs of labor and labor strikes.

We cannot predict or control the factors that affect demand for our products. Negative developments in the above factors, among others, could cause the demand for commercial silica, DE, perlite, clay, cellulose or other minerals to decline, which could have a material adverse effect our business, financial condition, results of operations, cash flows and prospects.

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A significant portion of our sales is generated at five of our plants. Any adverse developments at any of those plants or in the end markets those plants serve could have a material adverse effect on our financial condition and results of operations.

A significant portion of our sales are generated at our plants located in Ottawa, Illinois; Sparta, Wisconsin; Mill Creek, Oklahoma; Utica, Illinois; and Festus, Missouri. These plants represented a combined 38%, 51%, and 51% of our total sales in 2018, 2017 and 2016, respectively. Any adverse development at these plants or in the end markets these plants serve, including adverse developments due to catastrophic events or weather, decreased demand for commercial silica products, a decrease in the availability of transportation services or adverse developments affecting our customers, could have a material adverse effect on our financial condition and results of operations.

Our business and financial performance depend on the level of activity in the oil and natural gas industries.

Our operations that produce frac sand are materially dependent on the levels of activity in natural gas and oil exploration, development and production. More specifically, the demand for the frac sand we produce is closely related to the number of natural gas and oil wells completed in geological formations where sand-based proppants are used in fracture treatments. These activity levels are affected by both short- and long-term trends in natural gas and oil prices. In recent years, natural gas and oil prices and, therefore, the level of exploration, development and production activity, have experienced significant fluctuations. Worldwide economic, political and military events, including war, terrorist activity, events in the Middle East and initiatives by the Organization of the Petroleum Exporting Countries ("OPEC"), have contributed, and are likely to continue to contribute, to price volatility. Additionally, warmer than normal winters in North America and other weather patterns may adversely impact the short-term demand for natural gas and, therefore, demand for our products. Reduction in demand for natural gas to generate electricity could also adversely impact the demand for frac sand. A prolonged reduction in natural gas and oil prices would generally depress the level of natural gas and oil exploration, development, production and well completion activity and result in a corresponding decline in the demand for the frac sand we produce. Such a decline could result in us selling fewer tons of frac sand at lower prices or selling lower priced products, which would have a material adverse effect on our results of operations and financial condition. When demand for frac sand increases, there may not be a corresponding increase in the prices for our products or our customers may not switch back to higher priced products, which could have a material adverse effect on our results of operations and financial condition. In addition, any future decreases in the rate at which oil and natural gas reserves are discovered or developed, whether due to increased governmental regulation, limitations on exploration and drilling activity or other factors, could have a material adverse effect on our business, even in a stronger natural gas and oil price environment.

We may be adversely affected by decreased demand for frac sand or the development of either effective alternative proppants or new processes to replace hydraulic fracturing.

Frac sand is a proppant used in the completion and re-completion of natural gas and oil wells through hydraulic fracturing. Frac sand is the most commonly used proppant and is less expensive than ceramic proppant, which is also used in hydraulic fracturing to stimulate and maintain oil and natural gas production. A significant shift in demand from frac sand to other proppants, such as ceramic proppants, could have a material adverse effect on our financial condition and results of operations. The development and use of other effective alternative proppants, or the development of new processes to replace hydraulic fracturing altogether, could also cause a decline in demand for the frac sand we produce and could have a material adverse effect on our financial condition and results of operations.

Our future performance will depend on our ability to succeed in competitive markets, and on our ability to appropriately react to potential fluctuations in demand for and supply of our products.

We operate in a highly competitive market that is characterized by a small number of large, national producers and a larger number of small, regional or local producers. Competition in the industry is based on price, consistency and quality of product, site location, distribution capability, customer service, reliability of supply, breadth of product offering and technical support. Because transportation costs are a significant portion of the total cost to customers of commercial silica (in many instances transportation costs can represent more than 50% of delivered cost), the commercial silica market is typically local, and competition from beyond the local area is limited. Notable exceptions to this are the frac sand and fillers and extenders markets, where certain product characteristics are not available in all deposits and not all plants have the requisite processing capabilities, necessitating that some products be shipped for

extended distances.

We compete with national producers such as Covia Holdings Corporation, Hi-Crush Partners LP and Emerge Energy Services LP. Our competitors may have greater financial and other resources than we do, may develop technology superior to ours or may have production facilities that are located closer to key customers than ours.

Because the markets for our products are typically local, we also compete with smaller, regional or local producers. There typically is an increasing number of small producers servicing the frac sand market when there is increased demand for

hydraulic fracturing services. If demand for hydraulic fracturing services decreases and the supply of frac sand available in the market increases, prices in the frac sand market could continue to materially decrease as less-efficient producers exit the market, selling frac sand at below market prices. Furthermore, our competitors may choose to consolidate, which could provide them with greater financial and other resources than us and negatively impact demand for our frac sand products. In addition, oil and natural gas exploration and production companies and other providers of hydraulic fracturing services could acquire their own frac sand reserves, expand their existing frac sand production capacity or otherwise fulfill their own proppant requirements, and existing or new frac sand producers could add to or expand their frac sand production capacity, which would negatively impact demand for our frac sand products. We may not be able to compete successfully against either our larger or smaller competitors in the future, and competition could have a material adverse effect on our business, financial condition, results of operations, cash flows and prospects.

If our customers delay or fail to pay a significant amount of our outstanding receivables, it could have a material adverse effect on our liquidity, consolidated results of operations, and financial condition.

We bill our customers for our products in arrears and are, therefore, subject to our customers delaying or failing to pay our invoices. In weak economic environments, we may experience increased delays or failures due to, among other reasons, a reduction in our customers' cash flow from operations and their access to the credit markets. If our customers delay or fail to pay us a significant amount of our outstanding receivables, it could have a material adverse effect on our liquidity, consolidated results of operations, and financial condition.

Some of our customers may experience financial difficulties, including insolvency. If a customer cannot provide us with reasonable assurance of payment, we will fully reserve the outstanding accounts receivable balance for the customer and only recognize revenue when we collect payment for our products shipped, assuming all other criteria for revenue recognition have been met. Although we will continue to try to obtain payments from these customers, it is likely that one or more of these customers will not pay us for our products. With respect to customers that are in bankruptcy proceedings, we similarly may not be able to collect sums owed to us by these customers and we also may be required to refund pre-petition amounts paid to us during the preference period (typically 90 days) prior to the bankruptcy filing.

A large portion of our sales is generated by our top ten customers, and the loss of, or a significant reduction in purchases by our largest customers could adversely affect our operations.

Our ten largest customers accounted for approximately 48%, 58% and 52% of total sales during the year ended December 31, 2018, 2017 and 2016, respectively. As of December 31, 2018, we had twenty-one long-term, competitively-bid minimum purchase supply agreements in the Oil & Gas Proppants segment with initial terms expiring between 2019 and 2034, including 10 that expire between 2018 and 2020. While some of our largest customers have entered into supply agreements with us, these customers may not continue to purchase the same levels of our commercial silica products in the future due to a variety of reasons, contract requirements notwithstanding. For example, some of our top customers could go out of business or, alternatively, be acquired by other companies that purchase the same products and services provided by us from other third-party providers. Our customers could also seek to capture and develop their own sources of commercial silica. If any of our major customers substantially reduces or altogether ceases purchasing our commercial silica products, depending on market conditions, we could suffer a material adverse effect on our business, financial condition, results of operations, cash flows and prospects.

In addition, the long-term minimum purchase supply agreements may negatively impact our results of operations.

Some of our long-term agreements are for sales at fixed prices that are adjusted only for certain cost increases. As a result, in periods with increasing prices, our sales could grow at a slower rate than industry spot prices.

Our sales and profitability fluctuate on a seasonal basis and are affected by a variety of other factors.

Our sales and profitability from period to period are affected by a variety of factors, including actions of competitors, changes in general economic conditions, weather conditions and seasonal periods. As a result, our results of operations may fluctuate on a quarterly basis and relative to corresponding periods in prior years. For example, we sell more of our products in the second and third quarters in the building products and recreation end markets due to the seasonal rise in construction driven by more favorable weather conditions. Conversely, we sell fewer of our products in the first and fourth quarters due to reduced construction and recreational activity largely as a result of adverse

weather conditions. Any unanticipated decrease in demand for our products during the second and third quarters could have a material adverse effect on our overall sales and profitability. Moreover, our performance may also fluctuate from period to period in unpredictable ways as a result of the non-seasonal factors described above or other factors, such as changes in market or industry conditions. Many of these factors cannot be foreseen or are outside of our control. These fluctuations in our operating results may render period-to-period comparisons less meaningful, and investors in our securities should not rely on the results of any one period as an indicator of performance in any other period. Additionally, these fluctuations could cause our performance in any period to fall below the financial

guidance we have provided to the public or the estimates and projections of the investment community, which could negatively affect the price of our common stock.

We face risks as a result of our international sales and business operations.

We derived approximately 4% of our consolidated sales from sales outside of the United States in 2018. Our ability to sell our products and conduct our operations outside of the United States is subject to a number of risks, including, among others:

•local economic, political and labor conditions in each country could adversely affect demand for our products or disrupt our operations in these markets, particularly when local political and economic conditions are unstable;
•international sales and operations are subject to currency exchange fluctuations, fund transfer and trade restrictions and import/export duties, which are subject to increased uncertainty as a result of the trade policies of the current Administration regarding existing and proposed trade agreements, the ability to import and export goods, and newly imposed tariffs on a number of goods that could impact our operations;
•international operations are subject to foreign regulatory requirements and issues, including with respect to environmental, employee and other matters;
•operating in several geographic territories subjects us to challenges complying with the laws and regulations of multiple jurisdictions, which can vary substantially;
•certain jurisdictions offer limited intellectual property protections relative to the United States; and
•we may have difficulty enforcing agreements and collecting accounts receivable through a foreign country's legal system.

Any of these matters could result in sudden, and potentially prolonged, changes in demand for our products, limit our international operations, increase our costs or expose us to fines or other legal sanctions or damages, any of which would negatively impact our business and financial condition.

Legal & Compliance Risks

Federal, state and local legislative and regulatory initiatives relating to hydraulic fracturing and the potential for related regulatory action or litigation could result in increased costs and additional operating restrictions or delays for our customers, which could negatively impact our business, financial condition and results of operations.

A significant portion of our business supplies frac sand to hydraulic fracturing operators in the oil and natural gas industry. Although we do not directly engage in hydraulic fracturing activities, our customers purchase our frac sand for use in their hydraulic fracturing operations. Increased regulation of hydraulic fracturing may adversely impact our business, financial condition and results of operations. There is significant federal oversite by the EPA, BLM, and the US DOE.

Additionally, various state, local and foreign governments have implemented, or are considering, increased regulatory oversight of hydraulic fracturing through additional permitting requirements, operational restrictions, disclosure requirements and temporary or permanent bans on hydraulic fracturing. A number of local municipalities across the United States have instituted measures resulting in temporary or permanent bans on or otherwise limiting or delaying hydraulic fracturing in their jurisdictions. Such moratoriums and bans could make it more difficult to conduct hydraulic fracturing operations and increase our customers' cost of doing business, which could negatively impact demand for our frac sand products. A number of states have also enacted legislation or issued regulations which impose various disclosure requirements on hydraulic fracturing operators. The availability of information regarding the constituents of hydraulic fracturing fluids could make it easier for third parties opposing the hydraulic fracturing process to initiate individual or class action legal proceedings based on allegations that specific chemicals used in the hydraulic fracturing process could adversely affect groundwater and drinking water supplies or otherwise cause harm to human health or the environment. Moreover, disclosure to third parties or to the public, even if inadvertent, of our customers' proprietary chemical formulas could diminish the value of those formulas and result in competitive harm to our customers, which could indirectly impact our business, financial condition and results of operations.

