

CARBO CERAMICS INC
Form 10-K
February 28, 2019

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

Form 10-K

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

For the transition period from _____ to _____

Commission File No. 001-15903

CARBO Ceramics Inc.

(Exact name of registrant as specified in its charter)

DELAWARE 72-1100013
(State or other jurisdiction of (I.R.S. Employer
incorporation or organization) Identification Number)

575 North Dairy Ashford, Suite 300

Houston, Texas 77079

(Address of principal executive offices)
(281) 921-6400

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(Registrant's telephone number)

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

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes 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

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 No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted 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 such files). Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of 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	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

The aggregate market value of the Common Stock held by non-affiliates of the Registrant, based upon the closing sale price of the Common Stock on June 30, 2018, as reported on the New York Stock Exchange, was approximately \$129,537,208. Shares of Common Stock held by each director and executive officer and each person who owns 10% or more of the outstanding Common Stock have been excluded in that such persons may be deemed to be affiliates. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

As of February 22, 2019, the Registrant had 28,092,216 shares of Common Stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for Registrant's Annual Meeting of Stockholders to be held May 21, 2019, are incorporated by reference in Part III.

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PART I

Item 1. Business

General

CARBO Ceramics Inc. (“we,” “us,” “our” or our “Company”) is a global technology company that provides products and services to the oil and gas, industrial, and environmental markets to enhance value for its clients. The Company was incorporated in 1987 in Delaware. As used herein, “Company”, “CARBO”, “we”, “our” and “us” may refer to the Company and/or its consolidated subsidiaries.

The Company conducts its business within two operating segments: 1) Oilfield and Industrial Technologies and Services and 2) Environmental Technologies and Services. Financial information about reportable operating segments is provided in Note 14 to the Company’s Consolidated Financial Statements.

The Company’s Oilfield and Industrial Technologies and Services segment manufactures and sells ceramic technology products and services, base ceramic proppant and frac sand for both the oilfield and industrial sectors. The products have different technology features and product characteristics, which vary based on the application for which they are intended to be used. The various ceramic products’ manufacturing processes are similar.

Oilfield ceramic technology products, base ceramic proppant and frac sand proppant are manufactured and sold to pressure pumping companies and oil and gas operators for use in the hydraulic fracturing of natural gas and oil wells. Hydraulic fracturing is the most widely used method of increasing production from oil and natural gas wells. The hydraulic fracturing process consists of pumping fluids down a natural gas or oil well at pressures sufficient to create fractures in the hydrocarbon-bearing rock formation. A granular material, called proppant, is suspended and transported in the fluid and fills the fracture, “propping” it open once high-pressure pumping stops. The proppant filled fracture creates a conductive channel through which the hydrocarbons can flow more freely from the formation to the well and then to the surface.

There are three primary types of proppant that can be utilized in the hydraulic fracturing process: sand, resin coated sand and ceramic. Sand is the least expensive proppant, resin-coated sand is more expensive and ceramic proppant is typically the most expensive. We believe that the higher initial cost of ceramic proppant is justified by the fact that its use in certain well conditions typically results in an increase in the production rate of oil and natural gas, an increase in the total oil or natural gas that can be recovered from the well and, consequently, an increase in cash flow for the operators of the well. The increased production rates are primarily attributable to the higher strength and more uniform size and shape of ceramic proppant versus alternative materials. We are one of the world’s largest suppliers of ceramic proppant.

We manufacture various distinct ceramic proppants. Our technology suite of ceramic proppants include the following:

KRYPTOSPHERE® HD is a high-performance mono-mesh ceramic proppant engineered to deliver increased conductivity and durability in the highest closure stress wells. In challenging, high-cost environments such as ultra-deep wells, KRYPTOSPHERE HD retains its integrity and enables greater production and Estimated Ultimate Recovery (“EUR”) from the reservoir.

KRYPTOSPHERE XT meets client needs for a lower density proppant than KRYPTOSPHERE HD, and the closure stress is lower than the application for KRYPTOSPHERE HD, but higher than KRYPTOSPHERE LD. Commercialization occurred in January 2019.

KRYPTOSPHERE LD meets client needs for a lower density proppant than KRYPTOSPHERE HD, yet has similar characteristics and conductivity in high stress wells.

SCALEGUARD® is a porous ceramic proppant that is infused with scale-inhibiting chemicals and placed throughout the fracture as part of the hydraulic fracturing process. The infused scale inhibitor in SCALEGUARD is designed to be released into the fracture only on contact with water and thereby reduce or eliminate expensive remedial maintenance programs. SALTGUARD® was commercialized in 2018. The product has been shown to prevent salt build up in oil and gas wells.

Our FUSION® technology improves well productivity by forming a stable, high-permeability proppant pack that prevents proppant washout from the non-compressive annulus and near-wellbore areas.

CARBOAIR® is a high-transport, ultra-low-density ceramic proppant technology that has been developed primarily to increase production and EUR from slickwater fracturing operations. The technology enables exploration and production (“E&P”) operators to avoid the introduction of gel into their fracs while improving reservoir contact and fracture conductivity.

NANOMITE™ C is a micro mesh ceramic proppant which is engineered to prop natural fractures which are opened during the hydraulic fracturing process which would not normally be propped open. The resulting propped reservoir contact increases and the EUR is increased.

Our RPM relative permeability modification technology is engineered to alter the wettability of proppant to neutral, preventing the retention of water-based fluid in the proppant pack. As a result, RPM technology increases the effective fracture length, conductivity and permeability of the pack to hydrocarbons, leading to higher production and increased ultimate recovery.

In addition, we manufacture CARBONRT®, a detectable proppant that utilizes a non-radioactive tracer material to assist operators in determining the locations of fractures in a natural gas or oil well. This tracer is added to the proppant granules during the manufacturing process, and can be added to most of the types of proppant that the Company sells.

Our base ceramic suite of products include:

CARBOLITE® and CARBOECONOPROP® are low-density ceramic proppants. CARBOLITE® is used in medium depth oil and natural gas wells, where higher production rates can be achieved due to the product’s uniform size and spherical shape. CARBOECONOPROP was introduced to provide a lower cost ceramic to compete more directly with resin-coated sand and sand proppant.

We produce resin-coated ceramic (CARBOBOND LITE®), which addresses a niche market in which oil and natural gas wells are subject to the risk of proppant flow-back.