The adoption of new laws or regulations at the federal, state, local or foreign levels imposing reporting obligations on, or otherwise limiting or delaying, the hydraulic fracturing process could make it more difficult to complete natural gas and oil wells in shale formations, increase our customers' costs of compliance and doing business and otherwise adversely affect the hydraulic fracturing services they perform, which could negatively impact demand for our frac

sand products. In addition, heightened political, regulatory and public scrutiny of hydraulic fracturing practices could potentially expose us or our customers to increased legal and regulatory proceedings, and any such proceedings could be time-consuming, costly or result in substantial legal liability or significant reputational harm. Any such developments could have a material adverse effect on our business, financial condition and results of operations, whether directly or indirectly. For example, we could be directly

affected by adverse litigation involving us, or indirectly affected if the cost of compliance limits the ability of our customers to operate in the geographic areas we serve.

Title to, and the area of, mineral properties and water rights may also be disputed. Mineral properties sometimes contain claims or transfer histories that examiners cannot verify. A successful claim that we do not have title to one or more of our properties or lack appropriate water rights could cause us to lose any rights to explore, develop and extract any minerals on that property, without compensation for our prior expenditures relating to such property. Our business may suffer a material adverse effect in the event one or more of our properties are determined to have title deficiencies.

In some instances, we have received access rights or easements from third parties, which allow for a more efficient operation than would exist without the access or easement. A third party could take action to suspend the access or easement, and any such action could be materially adverse to our results of operations or financial condition.

See Part I, Item 1. Our Business - Regulation and Legislation, in this Annual Report on Form 10-K.

We and our customers are subject to extensive environmental and health and safety regulations which impose, and will continue to impose, significant costs and liabilities. In addition, future regulations, or more stringent enforcement of existing regulations, could increase those costs and liabilities, which could adversely affect our results of operations.

We are subject to a variety of federal, state and local regulatory environmental requirements affecting the mining and mineral processing industry, including among others, those relating to employee health and safety, environmental permitting and licensing, air and water emissions, greenhouse gas emissions, water pollution, waste management, remediation of soil and groundwater contamination, land use, reclamation and restoration of properties, hazardous materials and natural resources. These laws, regulations and permits have had, and will continue to have, a significant effect on our business. Some environmental laws impose substantial penalties for noncompliance, and others, such as CERCLA, impose strict, retroactive and joint and several liability for the remediation of releases of hazardous substances. Liability under CERCLA, or similar state and local laws, may be imposed as a result of conduct that was lawful at the time it occurred or for the conduct of, or conditions caused by, prior operators or other third parties. Failure to properly handle, transport, store or dispose of hazardous materials or otherwise conduct our operations in compliance with environmental laws could expose us to liability for governmental penalties, cleanup costs and civil or criminal liability associated with releases of such materials into the environment, damages to property or natural resources and other damages, as well as potentially impair our ability to conduct our operations. In addition, future environmental laws and regulations could restrict our ability to expand our facilities or extract our mineral deposits or could require us to acquire costly equipment or to incur other significant expenses in connection with our business. Future events, including changes in any environmental requirements (or their interpretation or enforcement) and the costs associated with complying with such requirements, could have a material adverse effect on us.

Any failure by us to comply with applicable environmental laws and regulations may cause governmental authorities to take actions that could adversely impact our operations and financial condition, including:

•issuance of administrative, civil and criminal penalties;
•denial, modification or revocation of permits or other authorizations;
•imposition of injunctive obligations or other limitations on our operations, including cessation of operations; and
•requirements to perform site investigatory, remedial or other corrective actions.

Moreover, environmental requirements, and the interpretation and enforcement thereof, change frequently and have tended to become more stringent over time. For example, greenhouse gas emission regulation is becoming more rigorous. We expect to be required to report annual greenhouse gas emissions from our operations to the EPA, and additional greenhouse gas emission related requirements at the supranational, federal, state, regional and local levels are in various stages of development. The U.S. Congress has considered, and may adopt in the future, various legislative proposals to address climate change, including a nationwide limit on greenhouse gas emissions. In addition, the EPA has issued regulations, including the “Tailoring Rule,” that subject greenhouse gas emissions from certain stationary sources to the Prevention of Significant Deterioration and Title V provisions of the federal Clean Air Act. Any such regulations could require us to modify existing permits or obtain new permits, implement additional pollution control technology, curtail operations or increase significantly our operating costs. Any regulation of

greenhouse gas emissions, including, for example, through a cap-and-trade system, technology mandate, emissions tax, reporting requirement or other program, could adversely affect our business, financial condition, reputation, operating performance and product demand.

In addition to environmental regulation, we are subject to laws and regulations relating to human exposure to crystalline silica. Several federal and state regulatory authorities, including MSHA and OSHA, may continue to propose changes in their regulations regarding workplace exposure to crystalline silica, such as permissible exposure limits and required controls and personal protective equipment. For instance, in June 2016, OSHA issued final regulations that will reduce permissible exposure

limits to 50 micrograms of respirable crystalline silica per cubic meter of air, averaged over an 8-hour day.

We may not be able to comply with any new laws and regulations that are adopted, and any new laws and regulations could have a material adverse effect on our operating results by requiring us to modify our operations or equipment or shut down some or all of our plants. Additionally, our customers may not be able to comply with any new laws and regulations, and any new laws and regulations could have a material adverse effect on our customers by requiring them to shut down old plants or to relocate plants to locations with less stringent regulations farther away from our facilities. We cannot at this time reasonably estimate our costs of compliance or the timing of any costs associated with any new laws and regulations, or any material adverse effect that any new standards will have on our customers and, consequently, on our operations.

We are subject to various lawsuits relating to the actual or alleged exposure of persons to silica. See the risk factor discussing silica-related health issues and litigation below for more information about these risks.

We are subject to the Mine Act, which imposes stringent health and safety standards on numerous aspects of our operations.

Our operations are subject to the Mine Act, as amended by the Mine Improvement and New Emergency Response Act of 2006, which imposes stringent health and safety standards on numerous aspects of mineral extraction and processing operations, including the training of personnel, operating procedures, operating equipment and other matters. Our failure to comply with such standards, or changes in such standards or the interpretation or enforcement thereof, could have a material adverse effect on our business and financial condition or otherwise impose significant restrictions on our ability to conduct mineral extraction and processing operations.

We and our customers are subject to other extensive regulations, including licensing, plant and wildlife protection and reclamation regulation, which impose, and will continue to impose, significant costs and liabilities. In addition, future regulations, or more stringent enforcement of existing regulations, could increase those costs and liabilities, which could adversely affect our results of operations.

In addition to the regulatory matters described above, we and our customers are subject to extensive governmental regulation on matters such as permitting and licensing requirements, plant and wildlife protection, wetlands protection, reclamation and restoration of mining properties after mining is completed, the discharge of materials into the environment and the effects that mining and hydraulic fracturing have on groundwater quality and availability.

Our future success depends, among other things, on the quantity of our commercial silica and other mineral deposits and our ability to extract these deposits profitably, and our customers being able to operate their businesses as they currently do.

In order to obtain permits and renewals of permits in the future, we may be required to prepare and present data to governmental authorities pertaining to the impact that any proposed exploration or production activities may have on the environment. Certain approval procedures may require preparation of archaeological surveys, endangered species studies and other studies to assess the environmental impact of new sites or the expansion of existing sites. Compliance with these regulatory requirements is expensive and significantly lengthens the time needed to develop a site. Finally, obtaining or renewing required permits is sometimes delayed or prevented due to community opposition and other factors beyond our control. The denial of a permit essential to our operations or the imposition of conditions with which it is not practicable or feasible to comply could impair or prevent our ability to develop or expand a site. Significant opposition to a permit by neighboring property owners, members of the public or other third parties or delay in the environmental review and permitting process also could impair or delay our ability to develop or expand a site. New legal requirements, including those related to the protection of the environment, could be adopted that could materially adversely affect our mining operations (including our ability to extract mineral deposits), our cost structure or our customers' ability to use our commercial silica products. Such current or future regulations could have a material adverse effect on our business and we may not be able to obtain or renew permits in the future.

Our trucking services are highly regulated, and increased direct and indirect costs of compliance with, or liability for violation of, existing or future regulations could have a material adverse effect on our business.

The DOT and various state agencies exercise broad powers over our trucking services, generally governing matters including authorization to engage in motor carrier service, equipment operation, safety, and financial reporting. In the future, we may become subject to new or more restrictive regulations, such as regulations relating to engine exhaust

emissions, hours of service that our drivers may provide in any one-time period, security and other matters, which could substantially impair equipment productivity and increase our costs. In addition, our operations most comply with the Fair Labor Standard Act, which governs such matters as wages and overtime, and which is administered by the Department of Labor ("DOL"). We may be audited periodically by the DOT or the DOL to ensure that we are in compliance with various safety, hours-of-service, wage and other rules and regulations. If we were found to be out of compliance, the DOT or the DOL could restrict or otherwise impact our trucking services, which would adversely affect our profitability and results of operations.

Silica-related health issues and litigation could have a material adverse effect on our business, reputation or results of operations.

The inhalation of respirable crystalline silica is associated with the lung disease silicosis. There is evidence of an association between crystalline silica exposure or silicosis and lung cancer and a possible association with other diseases, including immune system disorders such as scleroderma. These health risks have been, and may continue to be, a significant issue confronting the commercial silica industry. Concerns over silicosis and other potential adverse health effects, as well as concerns regarding potential liability from the use of silica, may have the effect of discouraging our customers' use of our silica products. The actual or perceived health risks of mining, processing and handling silica could materially and adversely affect silica producers, including us, through reduced use of silica products, the threat of product liability or employee lawsuits, increased scrutiny by federal, state and local regulatory authorities of us and our customers or reduced financing sources available to the commercial silica industry.

Since at least 1975, we and/or our predecessors have been named as a defendant, usually among many defendants, in numerous products liability lawsuits brought by or on behalf of current or former employees of our customers alleging damages caused by silica exposure. As of December 31, 2018, there were 74 active silica-related products liability claims pending in which U.S. Silica is a defendant. Almost all of the claims pending against us arise out of the alleged use of our silica products in foundries or as an abrasive blast media, involve various other defendants and have been filed in the states of Texas, Louisiana and Mississippi, although some cases have been brought in many other jurisdictions over the years.

Prior to the fourth quarter of 2012, we had insurance policies for both our predecessors that covered certain claims for alleged silica exposure for periods prior to certain dates in 1985 and 1986 (with respect to various insurance). As a result of a settlement with a former owner and its insurers in the fourth quarter of 2012, some of these policies are no longer available to us and we will not seek reimbursement for any defense costs or claim payments from these policies. Other insurance policies, however, continue to remain available to us and will continue to make such payments on our behalf. The silica-related litigation brought against us to date and associated litigation costs, settlements and verdicts have not resulted in a material liability to us to date. However, we continue to have silica exposure claims filed against us, including claims that allege silica exposure for periods not covered by insurance, and the costs, outcome and impact to us of any pending or future claims is not certain. Any such pending or future claims or inadequacies of our insurance coverage could have a material adverse effect on our business, reputation, financial condition, results of operations, cash flows and prospects. For further information, see Item 3. Legal Proceedings.

Due to the international nature of our business we could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act, similar worldwide anti-bribery laws, and various international trade and import/export laws.

The U.S. Foreign Corrupt Practices Act ("FCPA") and similar anti-bribery laws in other jurisdictions generally prohibit U.S. based companies and their intermediaries from making improper payments to non-U.S. officials for the purpose of obtaining or retaining business. We operate in parts of the world that experience government corruption to some degree, and, in certain circumstances, compliance with anti-corruption laws may conflict with those local customs and practices. Although we maintain policies, procedures and controls, and deliver training, designed to ensure compliance with anti-corruption laws, such efforts will not always protect us from reckless or criminal acts committed by our employees or agents. If we are found to be liable for FCPA or other regulatory violations (either due to our own acts or our inadvertence, or due to the acts or inadvertence of others), we could suffer from criminal or civil penalties or other sanctions, which could have a material adverse effect on our business and results of operations.

We may be exposed to certain regulatory and financial risks related to climate change.

Growing concerns about climate change may result in the imposition of additional regulations or restrictions to which we may become subject. Climate changes include changes in rainfall and in storm patterns and intensities, water shortages, significantly changing sea levels and increasing atmospheric and water temperatures, among others. A number of governments or governmental bodies have introduced or are contemplating regulatory changes in response to climate change, including regulating greenhouse gas emissions. Potentially, additional U.S. federal regulation will be forthcoming with respect to greenhouse gas emissions (including carbon dioxide) and/or "cap and trade" legislation that could impact our operations.