Our sand proppants include CARBO NORTHERN-WHITE, which is a frac sand that is used by operators that still value quality, but do not wish to pay the higher costs associated with ceramic or resin-coated proppants.

Our industrial ceramic technology products are manufactured and sold to industrial companies globally. These products are designed for use in various industrial technology applications, including but not limited to casting and milling.

Our industrial sand products are manufactured and sold to industrial companies. These products are designed for use in various industrial applications.

ACCUCAST® is a high-performance ceramic casting media that is engineered for precision performance. Outperforming specialty and silica sand products, their unique thermal, physical and chemical properties reduce media consumption and costs, lower production defects and reduce energy consumption.

CARBOGRIND® is a high-performance ceramic media that improves grinding efficiency while lowering operational costs for clients. The durability of our ceramic grinding media results in longer product life, while the uniform size and spherical shape add efficiency to grinding operations and reduce wear on the mechanical parts of milling equipment.

The CARBOBEAD™ family of high-performance ceramic media technologies are engineered to provide economic, Health, Safety and Environmental (HSE) and performance advantages in a wide variety of industrial applications compared to sand and other competing synthetic media types.

We also produce industrial products at our manufacturing facilities for third parties under tolling arrangements. These products have been used in industrial, agricultural and oilfield applications. Contract manufacturing has led to increased revenue generation. We continue to develop additional opportunities within the industrial, agricultural and oil and gas industries to grow revenue, and to reduce our plant's slowing and idling costs.

Through our wholly-owned subsidiary StrataGen, Inc., we promote increased production and EUR of oil and natural gas by selling a widely used fracture stimulation software under the brand FracPro®, and providing fracture design and consulting services to oil and natural gas E&P companies under the brand StrataGen®.

FracPro provides a suite of stimulation software solutions used for designing fracture treatments and for on-site real-time analysis. Use of FracPro enables our clients to optimize stimulation jobs to enhance oil and gas production. FracPro has been integrated with third-party reservoir simulation software, furthering its reach and utility.

The StrataGen consulting team works with operators around the world to help optimize well placement, fracture treatment design and production enhancement. The broad range of expertise of the StrataGen consultants includes: fracture treatment design; completion support; on-site treatment supervision; quality control; post-treatment evaluation and optimization; reservoir and fracture studies; rock mechanics and software application and training.

Our Environmental Technologies and Services segment is intended to protect operators' assets, minimize environmental risks and lower lease operating expense ("LOE"). Asset Guard Products Inc. ("AGPI"), the only wholly-owned subsidiary of ours to operate in this segment, provides spill prevention, containment and countermeasure systems for the oil and gas and industrial industries. AGPI uses proprietary technology to make products designed to enable its clients to extend the life of their storage assets, reduce the potential for hydrocarbon spills and provide containment of stored materials.

Current demand for proppant is extremely dynamic. Most of our oilfield products and services depend primarily on the supply of and demand for oil and natural gas, as well as on the number of natural gas and oil wells drilled, completed or re-completed worldwide. More specifically, the demand for most of our products and services is dependent on the number of oil and natural gas wells that are hydraulically fractured to stimulate production. The demand for our products and services is also dependent on the commodity price of oil and natural gas, and lower commodity prices result in fewer purchases of our premium products. In addition, our results of operations are also significantly affected by a host of other factors, including but not limited to (a) rig counts, (b) well completions activity, which is not necessarily correlated with rig count, (c) customer preferences, (d) new product and technology adoption, (e) imports and competition, (f) changes in the product mix of what we sell, (g) costs of developing our products and services and running our business, and (h) changes in our strategy and execution.

During the year ended December 31, 2018, we generated approximately 81% of our consolidated revenues in the United States and 19% in international markets.

Competition

As the demand for ceramic proppant (including proppant produced by us) continued to be negatively impacted in 2018 by the severe decline in the oil and natural gas industry, the number of domestic and international competitors in the marketplace continued to decrease, and many of our competitors have shut down plants and/or reduced production. However, we do not have full visibility as to the extent or duration of these shut-downs and reductions. One of our worldwide proppant competitors is Saint-Gobain Proppants ("Saint-Gobain"). Saint-Gobain is a division of Compagnie de Saint-Gobain, a large French glass and materials company. Saint-Gobain manufactures a variety of ceramic proppants that it markets in competition with some of our products. Saint-Gobain's primary manufacturing facilities are located in Bauxite, Arkansas. Saint-Gobain also manufactures ceramic proppant in China. Mineracao Curimbaba ("Curimbaba"), based in Brazil, also manufactures and markets ceramic proppant in competition with some of our products. Imerys, S.A., a competitor based in France ("Imerys"), has ceramic proppant manufacturing facilities in Andersonville and Wrens, Georgia and also competes with some of our products.

We are aware of a number of manufacturers in China. Most of these companies produce intermediate-density and low-density ceramic proppants that are marketed both inside and outside of China. Chinese proppant imports into the United States increased beginning in 2010 and 2011, which contributed to an over-supply of ceramic proppant beginning in 2012. However, beginning in early 2015, imports declined significantly or stopped.

Our KRYPTOSPHERE product line replaced both CARBOHSP and CARBOPROP. Historically, competition for CARBOHSP and CARBOPROP principally includes ceramic proppant manufactured by Saint-Gobain, Curimbaba, as well as various manufacturers located in China. Our CARBOLITE, CARBOECONOPROP and CARBOHYDROPROP products compete primarily with ceramic proppant produced by Saint-Gobain, Curimbaba and Imerys and with sand-based proppant for use in the hydraulic fracturing of natural gas and oil wells. At this time, there is not in our view a comparable competitor's product to our mono-mesh KRYPTOSPHERE product line, which is the subject of patent protection.

We believe that some of the significant factors that influence a customer's decision to purchase our ceramic proppant are (i) reservoir and geological characteristics, (ii) price/performance ratio, (iii) on-time delivery performance, (iv) technical support, (v) proppant availability and (vi) the financial status of E&P operators. We believe that our products are competitively priced and that our delivery performance and customer experience is far better than the competition. We have seen an increased usage of our technology proppants internationally and in North America, especially with E&Ps which are focused on increasing the EUR of their wells, are completing wells with higher permeability or are making attempts to lower their lease operating expenses (LOE).

The leading suppliers of Northern White mined sand are Covia Corporation, U.S. Silica Company, Hi-Crush Partners LP, and Badger Mining Corp. There are several other sand competitors (including the aforementioned) which have added in-basin capacity in the last year. This is sand which has significantly lower quality (resulting in lower EUR and production), but is closer to where the wells will be completed resulting in significantly lower costs. A large majority of our sand from our Northern White sand plant as well as the distribution center it is being railed into is under contract.

Our industrial ceramic products enhance our clients' performance for their manufacturing processes, products, and services. The two primary industries of the ten market segments we currently serve are foundry with our ACCUCAST products and grinding applications with our CARBOGRIND products. Our industrial sector has competitors across several industries we sell into.

ACCUCAST metal casting media products are used by foundries to form high quality cores and molds. During the past year, our sales activity has focused on North America and primarily in the United States due to the new OSHA PEL for respirable crystalline silica that went into effect in 2018 for foundries. ACCUCAST ceramic media is a solution for the new OSHA requirements. We utilize direct sales B2B and a network of qualified distributors. Our competition in the North American foundry market includes several ceramic media manufacturers and the primary competitors in the North American foundry market is Itochu and Prince Minerals. Itochu, based in Tokyo and Osaka, Japan, is a diverse global company competing in many industries including Textile, Machinery, Metals & Minerals, Energy & Chemicals, Food, General Products & Realty, and Financial Business Services with distribution facilities and manufacturing located globally. Their Cerabeads, casting media for the foundry market, is produced in Japan and distributed globally. Sales are direct B2B and through a broad group of distributors. Prince Minerals, headquarters in Houston, TX, is a manufacturer and distributor of specialty chemicals and industrial additives. They sell direct B2B and through distributors selling both internally and externally manufactured products. Their Ceramcast, media for the foundry market, has been historically produced by a third party manufacturer in China with narrow product offerings for foundries.

CARBOGRIND products are used in milling equipment for processing ore in the precious metals mining industry and other milling applications such as pigments, paints, and ceramic tile. Within the precious metals mining industry, we sell globally through direct sales teams and distributors. Competitors in the precious metals mining industry include Keramos, Magotteaux, Saint Gobain, Kings, and Cenotec. The majority of these competitors manufacture their ceramic grinding products in manufacturing plants located in China.

We believe some of the significant factors that influence a customer's decision to purchase our industrial ceramic media are (i) broad portfolio of superior ceramic products designed specifically to solve challenges for different industries (ii) excellent price/performance ratio, (iii) on-time delivery performance, (iv) technical support, (v) product availability (vi) consistent superior quality and (vii) the financial status of our clients. We believe our industrial products are competitively priced and our delivery performance and customer experience is better than the competition. Lastly, our superior technical support has enabled us to persuade customers to use our products in an increasingly broad range of applications which in turn has increased the overall market for our industrial products.

The ASSETGUARD™ environmental sector is divided into two divisions: a manufacturing division and a services division. The manufacturing division supplies products into both the oil and gas and industrial markets. The service business, operating as Falcon Technologies, provides services to the oil and gas market. In 2018, oil and gas activity levels accelerated beyond those seen in both 2016 as well as 2017, and as a result additional competition entered into the market. Falcon Technologies operates in the United States, and we are aware of at least two dozen competitors operating within the United States.

It is our belief that there are several key factors that are driving customers to purchase from ASSETGUARD, including (i) centralized manufacturing, which offers customers one stop shopping capability, along with a proven track record of on time delivery and competitive pricing, (ii) field services that are established across the United States as being professional, efficient, and reliable and centered on customer satisfaction, (iii) and the technical support available to the customer is unmatched in the industry, ensuring that the client receives timely response to their issues and quick resolution to any problem that might arise.

Product Development

We have broadened our product development efforts in 2018 to address the dynamic growth of the industrial, contract manufacturing, and environmental sectors. Product development efforts are roughly equally split between oilfield and industrial applications.

SALTGUARD was commercialized in our GUARD® product line to prevent salt buildup in oil and gas wells.

CARBOGRIND, our superior line of grinding media, portfolio of products continues to grow. Many new product offerings were launched in 2018 as a direct result of our customers requiring grinding solutions to solve their grinding challenges. The portfolio of

products will continue to grow as our development team develops products with heavier densities, various sizes, and improve grinding performance.

QUANTUM™ service based on iON™ electrically conducting proppant continues to be the industry best method to directly measure hydraulic fracture dimensions. This technology will become commercial in 2019.

Intellectual property continues to be a strong focus to support our technology leadership. In 2018, ten patents were issued to the Company.

Customers and Marketing

The customer base within CARBO is transforming as our revenue streams change from primarily oil and gas, to oil and gas, industrial and environmental customers. The three business sectors are each utilizing different sales channels, including direct to the end consumer of our products and services, an intermediary which adds their services around our products, distributors and through ecommerce for certain products. We are seeing shifts in the purchasing behaviors of some of the end users of our products and have changed and are changing our sales and marketing efforts accordingly.

Our largest customers are participants in the hydraulic fracturing industry. Specifically, Halliburton Energy Services, Inc. and Keane Group which each accounted for more than 10% of our 2018 revenues. We generally supply our customers with products on a just-in-time basis, as specified in individual purchase orders. Continuing sales of product depend on our direct customers and the operators being satisfied with value creation, product quality, availability and delivery performance. In addition, our ability to increase sales of our products and services depends on a favorable level of activity in the upstream oil and gas industry and expansion into other industrial and environmental business segments as well as capturing further market share in conventional segments.

We recognize the importance of a technical marketing program in demonstrating long-term economic advantages when selling products and services that offer financial benefits over time. We have a broad technical sales force to advise end users on the benefits of using our base ceramic proppant, technology ceramic products, fracture simulation software, and related consulting services. In addition we have added domain technical expertise within our industrial business unit to provide technical recommendations and ongoing support throughout the sales and ownership process. We also believe that our new product introductions and education-based technical marketing efforts have enabled us to maintain our position not only as one of the world's largest suppliers of ceramic proppant but also as a leading innovator in the three sectors we sell into: oil and gas, industrial and environmental.