We are subject to foreign government regulation that could negatively impact our business.

We are subject to government regulation in non-U.S. jurisdictions in which we conduct our business. The requirements for compliance with these laws and regulations may be unclear or indeterminate and may involve significant costs, including additional capital expenditures or increased operating expenses, or require changes in business practice, in each case that could result in reduced profitability for our business. Our having to comply with these foreign laws or regulations may provide a competitive advantage to competitors who are not subject to comparable restrictions or prevent us from taking advantage of

growth opportunities. Determination of noncompliance can result in penalties or sanctions that could also adversely impact our operating results and financial condition.

Strategic & General Business Risks

We may not be able to successfully implement capacity expansion plans within our projected timetable, the actual costs of any capacity expansion may exceed our estimated costs, and we may not be able to secure demand for the incremental production capacity. In addition, actual operating costs once we have completed the capacity expansion may be higher than anticipated.

We undertake projects from time to time to expand our production capacity. The completion of these projects may be affected by market conditions and demand for our products. In addition, under our current business plan, we expect to fund any expansion plans through a combination of cash on our balance sheet and cash generated from our operating and financing activities. If the assumptions on which we base our estimated capital expenditures change or are inaccurate, we may require additional funding. Such funding may not be available on terms acceptable to us, or at all. Moreover, actual operating costs once we have completed a capacity expansion may be higher than initially anticipated. We also may not secure off-take commitments for the incremental production from our capacity expansion plans, and we may not be able to secure adequate demand for the incremental production. Furthermore, substantial investments in transportation infrastructure may be required to effectively execute the capacity expansion, and we may not be successful in expanding our logistical capabilities to accommodate the additional production capacity.

Any failure to successfully implement capacity expansion plans due to an inability to obtain necessary permits, insufficient funding, delays, unanticipated costs, adverse market conditions or other factors, or failure to realize the anticipated benefits of our capacity expansion plans, including securing demand for the incremental production, could have a material adverse effect on our business, financial condition and results of operations.

If we cannot successfully complete acquisitions or integrate acquired businesses, our growth may be limited, and our financial condition may be adversely affected.

Our business strategy includes supplementing internal growth by pursuing acquisitions of complementary businesses. Any acquisition involves potential risks, including, among other things:

•the validity of our assumptions about mineral reserves, future production, sales, capital expenditures, operating expenses and costs, including synergies;
•an inability to successfully integrate the businesses we acquire;
•the use of a significant portion of our available cash or borrowing capacity to finance acquisitions and the subsequent decrease in our liquidity;
•a significant increase in our interest expense or financial leverage if we incur additional debt to finance acquisitions;
•the assumption of unknown liabilities, losses or costs for which we are not indemnified or for which our indemnity is inadequate;
•the diversion of management’s attention from other business concerns;
•an inability to hire, train or retain qualified personnel both to manage and to operate our growing business and assets;
•the incurrence of other significant charges, such as impairment of goodwill or other intangible assets, asset devaluation or restructuring charges;
•unforeseen difficulties encountered in operating in new geographic areas;
•customer or key employee losses at the acquired businesses; and
•the accuracy of data obtained from production reports and engineering studies, geophysical and geological analyses and other information used when deciding to acquire a property, the results of which are often inconclusive and subject to various interpretations.

If we cannot successfully complete acquisitions or integrate acquired businesses, our growth may be limited, and our financial condition may be adversely affected.

We may continue to expand our business through acquisitions and we may incur additional indebtedness, including indebtedness related to acquisitions.

Our business strategy includes supplementing internal growth by pursuing acquisitions of complementary businesses. As a result, we may incur substantial additional indebtedness in connection with acquisitions. Any such additional

indebtedness

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and the related debt service obligations could have important consequences and risks for us, including:
•reducing flexibility in planning for, or reacting to, changes in our businesses, the competitive environment and the industries in which we operate, and to technological and other changes;
•reducing access to capital and increasing borrowing costs generally or for any additional indebtedness to finance future operating and capital expenses and for general corporate purposes;
•reducing funds available for operations, capital expenditures and other activities;
•creating competitive disadvantages relative to other companies with lower debt levels; and
•lowering credit ratings.

Anti-takeover provisions in our charter documents and Delaware law might discourage or delay acquisition attempts for us that you might consider favorable.

Our certificate of incorporation and bylaws contain provisions that may make the acquisition of our company more difficult without the approval of our Board. These provisions:
•authorize the issuance of undesignated preferred stock, the terms of which may be established and the shares of which may be issued without stockholder approval, and which may include super voting, special approval, dividend, or other rights or preferences superior to the rights of the holders of common stock;
•prohibit stockholder action by written consent, which requires all stockholder actions to be taken at a meeting of our stockholders;
•provide that the Board is expressly authorized to make, alter or repeal our bylaws; and
•establish advance notice requirements for nominations for elections to our Board or for proposing matters that can be acted upon by stockholders at stockholder meetings.

Our certificate of incorporation also contains a provision that provides us with protections similar to Section 203 of the Delaware General Corporation Law (the "DGCL"), and will prevent us from engaging in a business combination with a person who acquires at least 15% of our common stock for a period of three years from the date such person acquired such common stock, unless Board or stockholder approval is obtained prior to the acquisition. These anti-takeover provisions and other provisions under Delaware law could discourage, delay or prevent a transaction involving a change in control of our company, even if doing so would benefit our stockholders. These provisions could also discourage proxy contests and make it more difficult for you and other stockholders to elect directors of your choosing and to cause us to take other corporate actions you desire.

We rely upon patents, trade secrets and contractual restrictions to protect our proprietary rights. Failure to protect our intellectual property rights may undermine our competitive position and protecting our rights or defending against third-party allegations of infringement may be costly.

Our commercial success depends on our proprietary information and technologies, know-how and other intellectual property. Because of the technical nature of our business, we rely primarily on patents, trade secrets, trademarks and contractual restrictions to protect our intellectual property rights. The measures we take to protect our patents, trade secrets and other intellectual property rights may be insufficient. Failure to protect, monitor and control the use of our existing intellectual property rights could cause us to lose our competitive advantage and incur significant expenses. It is possible that our competitors or others could independently develop the same or similar technologies or otherwise obtain access to our unpatented technologies. In such case, our patents and trade secrets would not prevent third parties from competing with us. As a result, our results of operations may be adversely affected. Furthermore, third parties or employees may infringe or misappropriate our proprietary technologies or other intellectual property rights, which could also harm our business and results of operations. Policing unauthorized use of intellectual property rights can be difficult and expensive, and adequate remedies may not be available.

In addition, third parties may claim that our products infringe or otherwise violate their patents or other proprietary rights and seek corresponding damages or injunctive relief. Defending ourselves against such claims, with or without merit, could be time-consuming and result in costly litigation. An adverse outcome in any such litigation could subject us to significant liability to third parties (potentially including treble damages) or temporary or permanent injunctions prohibiting the manufacture or sale of our products, the use of our technologies or the conduct of our business. Any adverse outcome could also require us to seek licenses from third parties (which may not be available on acceptable terms, or at all) or to make substantial one-time or ongoing royalty payments. Protracted litigation could also result in

our customers or potential customers deferring or limiting their purchase or use of our products until resolution of such litigation. In addition, we may not have insurance coverage in connection with such litigation and may have to bear all costs arising from any such litigation to the extent we are unable to

recover them from other parties. Any of these outcomes could have a material adverse effect on our business, financial condition, results of operations, cash flows and prospects.

A terrorist attack or armed conflict could harm our business.

Terrorist activities, anti-terrorist efforts and other armed conflicts involving the United States could adversely affect the U.S. and global economies and could prevent us from meeting financial and other obligations. We could experience loss of business, delays or defaults in payments from payors or disruptions of fuel supplies and markets if pipelines, production facilities, processing plants or refineries are direct targets or indirect casualties of an act of terror or war. Such activities could reduce the overall demand for oil and natural gas, which, in turn, could also reduce the demand for our products and services. Terrorist activities and the threat of potential terrorist activities and any resulting economic downturn could adversely affect our results of operations, impair our ability to raise capital or otherwise adversely impact our ability to realize certain business strategies.

Our insurance may not fully cover all potential exposures.

We maintain property, general liability, business interruption, casualty, and other insurance, but such insurance may not cover all risks associated with the hazards of our business and is subject to limitations, including deductibles and coverage limits. We may incur losses beyond the limits, or outside the coverage, of our insurance policies, including liabilities for environmental remediation. We are potentially at additional risk if one or more of our insurance carriers fail. Additionally, severe disruptions in the domestic and global financial markets could adversely impact the ratings and survival of some insurers. Future downgrades in the ratings of enough insurers could adversely impact both the availability of appropriate insurance coverage and its cost. In the future, we may not be able to obtain coverage at current levels, if at all, and our premiums may increase significantly on coverage that we maintain.

Capital Resources & Stock Ownership Risks

We will be required to make substantial capital expenditures to maintain, develop and increase our asset base. The inability to obtain needed capital or financing on satisfactory terms, or at all, could have an adverse effect on our growth and profitability.

Although we currently use a significant amount of our cash reserves and cash generated from our operations to fund the maintenance and development of our existing mineral reserves and our acquisitions of new mineral reserves, we may need to depend on external sources of capital to fund future capital expenditures. Our ability to obtain bank financing or to access the capital markets for future equity or debt offerings may be limited by our financial condition at the time of any such financing or offering, the covenants contained in our existing credit facilities or future debt agreements, adverse market conditions or other contingencies and uncertainties that are beyond our control. Our failure to obtain the funds necessary to maintain, develop and increase our asset base could adversely impact our growth and profitability.

Even if we are able to obtain financing or access the capital markets, incurring additional debt may significantly increase our interest expense and financial leverage, and our level of indebtedness could restrict our ability to fund future development and acquisition activities. In addition, the issuance of additional common stock in an equity offering may result in significant stockholder dilution. Further, we may incur substantial costs in pursuing any capital-raising transactions, including investment banking, legal and accounting fees, which may not be adequately offset by the proceeds from the transaction.

Our substantial indebtedness and pension obligations could adversely affect our financial flexibility and our competitive position.

We have, and we expect to maintain in the near term, a significant amount of indebtedness. On May 1, 2018, we entered into the Credit Agreement. The Credit Agreement increased our existing senior debt by entering into a new $1.380 billion Credit Facility, consisting of a $1.280 billion Term Loan and a $100 million Revolver that may also be used for swingline loans or letters of credit, and we may elect to increase the Term Loan in accordance with the terms of the Credit Agreement.

As of December 31, 2018, we had $1.270 billion of outstanding indebtedness. Under our Credit Agreement, as of December 31, 2018, we had a $100.0 million line-of-credit, of which $4.8 million is being used for outstanding letters of credit, leaving $95.2 million of borrowing availability. Our substantial level of indebtedness increases the risk that we may be unable to generate cash sufficient to pay amounts due in respect of our indebtedness. We also have, and

will continue to have, significant pension obligations. As of December 31, 2018, our unfunded pension and post-retirement benefit obligations totaled $36.5 million and $21.6 million, respectively. Our substantial indebtedness and pension and post-retirement benefit obligations could have other important consequences to you and significant effects on our business. For example, they could:

•increase our vulnerability to adverse changes in general economic, industry and competitive conditions;

•require us to dedicate a substantial portion of our cash flow from operations to make payments on our indebtedness and pension obligations, thereby reducing the availability of our cash flow to fund working capital, capital expenditures and other general corporate purposes;
•limit our flexibility in planning for, or reacting to, changes in our business and the industry in which we operate;
•restrict us from exploiting business opportunities;
•make it more difficult to satisfy our financial obligations, including payments on our indebtedness;
•place us at a disadvantage compared to our competitors that have less debt and pension obligations; and
•limit our ability to borrow additional funds for working capital, capital expenditures, acquisitions, debt service requirements, execution of our business strategy or other general corporate purposes.

In addition, the amounts owed under the Credit Agreement use LIBOR as a benchmark for establishing the rate at which interest accrues. LIBOR is the subject of recent national, international and other regulatory guidance and proposals for reform. These reforms and other pressures may cause LIBOR to disappear entirely or to perform differently than in the past. The consequences of these developments cannot be entirely predicted, but could include an increase in the cost to us of this indebtedness.

Our Credit Agreement contains certain restrictions and financial covenants that may restrict our business and financing activities.

Our existing Credit Agreement contains, and any future financing agreements that we may enter into will likely contain, operating and financial restrictions and covenants that may restrict our ability to finance future operations or capital needs or to engage in, expand or pursue our business activities.

Our ability to comply with these restrictions and covenants is uncertain and will be affected by the levels of cash flow from our operations and events or circumstances beyond our control. If market or other economic conditions deteriorate, our ability to comply with these covenants may be impaired. If we violate any of the restrictions, covenants, ratios or tests in our Credit Agreement, a significant portion of our indebtedness may become immediately due and payable and our lenders' commitment to make further loans to us may terminate. We might not have, or be able to obtain, sufficient funds to make these accelerated payments. In addition, our obligations under our Credit Agreement are secured by substantially all of our assets, and if we are unable to repay our indebtedness under our Credit Agreement, the lenders could seek to foreclose on our assets.

We may incur substantial debt in the future to enable us to maintain or increase our production levels and to otherwise pursue our business plan. This debt may impair our ability to operate our business.

Our business plan requires a significant amount of capital expenditures to maintain and grow our production levels. If commercial silica prices were to decline for an extended period of time, if the costs of our acquisition and development operations were to increase substantially or if other events were to occur which reduced our sales or increased our costs, we may be required to borrow significant amounts in the future to enable us to finance the expenditures necessary to replace the reserves we produce. The cost of the borrowings and our obligations to repay the borrowings could have important consequences to us, including:

•our ability to obtain additional financing, if necessary, for working capital, capital expenditures, acquisitions or other purposes may be impaired, or such financing may not be available on favorable terms, or at all;
•covenants contained in our existing and future credit and debt arrangements will require us to meet financial tests that may affect our flexibility in planning for, and reacting to, changes in our business, including possible acquisition opportunities;
•we will need a substantial portion of our cash flow to make principal and interest payments on our indebtedness and to improve the funded status of our defined benefit pension plan, reducing the funds that would otherwise be available for operations and future business opportunities; and
•our debt level will make us more vulnerable than our less leveraged competitors to competitive pressures or a downturn in our business or the economy generally.

Our ability to service our indebtedness will depend on, among other things, our future financial and operating performance, which will be affected by prevailing economic conditions and financial, business, regulatory and other factors, some of which are beyond our control. If our operating results are not sufficient to service our current or future indebtedness, we will be forced to take actions such as reducing or delaying business activities, acquisitions,

investments and/or capital expenditures; selling assets; restructuring or refinancing our indebtedness; or seeking additional equity capital or bankruptcy protection. We may not be able to affect any of these remedies on satisfactory terms or at all.

We may have to utilize significant cash to meet our unfunded pension obligations and post-retirement health care liabilities and these obligations are subject to increase.

Many of our employees participate in our defined benefit pension plans. In 2018, we made contribution payments totaling $3.4 million toward reducing the unfunded liability of our defined benefit pension plans. Declines in interest rates or the market values of the securities held by the plans, or other adverse changes, could materially increase the underfunded status of our plans and affect the level and timing of required cash contributions. To the extent we use cash to reduce these unfunded liabilities, the amount of cash available for our working capital needs would be reduced. In addition, under the Employee Retirement Income Security Act of 1974, as amended ("ERISA"), the Pension Benefit Guaranty Corporation ("PBGC") has the authority to institute proceedings to terminate a pension plan if (1) the plan has not met the minimum funding requirements, (2) the plan cannot pay current benefits when due, (3) a lump sum payment has been made to a participant who is a substantial owner of the sponsoring company (and certain other technical conditions exist) or (4) the loss to the PBGC is reasonably expected to increase unreasonably over time if the plan is not terminated. In the event our tax-qualified pension plans are terminated by the PBGC, we could be liable to the PBGC for the underfunded amount, which could trigger default provisions in our credit facilities. As of December 31, 2018 and 2017, our pension obligation was $138.9 million and $122.1 million, respectively, with plan assets of $102.4 million and $92.1 million, respectively. The amount of cash ultimately required to fund these obligations will vary based on a number of factors including future return on assets, mortality rates and other such actuarial assumptions. Based on current assumptions, we expect to pay $10.0 million in the year 2019, a total of $18.4 million for the two-year period from 2020 through 2021, a total of $18.8 million for the two-year period from 2022 through 2023 and a total of $47.7 million thereafter.

We also have a post-retirement health and life insurance plan for many of our employees. The post-retirement benefit plan is unfunded. We derive post-retirement benefit expense from an actuarial calculation based on the provisions of the plan and a number of assumptions provided by us including information about employee demographics, retirement age, future health care costs, turnover, mortality, discount rate, amount and timing of claims and a health care inflation trend rate. We previously maintained a Voluntary Employees' Beneficiary Association trust that was used to partially fund health care benefits for future retirees. Benefits were funded to the extent contributions were tax deductible, which under current legislation is limited. In 2017, the trust terminated upon depletion of its assets, which were used in accordance with trust terms. In general, retiree health benefits are paid as covered expenses are incurred. Our post-retirement healthcare obligations were $21.6 million and $22.8 million as of December 31, 2018 and 2017, respectively. Based on current assumptions, we expect to pay $1.4 million in the year 2019, a total of $2.9 million for the two-year period from 2020 through 2021, a total of $3.1 million for the two-year period from 2022 through 2023 and a total of $7.4 million thereafter.

See Part II, Item 8. Management's Discussion and Analysis of Financial Condition and Results of Operations - Contractual Obligations, in this Annual Report on Form 10-K.

Our inability to acquire, maintain or renew financial assurances related to the reclamation and restoration of mining property could have a material adverse effect on our business, financial condition and results of operations.

We are generally obligated to restore property in accordance with regulatory standards and our approved reclamation plan after it has been mined. We are required under federal, state and local laws to maintain financial assurances, such as surety bonds, to secure such obligations. The inability to acquire, maintain or renew such assurances, as required by federal, state and local laws, could subject us to fines and penalties as well as the revocation of our operating permits. Such inability could result from a variety of factors, including:

•the lack of availability, higher expense or unreasonable terms of such financial assurances;
•the ability of current and future financial assurance counterparties to increase required collateral; and
•the exercise by financial assurance counterparties of any rights to refuse to renew the financial assurance instruments.

Our inability to acquire, maintain or renew necessary financial assurances related to the reclamation and restoration of mining property could have a material adverse effect on our business, financial condition and results of operations.

Our stock price and trading volume could be volatile, and you may not be able to resell shares of your common stock at or above the price you paid, if at all.

The stock market has and continues to experience extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of the underlying businesses. These broad market fluctuations may adversely affect the market price of our common stock, regardless of our actual operating performance.

In addition to the other risks described in this section, the market price of our common stock may fluctuate significantly in response to a number of factors, many of which we cannot control, including:

- quarterly variations in our operating results compared to market expectations;
- announcements of acquisitions of or investments in other businesses and properties or dispositions;
- changes in preferences of our customers;
- announcements of new services or products or significant price reductions by us or our competitors;
- size of the public float;
- stock price performance of our competitors;
- fluctuations in general stock market prices and volumes;
- default on our indebtedness or foreclosure on our properties;
- actions by competitors;
- changes in our management team or key personnel;
- changes in ratings and financial estimates by securities analysts;
- negative earnings or other announcements by us or other industrial companies;
- downgrades in our credit ratings or the credit ratings of our competitors;
- changes in investor sentiment towards companies in the oil and gas industries;
- changes in prices of oil and gas;
- issuances of capital stock; and
- global economic, legal and regulatory factors unrelated to our performance.

Numerous factors affect our business and cause variations in our operating results and affect our sales levels, including overall economic trends, our ability to identify and respond effectively to customer preferences, actions by competitors, pricing, the level of customer service that we provide, changes in product mix or sales channels, our ability to source and distribute products effectively and weather conditions.

Volatility in the market price or trading volume of our common stock may prevent investors from being able to sell their common stock at or above the price at which you purchased the stock. As a result, you may suffer a loss on your investment.

Securities class action litigation has often been instituted against companies following periods of volatility in the overall market and in the market price of a company’s securities. This litigation, if instituted against us, could result in substantial costs, reduce our profits, divert our management’s attention and resources and harm our business.

If securities or industry analysts do not publish research or publish inaccurate or unfavorable research about our business, our stock price and trading volume could decline.

The trading market for our common stock depends in part on the research and reports that securities or industry analysts publish about us or our business. If one or more of the analysts who covers us downgrades our stock or publishes inaccurate or unfavorable research about our business, our stock price would likely decline. If one or more of these analysts ceases coverage of us or fails to publish reports on us regularly, demand for our stock could decrease, which could cause our stock price and trading volume to decline.

Holders of our common stock may not receive dividends on our common stock.

Holders of our common stock are entitled to receive only such dividends as our Board may declare out of funds legally available for such payments. We are incorporated in Delaware and are governed by the DGCL. The DGCL allows a corporation to pay dividends only out of a surplus, as determined under Delaware law or, if there is no surplus, out of net profits for the fiscal year in which the dividend was declared and for the preceding fiscal year. Under the DGCL, however, we cannot pay

dividends out of net profits if, after we pay the dividend, our capital would be less than the capital represented by the outstanding stock of all classes having a preference upon the distribution of assets. Any determination to pay dividends and other distributions in cash, stock or property by us in the future will be at the discretion of our Board and will be dependent on then-existing conditions, including business conditions, our financial condition, results of operations, liquidity, capital requirements, the ability of our subsidiaries to pay us dividends or make other distributions to us, contractual restrictions including restrictive covenants contained in debt agreements and other factors. We are not required to declare future cash dividends on our common stock.

Future sales of our common stock could lower our share price, and any additional capital raised by us through the sale of equity or convertible debt securities may dilute your ownership in us and may adversely affect the market price of our common stock.

We may sell additional shares of common stock in subsequent offerings. We may also issue additional common stock or convertible debt securities. As of February 14, 2019, we had 500,000,000 shares of common stock authorized, and 81,927,736 and 73,152,701 common stock issued and outstanding, respectively.

We cannot predict the size of future issuances or sales of shares of our common stock or the effect, if any, that future issuances and sales of shares of our common stock will have on the market price of our common stock. Sales of substantial amounts of our common stock (including sales by members of management and shares that may be issued in connection with an acquisition), or the perception that such sales could occur, may adversely affect prevailing market prices for our common stock.

U.S. Silica Holdings, Inc. is a holding company with no operations of its own. Because our operations are conducted almost entirely through our subsidiaries, we are largely dependent on our receipt of distributions and dividends or other payments from our subsidiaries for cash to fund all of our operations and expenses, including to make future dividend payments, if any.

Our operations are conducted almost entirely through our subsidiaries and our ability to generate cash to meet our debt service obligations or to make future dividend payments, if any, is highly dependent on the earnings and the receipt of funds from our subsidiaries in the form of dividends, loans or advances and through repayment of loans or advances from us. Payments to us by our subsidiaries will be contingent upon our subsidiaries' earnings and other business considerations and may be subject to statutory or contractual restrictions. To the extent that we determine in the future to pay dividends on our common stock, the Credit Agreement imposes certain restrictions on the ability of our subsidiaries to pay dividends or otherwise transfer assets to us. In addition, Delaware law imposes requirements that may restrict our ability to pay dividends to holders of our common stock.

We may need to recognize impairment charges related to goodwill, identifiable intangible assets and fixed assets, in which case our net earnings and net worth could be materially adversely affected.

Under the acquisition method of accounting, net assets acquired are recorded at fair value as of the acquisition date, with any excess purchase price allocated to goodwill. Our acquisitions have resulted in significant balances of goodwill and identifiable intangible assets. There is significant judgment required in the analysis of a potential impairment of goodwill, identified intangible assets and fixed assets. If, as a result of a general economic slowdown, deterioration in one or more of the markets in which we operate, impairment in our financial performance and/or future outlook or decline in our market capitalization for other factors, the estimated fair value of our long-lived assets or goodwill decreases, we may determine that one or more of our long-lived assets or our goodwill is impaired. An impairment charge would be determined based on the estimated fair value of the assets, and any such impairment charge could have a material adverse effect on our results of operations and financial position.