Our international marketing efforts are conducted primarily through our sales offices in Houston, the United Arab Emirates, Canada, Europe, and South America. Our products and services are used worldwide by U.S. customers operating domestically and abroad, and by foreign customers. Sales outside the United States accounted for 19% and 21% of our sales for 2018 and 2017, respectively. The distribution of our international and domestic revenues is shown below, based upon the region in which the customer used the products and services:

	For the years ended December 31, 2018 2017 (\$ in millions)	
Location		

United States	\$ 171.2	\$ 149.0
International	39.5	39.8
Total	\$ 210.7	\$ 188.8

Production Capacity

We have adequate capacity to support present and foreseeable demand for our products. We continue to incorporate new methods and technologies to reduce our manufacturing costs and make our products more cost-competitive. Our manufacturing costs per unit are typically inversely related to production levels. When production levels increase, costs per unit tend to decrease, and when production levels decrease, costs per unit tend to increase.

Stated capacity of our facilities varies based on the mix of products we expect to produce. The following table sets forth the current stated capacity of each of our existing ceramic manufacturing and other facilities:

Location	Annual Capacity (millions of pounds)	
Eufaula, Alabama	245	*
McIntyre, Georgia	275	*
Toombsboro, Georgia	1,000	*
Total ceramic manufacturing capacity	1,520	
Marshfield, Wisconsin – sand processing	1,500	
New Iberia, Louisiana – resin-coating	330	**
Total current capacity	3,350	

* Given market conditions, output levels at these facilities are at reduced levels.

** Processing activities at the New Iberia facility primarily involve resin-coating of previously manufactured ceramic proppant substrate.

The retrofit of the first production line at our Eufaula, Alabama plant to produce KRYPTOSPHERE was completed in late 2015. With this retrofit, we can now produce up to approximately 100 million pounds of KRYPTOSPHERE annually. While this retrofit enables production of our new KRYPTOSPHERE technology products, it did not add additional production capacity.

During 2018, our overall total ceramic plant utilization, excluding our Millen plant, which we sold in December 2018, was approximately 16% of stated capacity. Our sand processing plant in Marshfield operated at approximately 73% of its stated capacity during 2018. We expect improvements to our plant utilization in 2019 due to contract manufacturing growth. We expect utilization at our sand processing plant to improve during 2019. Depending on industry conditions, we can modify output levels or idle operations at plants as needed. Refer to our discussion of impairment considerations in the “Critical Accounting Policies” section of Item 7 - Management’s Discussion and Analysis of Financial Condition and Results of Operations. Construction of additional manufacturing capacity beyond our existing facilities is not expected in the foreseeable future, and would be dependent on the expected future demand for our products, access to needed capital and the ability to obtain necessary environmental permits.

Distribution

We maintain finished goods inventories at each of our manufacturing facilities and at remote stocking facilities. Our North American remote stocking facilities consist of bulk storage silos with truck trailer and sand box loading facilities, as well as rail yards for direct transloading from rail cars to truck trailers. International remote stocking sites are duty-free warehouses operated by independent owners. North American sites are typically supplied by rail, and international sites are typically supplied by container ship. In total, we lease approximately 1,691 rail cars for use in the distribution of our products, of which we have subleased approximately 570 rail cars.

Raw Materials

Ceramic proppant and ceramic media are made from alumina-bearing ores (commonly referred to as clay, bauxite, bauxitic clay or kaolin, depending on the alumina content) that are readily available on the world market. The main known deposits of alumina-bearing ores in the United States are in Arkansas, Alabama and Georgia; other

economically mineable known deposits are located in Australia, Brazil, China, Gabon, Guyana, India, Jamaica, Russia and Surinam. Bauxite is largely used in the production of aluminum metal, refractory material and abrasives. We believe that our ability to purchase bauxite on the open market coupled with our current bauxite inventories will sufficiently provide for our bauxite needs in the United States during 2019.

Our Eufaula, McIntyre and Toombsboro facilities primarily use locally mined kaolin for the production of CARBOLITE, CARBOECONOPROP and CARBOHYDROPROP. We have entered into bi-lateral contracts that require a supplier to sell to us, and require us to purchase from the supplier, at least fifty percent of the Eufaula facility's annual kaolin requirements. The contract runs through May 2020, with an option for us to extend this agreement for additional three year terms. We have obtained ownership rights in acreage in Wilkinson County, Georgia, which contains in excess of a twelve year supply of kaolin for our Georgia facilities based on full capacity production rates. We have entered into a long-term agreement with a third party to mine and transport this material at a fixed price subject to annual adjustment. The agreement requires us to utilize the third party to mine and transport a majority of the McIntyre and Toombsboro facility's annual kaolin requirement. Overall, we estimate that our fee simple and leasehold mineral rights

in the states of Alabama and Georgia contain approximately 19.0 million tons of kaolin suitable for use in production of our kaolin-based proppants.

We utilize our own Northern White sand, CARBO NORTHERN-WHITE, and purchase third party wet processed sand reserves for our sand processing facility in Marshfield, Wisconsin, which supplies raw frac sand to the proppant market.

Ceramic Production Process

Ceramic proppants are made by grinding or dispersing ore to a fine powder, combining the powder into small pellets and firing the pellets in a rotary kiln. We use three different methods to produce ceramic proppant. Industrial ceramic media follows a similar process.

Our plant in McIntyre, Georgia uses a dry process, which utilizes clay, bauxite, bauxitic clay or kaolin. The raw material is ground, pelletized and screened. The manufacturing process is completed by firing the product in a rotary kiln.

Our plants in Eufaula, Alabama and Toombsboro, Georgia use a wet process, which starts with kaolin that is formed into slurry. The slurry is then pelletized in a dryer and the pellets are then fired in a rotary kiln.

The portion of our plant in New Iberia, Louisiana that manufactures ceramic proppant, as well as one line at our Eufaula, Alabama facility, uses a proprietary manufacturing process associated with the Company's KRYPTOSPHERE product line.

Our rotary kilns are primarily heated by the use of natural gas.

Patent Protection and Intellectual Property

We make ceramic proppant and ceramic media used in foundry, grinding and scouring processes by processes and techniques that involve a high degree of proprietary technology, some of which is protected by patents.

We own multiple patents in the United States and various foreign countries that relate to different types of ceramic proppant and production methods used for ceramic proppant and ceramic media; however, depending on market conditions, production of products pursuant to these patents may not necessarily constitute a material portion of our output. We also own multiple U.S. and foreign patents that relate to methods for the detection of subterranean fractures and material, including gravel packs, in the near-borehole region. We also own multiple U.S. patents that relate to detectable proppant.