Labor & Employment Risks

A shortage of skilled labor together with rising labor costs in the mining industry may further increase operating costs, which could adversely affect our results of operations.

Efficient mining using modern techniques and equipment requires skilled laborers, preferably with several years of experience and proficiency in multiple mining tasks, including processing of mined minerals. If the shortage of experienced labor continues or worsens or if we are unable to train the necessary number of skilled laborers, there could be an adverse impact on our labor productivity and costs and our ability to grow our business may be limited.

Our business may suffer if we are unable to attract and retain key personnel.

We depend to a large extent on the services of our senior management team and other key personnel. Members of our

senior management and other key employees have extensive experience and expertise in evaluating and analyzing industrial mineral properties, maximizing production from such properties, marketing industrial mineral production and developing and executing financing and hedging strategies. Competition for management and key personnel is intense, and the pool of qualified candidates is limited. The loss of any of these individuals or the failure to attract additional personnel, as needed, could have a material adverse effect on our operations and could lead to higher labor costs or the use of less-qualified personnel. In addition, if any of our executives or other key employees were to join a competitor or form a competing company, we could lose customers, suppliers, know-how and key personnel. We do not maintain key-man life insurance with respect to any of our employees. Our success will be dependent on our ability to continue to attract, employ and retain highly skilled personnel.

Difficulty in truckload driver and independent contractor recruitment and retention may have a materially adverse effect on our business.

With respect to our trucking services, difficulty in attracting or retaining qualified drivers and independent contractors could have a materially adverse effect on our growth and profitability. The truckload transportation industry periodically experiences a shortage of qualified drivers, particularly during periods of economic expansion, in which alternative employment opportunities are more plentiful and freight demand increases, or during periods of economic downturns, in which unemployment benefits might be extended and financing is limited for independent contractors who seek to purchase equipment or for students who seek financial aid for driving school. Our independent contractors are responsible for paying for their own equipment, fuel, and other operating costs, and significant increases in these costs could cause them to seek higher compensation from us or seek other opportunities within or outside the trucking industry. The trucking industry suffers from a high driver turnover rate, which requires us to continually recruit a substantial number of drivers to operate our equipment. If we were unable to attract qualified drivers and contract with independent contractors, we could be forced to, among other things, limit our growth, decrease the number of our tractors in service, adjust our driver compensation package or independent contractor compensation, or pay higher rates to third-party truckload carriers, which could adversely affect our profitability and results of operations if not offset by a corresponding increase in customer rates.

Our profitability could be negatively affected if we fail to maintain satisfactory labor relations.

As of December 31, 2018, various labor unions represented approximately 17% of our hourly employees. If we are unable to renegotiate acceptable collective bargaining agreements with these labor unions in the future, we could experience, among other things, strikes, work stoppages or other slowdowns by our workers and increased operating costs as a result of higher wages, health care costs or benefits paid to our employees. An inability to maintain good relations with our workforce could cause a material adverse effect on our business and results of operations.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

Our corporate headquarters is located in Katy, Texas. In addition, we maintain corporate support centers and sales offices in Frederick, Maryland, Reno, Nevada, Chicago, Illinois and Houston, Texas.

As of December 31, 2018, we operate 27 production facilities located primarily in the eastern half of the United States, with operations in Alabama, Illinois (2), Louisiana, Michigan, Missouri (2), New Jersey, Oklahoma, Mississippi, Nebraska, Nevada (3), Oregon, Pennsylvania, South Carolina, Tennessee (2), Texas (5), Virginia, West Virginia and Wisconsin. We own a brownfield site under development in Georgia. We also operate several transload sites via service contracts with our transload operating partners.

Additionally, we operate corporate laboratories located at our Berkeley Springs, West Virginia and Reno, Nevada locations that provide critical technical expertise, analytical testing resources and application development to promote product value and cost savings.

We generally own our principal production properties, although some land is leased. Substantially all of our owned assets are pledged as security under the Credit Agreement; for additional information regarding our indebtedness see Note K - Debt to our Consolidated Financial Statements in Part II, Item 8. of this Annual Report on Form 10-K.

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Corporate offices, including sales locations are leased. In general, we consider our facilities, taken as a whole, to be suitable and adequate for our current operations.

Our Production Facilities

The following is a detailed description of our 27 production facilities.

Crane County, Texas

Our Crane County facility is a fully automated, state-of-the-art facility that features a 4 million ton per year plant with a wet plant, intermediate stockpile, dry plant, screening plant, and loadout. The facility uses natural gas and electricity to produce whole grain silica through surface mining methods. The reserves at Crane County contain windblown dune sand lying above ancient dunes of clayey sand, all of the Quaternary age. The facility is located approximately 25 miles southwest of Odessa, Texas in Crane County and is located 5 miles south of U.S. Interstate 20 on a main Farm-to-Market Road. The facility's location in West Texas allows it to ship local in-basin sand by truck.

We purchased 3200 acres of ranch land in May 2017, on which the Crane County facility was built and became operational during the first quarter of 2018. The facility primarily produces a range of API/ISO certified frac sand grades. The total net book value of the Crane County facility's real property and fixed assets as of December 31, 2018 was $233.8 million.

Lamesa, Texas

Our Lamesa facility is a fully-automated, state-of-the-art facility that currently features a 6 million ton per year plant with a wet plant, intermediate stockpile, dry plant, screening plant, and loadout. The facility uses natural gas and electricity to produce whole grain silica through surface mining methods. The reserves at Lamesa contain windblown dune sand lying above ancient dunes of clayey sand, all of the Quaternary age. The facility is located in Dawson County, approximately 55 miles north of Midland, Texas and 60 miles south of Lubbock, Texas. The site is located 13 miles north and west of Lamesa, Texas using state, farm-to-market and private roads. U.S. Route 87 runs through Lamesa and directly leads north to Lubbock and south to Midland. The facility's location in West Texas allows it to ship local in-basin sand by truck.

We purchased 3500 acres of ranch land in July 2017, on which the Lamesa facility was built and became operational during the third quarter 2018. The facility primarily produces a range of API/ISO certified frac sand grades. The total net book value of the Lamesa facility's real property and fixed assets as of December 31, 2018 was $186.9 million.

Festus, Missouri

The Festus facility uses natural gas and electricity to produce whole grain silica from a sandstone reserve that we lease, subject to the lease's expiration on June 30, 2048. The ore is mined by a contractor using both surface and underground hard-rock mining methods. The reserves are part of the St. Peter Sandstone Formation that stretches north-south from Minnesota to Missouri and east-west from Illinois to Nebraska and South Dakota. The facility is located approximately 30 miles south of St. Louis and is accessible by major highways including U.S. Interstate 55. Once the product is processed, it is packaged in bulk and shipped by truck to either barge or rail.

We acquired the Festus facility in August 2017 in connection with the closing of our MS Sand acquisition in August 2017. Since acquiring the facility, we completed an expansion to increase capacity. While the Festus facility's production techniques and distribution model enable it to serve all major silica markets, the primarily production has been frac sand for oil and gas proppants. The total net book value of the Festus facility's real property and fixed assets as of December 31, 2018 was $35.0 million.

Ottawa, Illinois

Our surface mines in Ottawa use natural gas and electricity to produce whole grain and ground silica through a variety of mining methods, including hard rock mining, mechanical mining and hydraulic mining. The reserves are part of the St. Peter Sandstone Formation that stretches north-south from Minnesota to Missouri and east-west from Illinois to Nebraska and South Dakota. The facility is located approximately 80 miles southwest of Chicago and is accessible by major highways including U.S. Interstate 80. Once the product is appropriately processed, it is shipped either in bulk or packaged form by rail by either the CSX Corporation or the BNSF Railway Company (via the Illinois Railway short line), truck or barge.

We acquired the Ottawa facility in 1987 by merger with the Ottawa Silica Company, which historically used the property to produce whole grain and ground silica for customers in industrial and specialty products end markets.

Since acquiring the facility, we renovated and upgraded its production capabilities to enable it to produce multiple products through various

processing methods, including washing, hydraulic sizing, grinding, screening and blending. These production techniques allow the Ottawa facility to meet a wide variety of focused specifications on product composition from customers. As such, the Ottawa facility services multiple end markets, such as glass, building products, foundry, fillers and extenders, chemicals and oil and gas proppants. In November 2009, we expanded the frac sand capacity by 500,000 tons. During the fourth quarter of 2011, we completed a follow-on expansion project that added an additional 900,000 tons of frac sand capacity. The total net book value of the Ottawa facility's real property and fixed assets as of December 31, 2018 was $105.8 million.

Voca, Texas

Our surface mines at the Voca facility use propane and electricity to produce whole grain silica through hard rock mining. The majority of reserves in Voca are sandstones of the Middle and Lower Hickory members of the Riley Formation in central Texas. The facility is located approximately 110 miles northwest of Austin, Texas in McCulloch County and is accessible by state highways. Once product is processed, it is shipped by truck.

We acquired the Voca facility upon the completion of our Cadre Services, Inc. ("Cadre") acquisition in July 2014. We are experiencing a declining shift in demand on our Voca facility, caused by their largest customer not renewing its contract. As a result, management decided to close the Voca facility within the coming months. The total net book value of the Voca facility's real property and fixed assets as of December 31, 2018 was $5.8 million.

Tyler, Texas

Our Tyler facility uses natural gas and electricity to produce whole grain silica through surface mining methods. The reserves at Tyler contain mostly unconsolidated sand of the Queen City Sand formation (Eocene Age). The facility is located approximately 9 miles north of Tyler, Texas in Smith County and is located immediately adjacent to U.S. Interstate 20. Once product is processed, it is shipped by truck.

We acquired the Tyler facility upon the completion of our NBI acquisition in August 2016. The fully automated, state-of-the-art facility became operational in 2011 and features one of the industry’s largest on-site storage capacities. The plant was recently expanded in 2014 and produces a range of API/ISO certified frac sand grades. The Tyler plant's location in Northeast Texas allows it to ship regional sand directly to the wellheads in the Texas and Louisiana basins by truck. The total net book value of the Tyler facility's real property and fixed assets as of December 31, 2018 was $207.2 million.

Mill Creek, Oklahoma

Our surface mines in Mill Creek use natural gas and electricity to produce whole grain, ground and fine ground silica through hydraulic mining. The reserves are part of the Oil Creek Formation in south central Oklahoma. The facility is located approximately 100 miles southeast of Oklahoma City and is accessible by major highways including U.S. Interstate 35. Once the product is appropriately processed, it is packaged in bulk and shipped either by rail by BNSF Railway Company or by truck.

We acquired the Mill Creek facility in 1987 by merger with the Pennsylvania Glass Sand Corporation, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including hydraulic sizing, fluid bed drying, grinding and air sizing. These production techniques allow the Mill Creek facility to meet a wide variety of focused specifications on product composition from customers. As such, the Mill Creek facility services multiple end markets, such as glass, foundry, fillers and extenders, building products and oil and gas proppants. The total net book value of the Mill Creek facility's real property and fixed assets as of December 31, 2018 was $23.1 million.

Sparta, Wisconsin

Our facility at Sparta uses natural gas and electricity to produce whole grain silica products through dredging. The reserve geology is that of high purity alluvial sands with the primary erosional source being the Wonewoc Formation. The Wonewoc Sandstone Formation is known for its round, coarse grains and superior crush strength properties, which makes it an ideal substrate for oil and gas proppants. The Sparta property was acquired on December 30, 2011, and site development began in April 2012. The property is located 25 miles northeast of La Crosse; approximately 120 miles northwest of Madison, Wisconsin; and is readily accessible by both U.S. Interstate 90 and the Canadian Pacific railroad. The total net book value of the Sparta facility's real property and fixed assets as of December 31, 2018 was

$37.8 million.

Utica, Illinois

Our surface mine at the Utica facility uses natural gas and electricity to produce whole grain silica products through surface mining. The reserves are part of the St. Peter Formation sandstone, which stretches north-south from Minnesota to Missouri and east-west from Illinois to Nebraska and South Dakota. We acquired the Utica property and plant in 2015 from Quality Sand Products LLC. The facility is located approximately 80 miles southwest of Chicago and is accessible by major highways including U.S. Interstate 80. Once the product is appropriately processed, it is shipped by truck or on the nearby Union Pacific Railroad. The total net book value of the Utica facility's real property and fixed assets as of December 31, 2018 was $26.0 million.

Mapleton Depot, Pennsylvania

Our surface mines in Mapleton Depot use natural gas, fuel oil and electricity to produce whole grain silica through hard rock mining. The reserves are part of the Ridgeley (sometimes called the Oriskany) Sandstone Formation in central Pennsylvania. The facility is located approximately 40 miles northwest of Harrisburg and is accessible by major highways including U.S. Interstates 99, 80 and 76 and U.S. Routes 22 and 322. Once the product is appropriately processed, it is packaged in bulk and shipped either by rail by Norfolk Southern Corporation or by truck.

We acquired the Mapleton Depot facility in 1987 by merger with the Pennsylvania Glass Sand Corporation, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we have renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including hydraulic sizing, fluid bed drying, scalping and a low iron circuit. These production techniques allow the Mapleton Depot facility to meet a wide variety of focused specifications on product composition from customers. As such, the Mapleton Depot facility services multiple end markets, such as glass, specialty glass, building products, recreation, and oil and gas proppants. The total net book value of the Mapleton Depot facility's real property and fixed assets as of December 31, 2018 was $14.8 million.

Pacific, Missouri

Our surface mines at the Pacific facility use natural gas and electricity to produce whole grain, ground and fine ground silica through a variety of mining methods, including hard rock and hydraulic mining. The reserves are part of the St. Peter Sandstone Formation that stretches north-south from Minnesota to Missouri and east-west from Illinois to Nebraska and South Dakota. The facility is located approximately 50 miles southwest of St. Louis and is accessible by major highways including U.S. Interstate 44. Once the product is appropriately processed, it is packaged in bulk and shipped either by rail directly by Union Pacific Corporation and through open switching on the same line by BNSF Railway Company or by truck.

We acquired the Pacific facility in 1987 by merger with the Pennsylvania Glass Sand Corporation, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility we renovated and upgraded its production capabilities to enable it to produce multiple products through

various processing methods, including hydraulic sizing, fluid bed drying, grinding, dry screening, classifying and microsizing. In August 2010, we expanded this facility’s processing capabilities to include the processing of frac sand. These production techniques allow the Pacific facility to meet a wide variety of focused specifications on product composition from customers. As such, the Pacific facility services multiple end markets, such as glass, foundry, fillers and extenders and oil and gas proppants. The total net book value of the Pacific facility's real property and fixed assets as of December 31, 2018 was $61.3 million.

Kosse, Texas

Our surface mine in Kosse uses mechanical mining to extract sand ore from the reserve. The plant uses natural gas and electricity to produce whole grain silica. The reserves are part of the Simsboro member of the Rockdale Formation in central Texas. The facility is located approximately 90 miles south of Dallas and is accessible by major highways including U.S. Interstates 45 and 35. Once the product is appropriately processed, it is shipped by truck.

We acquired the Kosse facility in 1987 by merger with the Ottawa Silica Company, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we have renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including washing, hydraulic sizing, fluid bed drying, and dry screening. These

production techniques allow the Kosse facility to meet a wide variety of focused specifications on product composition from customers. As such, the Kosse facility services multiple end markets, such as building products, recreation, and oil and gas proppants. The total net book value of the Kosse facility's real property and fixed assets as of December 31, 2018 was $14.8 million.

Berkeley Springs, West Virginia

Our surface mines at the Berkeley Springs facility use hard rock mining methods to produce high-purity sandstone. The plant uses propane, fuel oil and electricity to make whole grain, ground, and fine ground silica. Berkeley Springs also produces a synthetic magnesium-silica product called Florisil.

The reserves are part of the Ridgeley Sandstone Formation along the Warm Springs Ridge in eastern West Virginia. The facility is located approximately 100 miles northwest of Baltimore and is accessible by major highways including U.S. Interstate 70. Once the product is appropriately processed, it is packaged in bulk and shipped by rail by the CSX Corporation or truck.

We acquired the Berkeley Springs facility in 1987 by merger with the Pennsylvania Glass Sand Corporation, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility we have renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including primary, secondary and tertiary crushing, grinding, flotation, dewatering, fluid bed drying, mechanical screening and rotary drying processing. These production techniques allow the Berkeley Springs facility to meet a wide variety of focused specifications from customers producing specialty epoxies, resins and polymers, geothermal energy equipment and fiberglass. As such, the Berkeley Springs facility services multiple end markets, such as glass, building products, foundry, chemicals and fillers and extenders. The total net book value of the Berkeley Springs facility's real property and fixed assets as of December 31, 2018 was $22.3 million.

Columbia, South Carolina

Our surface mines in Columbia use natural gas, fuel oil and electricity to produce whole grain, ground and fine ground silica. The reserves are part of the Tuscaloosa Formation in central South Carolina. The facility is located approximately 10 miles southwest of Columbia and is accessible by major highways including U.S. Interstates 26 and 20. Once the product is appropriately processed, it is bagged or shipped in bulk either by rail by Norfolk Southern Corporation or by truck.

We acquired the Columbia facility in 1987 by merger with the Pennsylvania Glass Sand Corporation, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we have renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including hydraulic sizing, fluid bed drying, scalping and grinding. These production techniques allow the Columbia facility to meet a wide variety of focused specifications on product composition from customers. As such, the Columbia facility services multiple end markets, such as glass, building products, fillers and extenders, filtration and oil and gas proppants. The total net book value of the Columbia facility's real property and fixed assets as of December 31, 2018 was $32.8 million.

Dubberly, Louisiana

Our surface mines in Dubberly use natural gas and electricity to produce whole grain silica through dredge mining. The reserves are part of the Sparta Formation. The facility is located approximately 30 miles east of Shreveport and is accessible by major highways including U.S. Interstate 20 and state Highway 532. Once the product is appropriately processed, it is bagged or shipped in bulk by truck.

We acquired the Dubberly facility in 1987 by merger with the Ottawa Silica Company, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including screening, washing, fluid bed drying and conditioning to remove heavy and iron bearing minerals. These production techniques allow the Dubberly facility to meet a wide variety of focused specifications on product composition from customers. As such, the Dubberly facility services multiple end markets, such as glass, foundry and building products. The total net book value of the Dubberly facility's real property and fixed assets as of December 31, 2018 was $3.6 million.

Montpelier, Virginia

Our surface mines in Montpelier use fuel oil and electricity to produce aplite through hard rock mining. The reserves are part of an igneous rock complex that is unique to this location. The facility is located approximately 20 miles northwest of Richmond and is accessible by major highways including U.S. Interstates 64 and 95. Once the product is appropriately processed, it is packaged in bulk and shipped either by rail by Norfolk Southern Corporation or CSX Corporation or by truck.

We acquired the Montpelier facility in 1993 from The Feldspar Company, which had historically used the property to produce aplite for customers in industrial and specialty products end markets. Since acquiring the facility, we have renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including hydraulic crushing and sizing, washing, fluid bed drying and grinding. These production techniques allow the Montpelier facility to meet a wide variety of focused specifications on product composition from customers. As such, the Montpelier facility services multiple end markets, such as glass, building products and recreation. The total net book value of the Montpelier facility's real property and fixed assets as of December 31, 2018 was $14.4 million.

Hurtsboro, Alabama

Our surface mines in Hurtsboro use propane and electricity, to produce whole grain silica. Sand feed for processing is trucked in from surrounding mine locations. The reserves are mined from the Cusseta member of the lower Ripley Formation. The facility is located approximately 75 miles east of Montgomery and is accessible by major highways including U.S. Interstate 85 and state Highway 431. Once the product is appropriately processed, it is shipped in bulk by truck.

We acquired the Hurtsboro facility in 1988 from Warrior Sand & Gravel Company, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including trucking in sand from surrounding locations, hydraulic sizing, screening and fluid bed drying. These production techniques allow the Hurtsboro facility to meet a wide variety of focused specifications on product composition from customers. As such, the Hurtsboro facility services multiple end markets, such as foundry, building products and recreation. The total net book value of the Hurtsboro facility's real property and fixed assets as of December 31, 2018 was $0.5 million.

Jackson, Tennessee

Our surface mines in Jackson use natural gas and electricity to produce whole grain and ground silica. Sand is purchased from a local dredging company whose reserves are alluvial sands associated with an ancient river system. The facility is located approximately 75 miles east of Memphis and is accessible by major highways including U.S. Interstate 40. Once the product is appropriately processed, it is shipped in bulk by truck.

We acquired the Jackson facility in 1997 from Nicks Silica Company, which had historically used the property to produce whole grain and ground silica for customers in industrial and specialty products end markets. Since acquiring the facility, we renovated and upgraded its production capabilities, turning it into one of our premier grinding facilities and enabling it to produce multiple products through various processing methods, including rotary drying, screening and grinding. These production techniques allow the Jackson facility to meet a wide variety of focused specifications on product composition from customers. As such, the Jackson facility services multiple end markets, such as fiberglass, building products, ceramics, fillers and extenders and recreation. The total net book value of the Jackson facility's real property and fixed assets as of December 31, 2018 was $1.7 million.

Mauricetown, New Jersey

Our surface mines near the Mauricetown facility use natural gas, fuel oil and electricity, to produce whole grain silica through dredge mining. The reserves are mined from alluvial sands in the Maurice River Valley and are similar to those found in the Cohansey, Bridgeton and Cape May deposits. The facility is located approximately 50 miles south of Philadelphia and is accessible by major highways including U.S. Interstate 295 and state Highway 55. Once the product is appropriately processed, it is packaged in bags or bulk and shipped either by rail by Winchester & Western Railroad or by truck.

We acquired the Mauricetown facility in 1999 from Unimin Corporation, which had historically used the property to produce whole grain silica for customers in industrial and specialty products end markets. Since acquiring the facility, we renovated and upgraded its production capabilities, including the construction of a new wet processing plant, to enable it to produce multiple products through various processing methods, including washing, hydraulic sizing, fluid bed drying, rotary drying and scalping. These production techniques allow the Mauricetown facility to meet a wide variety of focused specifications on product composition from customers. As such, the Mauricetown facility services multiple end markets, such as foundry, filtration, building products and recreation. The total net book value of the

Mauricetown facility's real property and fixed assets as of December 31, 2018 was $15.5 million.
Rockwood, Michigan

Our Rockwood facility uses natural gas and electricity to produce whole grain silica. Rockwood's own surface mining reserves are part of the Sylvania Formation and are notable for their low iron content, making them particularly valuable to customers producing specialty glass for architectural or alternative energy applications. Currently sandstone ore is purchased from a local construction material company from that company's surface mining operation. The facility is located approximately 30 miles southwest of Detroit and is accessible by major highways including U.S. Interstate 75. Once the product is appropriately processed, it is packaged in bulk and shipped by rail via the Canadian National Railway or truck.

We acquired the Rockwood facility in 1987 by merger with the Ottawa Silica Company, which had historically used the property to produce whole grain and ground silica for customers in industrial and specialty products end markets. Since acquiring the facility we renovated and upgraded its production capabilities to enable it to produce multiple products through various processing methods, including fluid bed drying, dry screening and classifying. These production techniques allow the Rockwood facility to meet a wide variety of focused specifications on product composition from customers. As such, the Rockwood facility services multiple end markets, such as glass, building products, oil and gas proppants and chemicals. The total net book value of the Rockwood facility's real property and fixed assets as of December 31, 2018 was $15.6 million.

Rochelle, Illinois

Our Rochelle site contains a transloading facility where sand can be received and shipped both by truck and by the BNSF and Union Pacific railroads to help meet customer requirements. The resin coated sand processing plant on the Rochelle site was closed during 2018. The Rochelle property was purchased in 2011. The total net book value of the Rochelle facility's real property and fixed assets as of December 31, 2018 was $5.5 million.