During 2014 and 2015, we obtained three U.S. patents relating to our KRYPTOSPHERE manufacturing process, during 2017, we obtained one U.S. patent covering the KRYPTOSPHERE product, and during 2018, we obtained another U.S. patent covering the KRYPTOSPHERE product, each of which expire in 2031, and another U.S. patent relating to our KRYPTOSPHERE manufacturing process, which expires in 2036. Also, during 2018, we obtained two U.S. patents relating to our GUARD product lines, which expire in 2035 and one U.S. patent relating to our FUSION product line, which expires in 2037. We expect these patents to provide assistance in the future sales of these product lines. During 2015, 2016, 2017, and 2018, we obtained six U.S. patents, which expire in 2033, 2034, 2035 and 2036 and relate to our far-field proppant detection products, systems and methods which relate to our iON product line and the QUANTUM service line, which are still under development.

We own multiple U.S. patent applications (together with a number of counterpart applications pending in foreign jurisdictions). A portion of the U.S. patent applications cover ceramic proppant, detectable proppant, processes for making ceramic proppant and detectable proppant, tracers for detecting produced fluids, diversion particles, detection of subterranean fractures, and our KRYPTOSPHERE, GUARD, FUSION, CARBOAIR, and NANOMITE product lines and methods for making and using these products. Another portion of the U.S. patent applications cover non-oilfield or industrial products, such as water treatment compositions, foundry media, building materials and ceramic media for use in solar power plants. The applications are in various stages of the patent prosecution process, and patents may not issue on such applications in any jurisdiction for some time, if they issue at all.

AGPI owns three U.S. patents, which expire in 2026, 2027 and 2034 and relate to construction of secondary containment areas. In addition, AGPI owns four U.S. patents, which expire in 2030 and 2031 and relate to polyurea-encapsulated tank bases. AGPI also owns multiple U.S. patent applications, each of which relates to tank bases, equipment bases, portable containments, or components useful in containment areas in upstream, midstream and downstream environments.

We believe that our patents have historically been important in enabling us to compete in the market to supply proppant to the natural gas and oil industry. We intend to enforce, and have in the past vigorously enforced, our patents. We may from time to time be involved in litigation to determine the enforceability, scope and validity of our patent rights. In addition to patent rights, and perhaps more notably, we use a significant amount of trade secrets, or “know-how,” and other proprietary information and technology in the conduct of our business. None of this “know-how” and technology is licensed from third parties. However, we have negotiated a long term license for some third party intellectual property used or jointly developed in connection with our QUANTUM service line.

Seasonality

Historically, we have experienced higher levels of proppant and environmental sales activities during warmer weather periods and less during colder weather months in the northern and eastern United States. In addition, sales activities can be decreased by the spring snow and ice “break-up” in Canada, North Dakota, Montana, and the Northeast U.S., as well as the winter holidays in December and January. Our industrial ceramic media products are not typically impacted by seasonality.

Environmental and Other Governmental Regulations

We believe that our operations are in substantial compliance with applicable domestic and foreign federal, state and local environmental and safety laws and regulations.

Existing federal environmental requirements such as the Clean Air Act and the Clean Water Act, as amended, impose certain restrictions on discharge of air and water pollutants from our operations via permits and regulations. Those pollutants include volatile organic compounds, nitrogen oxides, sulfur dioxide, particulate matter, storm water and wastewater discharges and other by-products. In addition to meeting environmental requirements for existing operations, the Company must also demonstrate compliance with environmental regulations in order to obtain any required permits prior to any future expansion. The United States Environmental Protection Agency (“EPA”) and state programs require covered facilities to obtain individual permits or have coverage under an EPA general permit issued to groups of facilities. A number of federal and state agencies, including but not limited to, the EPA, the Texas Commission on Environmental Quality, the Louisiana Department of Environmental Quality, the Alabama Department of Environmental Management, the Wisconsin Department of Natural Resources, and the Environmental Protection Division of the Georgia Department of Natural Resources promulgate and enforce environmental regulations applicable to our operations in the states in which we do business. Historically we have been able to obtain permits, where necessary, to build new facilities and modify existing facilities that allow us to continue compliant operations. Obtaining these permits in a timely manner will continue to be an important factor in our ability to do so in the future.

Employees

As of December 31, 2018, we had 407 employees worldwide. In addition to the services of our employees, we employ the services of consultants as required. Our employees are not represented by labor unions. There have been no work stoppages or strikes during the last three years that have resulted in the loss of production or production delays. We believe our relations with our employees are satisfactory.

Executive Officers of the Registrant

Gary A. Kolstad (age 60) was elected in June 2006 by our Board of Directors to serve as President and Chief Executive Officer and a Director of the Company. Mr. Kolstad previously served in a variety of positions over 21 years with Schlumberger. Mr. Kolstad became a Vice President of Schlumberger in 2001, where he last held the

positions of Vice President, Oilfield Services – U.S. Onshore and Vice President, Global Accounts.

Ernesto Bautista III (age 47) was appointed Vice President and Chief Financial Officer in January 2009. From July 2006 until joining the Company, Mr. Bautista served as Vice President and Chief Financial Officer of W-H Energy Services, Inc., a Houston, Texas based diversified oilfield services company (“W-H Energy”). From July 2000 to July 2006, he served as Vice President and Corporate Controller of W-H Energy. From September 1994 to May 2000, Mr. Bautista served in various positions at Arthur Andersen LLP, most recently as a manager in the assurance practice, specializing in emerging, high growth companies. Mr. Bautista is a certified public accountant in the State of Texas.

Don P. Conkle (age 54) was appointed Vice President, Marketing and Sales in October 2012. Mr. Conkle previously held a variety of domestic and international managerial positions in engineering, marketing and sales, and technology development over a 26 year period with Schlumberger. He served in the positions of Vice President of Stimulation Services from 2007 until 2009, as

GeoMarket Manager (Qatar & Yemen) from 2009 until 2011 and as Production Group Marketing and Technology Director from 2011 until he joined the Company.

Robert J. Willette (age 43) was appointed Vice President, General Counsel, Corporate Secretary and Chief Compliance Officer in October 2017. Prior to his current role, Mr. Willette served as General Counsel and Corporate Secretary for Texon Distributing L.P. beginning in 2009. From 2006 to 2009, Mr. Willette served as Corporate Counsel for Ferrellgas L.P.