Millen, Georgia

On December 31, 2018, we completed the acquisition of a manufacturing facility located in Millen, Georgia, which is southeast of Atlanta in Jenkins County and in close proximity to high quality kaolin and silica deposits. The facility has a kiln that will enable the production of specialty industrial products that require high temperature heat treatments. It is expected to become fully operational by the end of 2019. The total net book value of the Millen facility's real property and fixed assets as of December 31, 2018 was $23.3 million.

Lovelock, Nevada

Our Lovelock facility is the world's largest producing diatomaceous earth (DE) plant. The facility is 90 miles northeast of Reno, next to Interstate 80. The plant has full rail service on the UPRR, but primarily produces packaged products. The plant’s proximity to the port of Oakland allows it to be the primary export plant for filter aid and fillers. Its three kilns produce calcined and flux-calcined filter aids and functional additives. It has an annual capacity of approximately 156,000 tons. A perlite expander was installed in 1994, and the site crushes and screens perlite ore from our open-pit Popcorn Mine as a raw material for the Blair, Nebraska facility as well as selling expanded perlite ore for use as a filter aid and has an annual capacity of approximately 15,000 tons.

The facility uses DE ore from the open-pit Colado mine, soda ash, natural gas, and electricity to manufacture products used as filtration media across many industries including brewing, corn wet milling, oil and gas, wineries, potable water, swimming pools and petrochemicals. In addition, filler products are used as an anti-block in polyethylene film and flattening agents in paint.

The Lovelock facility was initially commissioned in 1959. We acquired the Lovelock facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Lovelock facility's real property and fixed assets as of December 31, 2018 was $42.6 million.

Vale, Oregon

Our Vale facility is the world’s third largest DE facility. Two kilns can produce calcined and flux-calcined diatomaceous earth for use as filter aids, functional additives, and low iron brewing grades of filter aids. It has an annual capacity of approximately 120,000 tons and uses DE ore from the open-pit Celatom mine, natural gas, electricity and soda ash.

The facility was originally commissioned in 1985, with the second kiln added in 1997. We acquired the Vale facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Vale facility's real property and fixed assets as of December 31, 2018 was $29.1 million.

Clark, Nevada

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The Clark facility utilizes a rotary kiln to produce granular DE products utilized in the soil amendment, absorbent, and carrier markets. In addition, a flash dryer process is utilized in producing natural DE powders in support of the functional additive and natural insecticide/animal feed markets. The Clark facility has an annual capacity of approximately 70,000 tons and utilizes DE ore from its surface mining, natural gas and electricity. It is located adjacent to the Truckee River, immediately accessible by Interstate 80 and serviced via the Union Pacific Railroad. In 1945, EPM (Eagle-Picher at that time) acquired the DE deposits 20 miles east of Reno, Nevada in what is known today as Clark, Nevada. We acquired the Clark facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Clark facility's real property and fixed assets as of December 31, 2018 was $27.4 million.

Fernley, Nevada

Our Fernley facility surface-mines DE and has a rotary kiln for granular DE products. The facility utilizes electricity and recycled oil to manufacture granular products used in absorbent products, soil amendments, fertilizer and pet litter. It has an annual capacity of approximately 50,000 tons and is located near Interstate 80, fifteen miles east of Fernley, Nevada.

EPM purchased the facility from Moltan Corporation in 2013. We acquired the Fernley facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Fernley facility's real property and fixed assets as of December 31, 2018 was $4.8 million.

Blair, Nebraska

Our Blair facility uses natural gas, electricity, and perlite ore from our open-pit Popcorn mine that has been initially processed at our Lovelock facility. Products produced are used in the industry as a filter media in the manufacturing of bio-fuels food grade oils.

Our Blair facility began producing perlite in 2014. We acquired the Blair facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Blair facility's real property and fixed assets as of December 31, 2018 was $3.8 million.

Jackson, Mississippi

Our Jackson facility, located approximately at the intersection of Interstate 20 and Interstate 55, uses natural gas, electricity, water, and sulfuric acid to process calcium bentonite from our open-pit mine (Fowlkes Mine) located in Monroe County, approximately 170 miles from the Jackson facility. Once the calcium bentonite is processed into finished product, the product is shipped to the animal feed, oleo bleaching/filtration or refinery catalyst/purification markets The products are shipped via bulk truck and rail leaving Jackson on the CN Railway. Packaged shipments are also made by common carriers for the North/South American markets and intermodal carriers to the ports of New Orleans, Louisiana or Mobile, Alabama for shipments to multiple overseas countries.

The processing facility sits on land leased from BASF, the former owner of the site. EPM purchased the facility and associated mining operations from BASF in July 2017. We acquired the Jackson facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Jackson facility's real property and fixed assets as of December 31, 2018 was $29.1 million.

Middleton, Tennessee

The Middleton facility surface-mines montmorillonite clay, a high calcium bentonite, and has two rotary kilns that have a capacity of roughly 150,000 tons. The facility uses natural gas, electricity, and sulfuric acid to process ore. With on-site milling, screening, and multiple packaging capabilities, this plant serves several different industries including agriculture, sports fields, and absorbents. This facility is located 80 miles east of Memphis, Tennessee and 60 miles south of Jackson, Tennessee.

EPM purchased the mines and processing facility from the Moltan Company in early 2013. We acquired the Middleton facility in connection with the completion of the acquisition of EPMH in May 2018. The total net book value of the Middleton facility's real property and fixed assets as of December 31, 2018 was $9.2 million.

Our Reserves

We believe we have a broad and high-quality mineral reserves base due to our strategically located mines and facilities. “Reserves” are defined by SEC Industry Guide 7 as that part of a mineral deposit which could be economically and legally

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extracted or produced at the time of the reserve determination. Industry Guide 7 divides reserves between “proven (measured) reserves” and “probable (indicated) reserves” which are defined as follows:

- Proven (measured) reserves. Reserves for which (1) quantity is computed from dimensions revealed in outcrops, trenches, workings or drill holes; grade and/or quality are computed from the results of detailed sampling and (2) the sites for inspection, sampling and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth and mineral content of reserves are well-established.
- Probable (indicated) reserves. Reserves for which quantity and grade and/or quality are computed from information similar to that used for proven (measured) reserves, but the sites for inspection, sampling, and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for proven (measured) reserves, is high enough to assume continuity between points of observation.

We categorize our reserves as proven or probable in accordance with these SEC definitions. We estimate that we had a total of approximately 683 million tons of proven and probable mineable mineral reserves as of December 31, 2018. Compared to 765 million tons of proven and probable mineable mineral reserves we had as of December 31, 2017, the decrease of 82 million tons was due to adjustments and mining, partly offset by the addition of diatomaceous earth, clay, and perlite reserves during the year ended December 31, 2018.

The quantity and nature of the mineral reserves at each of our properties are estimated by our internal Geology and Mine Planning departments. Our geology and mining staff updates our reserve estimates annually, making necessary adjustments for operations at each location during the year and additions or reductions due to property acquisitions and dispositions, quality adjustments and mine plan updates. Before acquiring new reserves, we perform surveying, drill core analysis and other tests to confirm the quantity and quality of the to-be acquired reserves. In some instances, we acquire the mineral rights to reserves without taking ownership of the properties.

Description of Deposits

The following is a description of the nature of our silica sand and aplite deposits for each of our reserve locations:

Crane County, Texas

The deposit has a minimum silica (SiO_2) content of 98%. The controlling attributes are grain crush strength and size distribution. All areas of the deposit are characterized by clean, low-clay content sand in windblown dunes. In many areas, a more clayey sand lies beneath the clean sand. In all cases the sand is unconsolidated.

Lamesa, Texas

The deposit has a minimum silica (SiO_2) content of 98%. The controlling attributes are grain crush strength and size distribution. All areas of the deposit are characterized by clean, low-clay content sand in windblown dunes. In many areas, a more clayey sand lies beneath the clean sand. In all cases the sand is unconsolidated.

Festus, Missouri

The deposit has a minimum silica (SiO_2) content of 98%. The controlling attributes are grain crush strength and size distribution. The top half of the deposit tends to have a coarser grain size distribution and exhibits stronger rock.

Ottawa, Illinois

The deposit has a minimum silica (SiO_2) content of 99%. The controlling attributes are grain crush strength, iron (Fe_2O_3) content and grain size distribution. Iron is concentrated near the surface, where orange iron staining is evident and also increases where the bottom contact becomes concentrated in iron pyrite. Maximum average full face iron content is 0.045%. The deposit tends to exhibit a coarser grain size distribution in the top half of deposit.

Voca, Texas

The deposit has a minimum silica (SiO_2) content of 99%. The controlling attributes are sand grain crush strength and size distribution. The majority of the sand reserves are hosted within the Hickory Sandstone, the basal member of the Riley Formation. The Cambrian age Hickory sandstone member consists chiefly of yellow, brown, or red sandstone overlying Pre-Cambrian granites.

Tyler, Texas
The deposit has a minimum silica (SiO2) content of 98%. The controlling attributes are crush strength and size distribution of the sand grains. The Queen City Sand formation, an Eocene Age unconsolidated sand deposit, makes up the Tyler reserves. The Queen City Sand consists mainly of white, brown, and grayish-green sand found mostly as loose particles.
Mill Creek, Oklahoma
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are iron (Fe2O3) content, calcium (CaO) content and grain size distribution. The sand/overburden contact is occasionally concentrated in calcium and any sand with greater than 0.03% CaO is removed during the overburden removal process. Sand with iron greater than 0.03% Fe2O3 is not mined.
Sparta, Wisconsin
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are sand grain crush strength and size distribution. A thin layer of silt overlies the 50 to 100 foot thick sand deposit. The deposit is unconsolidated and well graded and can be used to manufacture three main API product grades, 40/70, 30/50, and 20/40 as well as the non-API 100-mesh product.
Utica, Illinois
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are sand grain crush strength and size distribution. The deposit is well graded and can produce a variety of products.
Mapleton Depot, Pennsylvania
The deposit has a minimum silica (SiO2) content of 99%. The controlling attribute is iron (Fe2O3) as most sales have low iron specifications. Higher-iron ore is stockpiled and used when oil and gas proppant production is required or is blended when very low iron ore is available.
Pacific, Missouri
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are iron (Fe2O3) and calcium (CaO) content. Calcium can be concentrated at the upper sand contact with overlying carbonate cap rock. This enriched calcium zone is known from drill sample results and is stripped during the overburden removal process. Average full mining face washed sand samples are less than 0.03% iron and 0.05% calcium.
Kosse, Texas
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are iron content (Fe2O3), sand grain crush strength and size distribution. Multiple areas of deposit can be mined at any one time to assure consistency of ore and to smooth out variability of attributes. Maximum sand irons are 0.045%.
Berkeley Springs, West Virginia
The deposit has a minimum silica (SiO2) content of 99%. The controlling attribute is iron (Fe2O3). Ore that is higher than 0.06% iron is not mined. Ore less than 0.06% iron is mined and blended for feed to plant.
Columbia, South Carolina
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are iron content (Fe2O3) and percentage of clay/slimes. Clay content increases at depth and generally the pit bottom follows a marker bed at 250-foot elevation where clay content is in excess of 11%. Generally, sand having iron values greater than 0.03% is not mined.
Dubberly, Louisiana
The deposit has a minimum silica (SiO2) content of 99%. The controlling attributes are iron (Fe2O3) content and grain size distribution. Mining full-face average for iron is 0.045%. Fine and coarse areas are blended to meet the grain size average.