All officers are elected for one-year terms or until their successors are duly elected. There are no arrangements between any officer and any other person pursuant to which he was selected as an officer. There is no family relationship between any of the named executive officers or between any of them and the Company's directors.

Forward-Looking Information

The Private Securities Litigation Reform Act of 1995 provides a "safe harbor" for forward-looking statements. This Form 10-K, our Annual Report to Shareholders, any Form 10-Q or any Form 8-K of the Company or any other written or oral statements made by or on behalf of the Company may include forward-looking statements which reflect the Company's current views with respect to future events and financial performance. The words "believe", "expect", "anticipate", "project", "estimate", "forecast", "plan" or "intend" and similar expressions identify forward-looking statements. Readers are cautioned not to place undue reliance on these forward-looking statements, each of which speaks only as of the date the statement was made. We undertake no obligation to publicly update or revise any forward-looking statements, whether as a result of new information, future events or otherwise. Our forward-looking statements are based on assumptions that we believe to be reasonable but that may not prove to be accurate. All of our forward-looking information is subject to risks and uncertainties that could cause actual results to differ materially from the results expected. Although it is not possible to identify all factors, these risks and uncertainties include the risk factors discussed below.

Our results of operations could be adversely affected if our business assumptions do not prove to be accurate or if adverse changes occur in our business environment, including but not limited to:

- changes in the cost of raw materials and natural gas used in manufacturing our products;
- risks related to our ability to access needed cash and capital;
 - our ability to meet our current and future debt service obligations, including our ability to maintain compliance with our debt covenants;
- our ability to manage distribution costs effectively;
- our ability to successfully implement strategic changes in our business;
- changes in demand and prices charged for our products;
- technological, manufacturing and product development risks;
- our dependence on and loss of key customers and end users;
 - potential declines or increased volatility in oil and natural gas prices that adversely affect our customers, the energy industry or our production costs;
 - potential reductions in spending on exploration and development drilling in the oil and natural gas industry that reduce demand for our products and services;
- seasonal sales fluctuations;
- an increase in competition in the proppant market, including imports from foreign countries;
- logistical and distribution challenges relating to certain resource plays that do not have the type of infrastructure systems that are needed to efficiently support oilfield services activities;
- the development of alternative stimulation techniques that would not benefit from the use of our existing products and services, such as extraction of oil or gas without fracturing;

- changes in foreign and domestic governmental regulations, including environmental restrictions on operations and regulation of hydraulic fracturing;
- increased regulation of emissions from our manufacturing facilities;
- the development and utilization of alternative proppants for use in hydraulic fracturing;

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- general global economic and business conditions;
- weather-related risks and other risks and uncertainties;
- risks associated with the successful implementation of our transformation strategy;
- changes in foreign and domestic political and legislative risks;
- risks of war and international and domestic terrorism;
- risks associated with foreign operations and foreign currency exchange rates and controls and
- other risks and uncertainties.

Our results of operations could also be adversely affected as a result of worldwide economic, political and military events, including, but not limited to, war, terrorist activity or initiatives by the Organization of the Petroleum Exporting Countries (“OPEC”). For further information, see “Item 1A. Risk Factors.”

Available Information

Our annual reports on Form 10-K, proxy statements, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934 (“Exchange Act”) are made available free of charge on our internet website at <http://www.carboceramics.com> as soon as reasonably practicable after such material is filed with, or furnished to, the Securities and Exchange Commission (“SEC”).

The SEC maintains an Internet site that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC, at <http://www.sec.gov>.

Item 1A. Risk Factors

You should consider carefully the trends, risks and uncertainties described below and other information in this Form 10-K and subsequent reports filed with the SEC before making any investment decision with respect to our securities. If any of the following trends, risks or uncertainties actually occurs or continues, our business, financial condition or operating results could be materially adversely affected, the trading prices of our securities could decline and you could lose all or part of your investment.

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

Our operations are materially dependent upon the levels of activity in natural gas and oil exploration, development and production. More specifically, the demand for our products is related to the number of natural gas and oil wells completed in geologic formations where ceramic or sand proppants are used in fracture treatments. These activity levels are affected by both short-term and long-term trends in oil and natural gas prices. In recent years, oil and natural gas 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 OPEC, have contributed, and are likely to continue to contribute, to price volatility. Despite recent initiatives to curb supply, the global supply of oil is currently at historically high levels, and there is potential for geopolitical and regulatory events, such as normalization of trade relations with the Islamic Republic of Iran, to further increase the supply of oil. 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 and services. Natural gas prices experienced a significant decline during 2012 and, although they have increased since then, remain relatively low on a historic basis, resulting in generally lower gas drilling activity. Further, the price of oil declined precipitously from the second half of 2014 through mid-2016 and, although

the price rebounded from its low in the first half of 2018, it decreased again in the second half and still remains at weakened levels. This reduction in oil and natural gas prices has depressed the level of natural gas and oil exploration, development, production and well completions activity, resulting in significantly reduced demand and pricing for our base ceramic and sand products. In addition and because of the depressed commodity prices, we have seen a significant increase in the use of very low quality in-basin sand at the expense of lower production for unconventional wells, which have extremely low quality reservoirs. This decline has had, and continues to have, a significant adverse impact on our results. If oil and natural gas prices and well completion activity do not materially improve and/or demand for our products does not otherwise increase, this decline could reasonably be expected to have a material adverse effect on our financial condition or operations, including, but not limited to, the temporary idling of all, or a portion of all, of our facilities utilized for this sector of our business until such time as market conditions improve.

We may not have sufficient cash and/or be able to access liquidity alternatives in the credit and capital markets to meet our liquidity needs.

Our primary sources of liquidity are cash on hand and cash flow from operations. Our ability to fund our working capital and capital expenditures and other obligations depends on our future operating performance and cash from operations and other liquidity-generating transactions, which are in turn subject to prevailing oil and natural gas prices, economic conditions and other factors, many of which are beyond our control.

If our future operating performance falls materially below our expectations, our plans prove to be materially inaccurate, or industry conditions do not materially improve, we may require additional financing. Even if additional or alternative financing becomes available to us, future financing transactions may significantly increase the Company's interest expense, which could in turn reduce our financial flexibility and our ability to fund other activities, and could make us more vulnerable to changes in operating performance or economic downturns generally. The inability to generate sufficient cash, modify our New Credit Agreement, or obtain replacement or additional financing, or an event of default under our New Credit Agreement, could have a material adverse effect on our financial condition.

We therefore cannot provide any assurance that we will be able to access the capital or credit markets on acceptable terms or timing, or at all. Access to the capital markets and the cost and availability of credit may be adversely affected by factors beyond our control, including turmoil in the financial services industry, volatility in securities trading markets, the continuing downturn in the oil and gas industry and general economic conditions. Currently, we do not qualify as a "well-known seasoned issuer," which otherwise would allow us to, among other things, file automatically effective shelf registration statements. Now, even if we are able to access the public capital markets, any attempt to do so could be more expensive or subject us to significant delays when compared with previous periods.

Our business and financial performance has suffered and could suffer further if the levels of hydraulic fracturing continue to decline or cease as a result of the low commodity price of oil and natural gas, development of new processes, increased regulation or a continued decrease in drilling activity.

A large portion of our products are proppants used in the completion and re-completion of natural gas and oil wells through the process of hydraulic fracturing. Completion activity is directly impacted by the price of oil and natural gas. In addition, demand for our proppants is substantially higher in the case of horizontally drilled wells, which allow for multiple hydraulic fractures within the same well bore but are more expensive to develop than vertically drilled wells. A reduction in horizontal drilling or the development of new processes for the completion of natural gas and oil wells leading to a reduction in, or discontinuation of the use of, hydraulic fracturing could cause a decline in demand for our products. Additionally, increased regulation or environmental restrictions on hydraulic fracturing or the materials used in this process could negatively affect our business by increasing the costs of compliance or resulting in operational delays, which could cause operators to abandon the process due to commercial impracticability. Moreover, future federal, state, local or foreign laws or regulations could otherwise limit or ban hydraulic fracturing. Several states in which our customers operate have adopted, or are considering adopting, regulations that have imposed, or could impose, more stringent permitting, transparency, disposal and well construction requirements on hydraulic fracturing operations. Some states, such as New York, have banned the process of hydraulic fracturing altogether. Any of these events could have a material adverse effect on our results of operations and financial condition. As stated elsewhere, the upstream oil and natural gas industry is in the midst of a severe contraction, resulting in a significant reduction in horizontal drilling and further resulting in a material decline in demand for our products and services.

We face distribution and logistical challenges in our business.

As oil and natural gas prices fluctuate, our customers may shift their focus back and forth between different resource plays, some of which can be located in geographic areas that do not have well-developed transportation and distribution infrastructure systems. Transportation and logistical operating expenses continue to comprise a significant portion of our total delivered cost of sales. Therefore, serving our clients in these less-developed areas presents distribution and other operational challenges that affect our sales and negatively impact our operating costs. Disruptions in transportation services, including shortages of rail cars or a lack of rail transportation services or developed infrastructure, could affect our ability to timely and cost effectively deliver products to our customers and could provide a competitive advantage to competitors located in closer proximity to customers. Additionally, increases in the price of diesel fuel could negatively impact operating costs if we are unable to pass those increased costs along to our customers. Failure to find long-term solutions to these logistical challenges could adversely affect our ability to respond quickly to the needs of our customers or result in additional increased costs, and thus could negatively impact our results of operations and financial condition.

We operate in an increasingly competitive market.

The proppant market is highly competitive. We compete with other domestic and international suppliers of ceramic proppant, as well as with suppliers of sand for use as proppant, in the hydraulic fracturing of natural gas and oil wells. The expiration of key patents owned by the Company has resulted in additional competition in the market for ceramic proppant. The entry of additional competitors into the market, and/or a surge in the level of ceramic proppant imports into North America from existing competitors, could have a material adverse effect on our results of operations and financial condition.

Our industrial products have competitors across several industries we sell into. Competition for products in the North American foundry market includes several ceramic media manufacturers. There are also a number of competitors in the grinding market that primarily manufacture their ceramic grinding products in China. We believe our industrial products are competitively priced, are of higher quality and our customer experience is better than the competition.

Our environmental products have a large number of competitors across the United States. There are few barriers to entry in this market, however we do own key patents for some of our environmental products. We believe there are several key factors that drive customers to purchase our environmental products over the competition including centralized manufacturing, on time delivery, competitive pricing, a focus on customer satisfaction, and excellent technical support.

Adverse changes to these key factors or a shift in customer preferences to our competitor's products could have a material adverse effect on our results of operations and financial condition.

We have been and may continue to be adversely affected by decreased demand for our proppant or the development by our competitors of alternative proppants.

Ceramic proppant is a premium product capable of withstanding higher pressure and providing more highly conductive fractures than mined sand, which is the most commonly used proppant type. We continue to see operators that have traditionally used ceramic proppant shifting to use mined sand instead. Despite recently improving commodity prices in the oil and natural gas industry, continued pressure on operators to reduce cost or to evaluate returns on a shorter horizon has had a detrimental impact on the demand for ceramic proppant, which is a higher cost product than mined sand. Although we believe that the use of quality ceramic proppant in appropriate geologic formations typically generates higher production rates and more favorable long-term production economics than mined sand, the shifting of customer demand to lower cost products, such as mined sand, has had an adverse effect on our results of operations and its continuation could have a material adverse effect on our financial condition. The development and use of alternative proppant could also cause a decline in demand for our products, and could have a material adverse effect on our results of operations and financial condition.

We have no current plans to pay cash dividends on our common stock for the foreseeable future and our Amended Credit Agreement contains restrictions on our ability to pay dividends; therefore, you may not receive any return on investment unless you sell your common stock for a price greater than you paid.

We do not plan to declare dividends on shares of our common stock in the foreseeable future. In addition, our Amended Credit Agreement prohibits us from paying such dividends. We currently intend to retain any future earnings to finance the operation of our business and meet our debt obligations. As a result, you may only receive a return on your investment in our common stock if the market price of our common stock increases. Further, one of our financing options involves the issuance of equity securities, which would dilute current stockholders and could reduce our stock price.

The outstanding indebtedness under our New Credit Agreement is secured by a substantial portion of our domestic assets and guaranteed by our two domestic operating subsidiaries, subject to certain exceptions.