Montpelier, Virginia
The Montpelier anorthosite contains andesine feldspar which is mined and processed to create an alumina rich product. The general term aplite is used to denote the product. The controlling attributes are titanium (TiO2), aluminum (AI2O3), iron (Fe2O3) and phosphorous (P2O5).
The Montpelier anorthosite is approximately 1,000 million years in age and intruded into the older Precambrian Sabot Gneiss. The overall dome shape of the orebody has been altered by multiple structural and metamorphic events that result in the present day foliated and folded deposit. The deposit is highly weathered and soft near the surface. Hardness and strength increase with depth.
Aplite is used as a flux agent in glass making and is sold to the same glass end markets and used in the same processes and in a similar manner as our silica product.
Hurtsboro, Alabama
The deposit has a minimum silica (SiO2) content of 99%. The controlling attribute is grain size distribution. Sand reserves are located on the crests of rolling hills and mining occurs from multiple pits and faces within pits to assure optimum grain size distribution is available to meet the market product mix.
Jackson, Tennessee
The deposit has a minimum silica (SiO2) content of 99%. The controlling attribute of iron (Fe2O3) content is managed through keeping clay overburden from intermixing with the sand and maintaining adequate washing of sand in the wet processing of the sand.
Mauricetown, New Jersey
The deposit has a minimum silica (SiO2) content of 99%. The controlling attribute is grain size distribution. Occasional zones high in clay are avoided in the course of dredge mining.
Rockwood, Michigan
The deposit has a minimum silica (SiO2) content of 99%. The controlling attribute is iron content (Fe2O3). Mineable sand must have less than 0.01% Fe2O3.
Middleton, Tennessee and Mississippi
The deposits are calcium montmorillonite clays hosted in the Porters Creek formation (a deltaic clay deposit on the east flank of the Mississippi embayment) with ore types of low to high density black and brown clay interbedded with sand and silt laminations.
Clark, Nevada
The deposits are composed of freshwater diatomaceous earth, capped with basalt, and interbedded with volcanic ash and tephra units. The deposits are primarily amorphous silicate (SiO2) composition with controlling trace attributes.
Lovelock, Nevada
The deposits are composed of freshwater diatomaceous earth with the primary diatom species of Melosira granulata, typically capped with basalt, and interbedded with volcanic ash and tephra units. The deposits are primarily amorphous silicate (SiO2) composition with controlling trace attributes.
Fernley, Nevada
The deposits are composed of freshwater diatomaceous earth interbedded with minor volcanic ash and tephra units. The deposits are primarily amorphous silicate (SiO2) composition with controlling trace attributes.
Fowlkes Mine, Mississippi

The deposit occurs in the Tombigbee Sand in Mississippi and is composed of 90% clay, 100% of which is montmorillonite. It holds approximately 1/3 bound water by volume and is dark gray in color, frequently with a greenish tint. It is primarily of the calcium/magnesium type of bentonite. Tombigbee Sand bentonite contains byproducts of volcanic ash degradation and leading evidence suggests the ash came from volcanic vents on the Sharkey Platform, 130 miles to the southwest. The clay deposit contains calcareous concretions that have to be removed as part of the mining operations.

Hazen Mine, Nevada

The deposits are primarily amorphous silicate (SiO_2) composition with controlling trace attributes.

Popcorn Mine, Nevada

Perlite is an aqueous rich volcanic glass which was deposited beneath sea water and quenched. Upon crushing and heating, perlite's high-water saturation permits rapid expansion or popping.

Colado Mine, Nevada

The deposits are composed of freshwater diatomaceous earth with the primary diatom species of Melosira granulata, typically capped with basalt, and interbedded with volcanic ash and tephra units. The deposits are primarily amorphous silicate (SiO_2) composition with controlling trace attributes.

Celatom Mine, Oregon

The deposits are composed of freshwater diatomaceous earth with the primary diatom species of Melosira granulata, interbedded with volcanic ash and clay units. The deposits are primarily amorphous silicate (SiO_2) composition with controlling trace attributes.

Cheto Mine, Arizona

The deposit has a silica content (SiO_2) of 68%, alumina content (Al_2O_3) of 17%, calcium (CaO) content of around 3%, and magnesium (MgO) content of around 5%. It is classified of the montmorillonite type, primarily of the calcium/magnesium type of bentonite.

Fallon, Nevada

The deposit is a greenfield diatomite deposit currently in the process of permitting. This a deposit of fresh water diatoms deposits. Melosira granulata is the primary species of dia tom present with minor traces of volcanic ash and basalt detritus.

Mineral Rights

The mineral rights and access to mineral reserves for the majority of our operations are secured through land that is owned in fee. There are no underlying agreements and/or royalties associated with our locations other than those listed below. None of our operations, except as listed below, are on government land and, accordingly, we do not have any other government leases or associated mining claims.

The mineral rights and access to mineral reserves at our Mill Creek operation are a combination of land owned in fee and one mineral lease. A non-participating royalty is paid to the original sellers of the fee property that covers almost all of the reserves. The lease agreements involve an annual minimum payment and a non-participating per-ton production royalty payment expiring on December 31, 2019.

The Columbia operation mineral reserves and rights are secured under a long-term mineral lease. The lease includes an annual minimum payment and a production royalty based on gross revenue expiring on April 24, 2021.

The Hurtsboro operation mineral reserves and rights are secured under three mineral leases. They are long-term leases that include an annual minimum payment and a production royalty payment based on average selling price expiring from May 2019 through March 2027. These mineral leases are renewed for 2 to 10 year periods and have been renewed in the past, and it is expected that if mining is still occurring on these properties the leases can be extended again.

The mineral rights and access to mineral reserves at our Kosse operation are a combination of land owned in fee and one long-term mineral lease. The lease is for 25 acres and a minimum royalty is paid annually expiring on November 26, 2042.

The Mapleton Depot operation mineral reserves and rights are secured under three long-term mineral leases. One of the leases is with a Commission of the Pennsylvania State government. Annual minimum royalty is nominal, and production royalty payments are based on selling price with a minimum per-ton royalty expiring from June 2021 through August 2025.

The Festus operation leases its reserves from another company that is also the mining contractor for those reserves. There is a royalty associated with the mineral lease agreement expiring on December 31, 2048.

When Crane County reserves were acquired, we entered into a royalty agreement with the company that sold us the land. The non-participating royalty interest is perpetual and based on tons of frac sand sold. Currently, the Crane County site is in development.

The Clark operation mineral reserves and rights are secured by a combination of land owned in fee, unpatented placer claims and a mineral lease. A federal lease covers unpatented placer claims expiring on December 12, 2022, and includes a minimum royalty and production royalty clause with credits.

The Fernley operation mineral reserves and rights are secured by a combination of land owned in fee and unpatented placer claims.

The Fowlkes operation mineral reserves and rights are secured by a combination of land leased, for which royalty obligations expired in November 2018, and land owned in fee simple.

The Hazen Mine’s mineral reserves and rights are secured by a combination of land owned in fee and unpatented placer claims. A mineral lease covers unpatented placer claims on federal lands expiring September 12, 2020, with royalty obligations.

The Popcorn Mine mineral reserves and rights are secured by lode claims.

The Colado Mine mineral reserves and rights are secured by owned claims on federal land and an evergreen land lease.

The Celatom Mine mineral reserves and rights are secured by a combination of land owned in fee, unpatented placer claims, unpatented mill site claims and mineral leases. Some of the leased unpatented mineral rights are state owned.

The Cheto Mine mineral reserves and rights consist of leased private land for which a minimum annual royalty is owed as well as a per ton royalty with a credit back against the minimum annual royalty.

The Fallon Mine’s mineral reserves and rights are secured by unpatented placer claims on federal lands.

Summary of Reserves

We follow SEC Industry Guide 7 in determining our mineral reserves. Exploration samples are evaluated in our laboratory facilities to assess product quality and mining/processing parameters. Members of our sales management team assess the salability of the product(s). Geologic, topographic and site data are used to create a geologic model and mining plan. We prepare an analysis of operating costs, capital costs and long-term anticipated sales volume and price to ensure the economic viability of the reserve. In performing feasibility economic analysis for purposes of categorizing proven and probable reserves, we considered a range of average sales price assumptions: for commercial silica, from $30 per ton for some of our Oil & Gas Proppants sands to $80 per ton for high-quality glass sand in our Industrial & Specialty Products segment; for diatomaceous earth, from $65 to $1015 per ton; for clay, from $60 to $1625 per ton; and for perlite, $70 to $1600 per ton. Reserve estimates are updated when necessary to account for new geologic, mining, sales or cost data.

The following table provides information on our production facilities that have reserves as of December 31, 2018. Included is the location and area of the facility; the type, amount and ownership status of its reserves; and the primary end markets that it serves.

Mine/Plant Location	Acreage Owned/Leased	Proven Reserves	Probable Reserves	Combined Proven and Probable Reserves	Estimated Processing Recovery Percentages		2018 Tons Mined	Primary End Markets Served
	(in acres)	(tonnage data in thousands)						
Crane County, TX	3200 owned	122,777	47,500	170,277	73	%	1,123	Oil and gas proppants[3]
Lamesa, TX	3523 owned	101,695	16,300	117,995	58	%	1,205	Oil and gas proppants[3]
Festus, MO	635 leased	16,318	7,411	23,729	84	%	1,796	Oil and gas proppants[3]
Ottawa, IL	2,100 owned	123,778	—	123,778	89	%	4,093	Oil and gas proppants[3], glass, chemicals, foundry[4]
Voca, TX	1,061 owned	22,793	19,080	41,873	30	%	2,669	Oil and gas proppants[3]
Tyler, TX	1356 owned	—	17,898	17,898	72	%	1,932	Oil and gas proppants[3]
Mill Creek, OK	2,174 owned 16 mineral lease	—	13,550	13,550	61	%	2,437	Oil and gas proppants[3], glass, foundry, building products[4]
Sparta, WI	660 owned	22,930	2,740	25,670	85	%	1,996	Oil and gas proppants[3]
Utica, IL	148 owned	7,363	—	7,363	88	%	2,152	Oil and gas proppants[3]
Mapleton Depot, PA	1,761 owned 194 mineral lease 98 access lease	1,989	2,100	4,089	81	%	683	Glass, building products[4]
Pacific, MO	524 owned	13,175	7,994	21,169	83	%	1,255	Oil and gas proppants[3], glass, foundry, fillers and extenders[4]
Kosse, TX	1,053 owned 25 mineral lease	10,830	—	10,830	40	%	—	Oil and gas proppants[3], building products, recreational products[4]
Berkeley Springs, WV	4,435 owned	1,223	6,000	7,223	72	%	504	Glass, building products, fillers and extenders[4]
Columbia, SC	648 lease 204 owned	4,208	—	4,208	72	%	534	Glass, building products, fillers and extenders[4]
Dubberly, LA	356 owned	4,300	—	4,300	82	%	225	Glass, foundry, building products[4]
Montpelier[1], VA	824 owned	—	12,774	12,774	39	%	191	Glass, building products[4]
Hurtsboro, AL		322	—	322	83	%	156	Foundry, building products[4]

	117 owned 1,108 mineral lease							
Mauricetown, NJ	1,279 owned	11,554	—	11,554	55	%	260	Filtration, foundry, building products[4]

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Rockwood [(2)], MI	872 owned	8,363	—	8,363	—	%	—	Glass, building products[(4)]
Middleton, TN	1,178 owned	1,528	11,657	13,185	66	%	182	Absorbent for automotive, industrial[(4)]
Clark, NV	1,730 owned 70 leased	2,338	973	3,311	78	%	72	Absorbents, catalysts, supports filtration[(4)]
Fernley, NV	5,668 owned	1,616	—	1,616	60	%	55	Absorbent for automotive, industrial[(4)]
Fowlkes Mine, MS	502 owned / 146 leased	—	1,222	1,222	100	%	74	Edible oil, petro chemical, animal feed[(4)]
Hazen Mine, NV	120 owned 1135 leased	358	84	442	90	%	38	Calcium silicate insulation[(4)]
Popcorn Mine, NV	200 owned	4,662	—	4,662	93	%	17	Filtration for wine, sugar, enzymes[(4)]
Colado Mine, NV	3,067 owned 3,799 leased	1,066	3,273	4,339	83	%	279	Filtration for brewing, wine, swimming pools, sweeteners; additives for coatings, LDPE film[(4)]
Celatom Mine, OR	4,998 owned 2,120 leased	—	25,381	25,381	90	%	102	Filtration for brewing, wine, swimming pools, sweeteners; additives for coatings[(4)]
Cheto Mine, AZ	10,240 lease	—	579	579	100	%	1	Static desiccant[(4)]
Fallon, NV	840 owned	—	935	935	70	%		