The outstanding indebtedness under our New Credit Agreement is secured by (i) a pledge of all accounts receivable and inventory, (ii) cash in certain accounts, (iii) domestic distribution assets residing on owned real property, (iv) our Marshfield, Wisconsin and Toombsboro, Georgia plant facilities and equipment, and (v) certain real property interests in mines and minerals. In the event of a default, our lenders may (1) elect to declare all outstanding borrowings made under the New Credit Agreement and the guaranties of the two operating subsidiaries, together with accrued interest and other fees, to be immediately due and payable; (2) exercise their set-off rights; and/or (3) enforce and foreclose on their security interest and liquidate some or all of such pledged assets. Any of these actions could, individually or in the aggregate, have a substantial negative impact on our financial condition and results of operations.

We rely upon, and receive a significant percentage of our revenues from, a limited number of key customers and end users.

During 2018, our key customers included several of the largest participants in the worldwide petroleum pressure pumping industry. Two of these customers each accounted for more than 10% of our 2018 revenues. However, the end users of our products are numerous operators of natural gas and oil wells that hire pressure pumping service companies to hydraulically fracture wells. During 2018, a majority of our ceramic proppant sales were directed to a concentrated number of end users. We generally supply our domestic pumping service customers with products on a just-in-time basis, with transactions governed by individual purchase orders and/or a master supply agreement. Because of their purchasing power, our key customers may have greater bargaining leverage than us with respect to the negotiation of prices and other terms of the sale in their supply contracts with us, which in turn, could adversely affect our profit margins associated with those contracts. Disparities in bargaining leverage, when combined with the Company's desire to maintain long-term relationships with key customers, could limit our practical ability to assert certain terms of our supply agreements with them. Continuing sales of our products depend on our direct customers and the end user well operators being satisfied with product quality, pricing, availability, and delivery performance. While we believe we have satisfactory relations with our customers and our end users, a material decline in the level of sales to any one of our major customers or loss of a key end user due to unsatisfactory product performance, pricing, delivery delays or any other reason could have a material adverse effect on our results of operations and financial condition.

The operations of our customers, and thus the results of our operations, are subject to a number of operational risks, interruptions and seasonal trends.

As hydraulic fracturing jobs have increased in size and intensity, common issues such as weather, equipment delays or changes in the location and types of oil and natural gas plays can result in increased variability in proppant sales volumes. Our business operations and those of our customers involve a high degree of operational risk. Natural disasters, adverse weather conditions, collisions and operator error could cause personal injury or loss of life, severe damage to and destruction of property, equipment and the environment, and suspension of operations. Our customers perform work that is subject to unexpected or arbitrary interruption or termination. The occurrence of any of these events could result in work stoppage, loss of revenue, casualty loss, increased costs and significant liability to third parties. With the increase in resource plays in the northern and eastern United States, as well as our operations in Marshfield, Wisconsin, our results of operations are increasingly exposed to seasonal variations and inclement weather. Operations in certain regions involve more seasonal risk in the winter months, and work is hindered during other inclement weather events. This variability makes it more difficult to predict sales and can result in greater fluctuations to our quarterly financial results. These quarterly fluctuations could result in operating results that are below the expectations of public market analysts and investors, and therefore may adversely affect the market price for our common stock.

The ability of our customers to complete work, as well as our ability to mine sand from cold climate areas, could be affected during the winter months. Our revenue and profitability could decrease during these periods, as well as in other severe weather conditions, because work is either prevented or more costly to complete. If a substantial amount of production is interrupted, our cash flow and, in turn, our results of operations could be materially and adversely affected.

Our North American ceramic proppant production is manufactured at two plants. The vast majority of our mined sand is processed at one plant. Any adverse developments at those plants could have a material adverse effect on our financial condition and results of operations.

With the very limited production at our McIntyre plant, we are producing the majority of our North American ceramic production from two plants, our Eufaula and our Toombsboro plant. Our Marshfield, Wisconsin plant represents the vast majority of our annual mined sand processing capacity. Any adverse developments at these plants, including a material disruption in production, an inability to supply the plant with raw materials at a competitive cost, or adverse developments due to catastrophic events, could have a material adverse effect on our financial condition and results of operations.

We provide environmental warranties on certain of our containment and spill prevention products.

AGPI's tank liners, secondary containments and related products and services are designed to contain or avoid spills of hydrocarbons and other materials. If a release of these materials occurs, it could be harmful to the environment.

Although we attempt to negotiate appropriate limitations of liability in the applicable terms of sale, some customers have required expanded warranties, indemnifications or other terms that could hold AGPI responsible in the event of a spill or release under particular circumstances. If AGPI is held responsible for a spill or release of materials from one of its customer's facilities, it could have a material adverse effect on our results of operations and financial condition.

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

The Company uses a significant amount of trade secrets, or “know-how,” and other proprietary information and technology in the conduct of its business. In some cases, we rely on trade secrets, trademarks or contractual restrictions to protect intellectual property rights that are not patented. The steps we take to protect the non-patented intellectual property may not be sufficient to protect it and any loss or diminishment of such intellectual property rights could negatively impact our competitive advantage. Additionally, our competitors could independently develop the same or similar technologies that are only protected by trade secret and thus do not prevent third parties from competing with us. Furthermore, even protected intellectual property rights can be infringed upon by third parties. Monitoring unauthorized use of Company intellectual property can be difficult and expensive, and adequate remedies may not be available.

Although the Company does not believe that it is infringing upon the intellectual property rights of others by using such proprietary information and technology, it is possible that such a claim might be asserted against the Company in the future. In the event any third party makes a claim against us for infringement of patents or other intellectual property rights of a third party, such claims, with or without merit, could be time-consuming and result in costly litigation. In addition, the Company could experience loss or cancellation of customer orders, experience product shipment delays, or be subject to significant liabilities to third parties. If our products or services were found to infringe on a third party’s proprietary rights, the Company could be required to enter into royalty or licensing agreements to continue selling its products or services. Royalty or licensing agreements, if required, may not be available on acceptable terms, if at all, which could seriously harm our business. Involvement in any patent dispute or other intellectual property dispute or action to protect trade secrets and expertise could have a material adverse effect on the Company’s business.

Significant increases in fuel prices for any extended periods of time will increase our operating expenses.

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 of our control, such as changes in supply and demand due to weather conditions, actions by OPEC and other oil and gas producers, regional production patterns and environmental concerns. Natural gas is a significant component of our direct manufacturing costs and price escalations will likely increase our operating expenses and can have a negative impact on income from operations and cash flows. We operate in a competitive marketplace and may not be able to pass through all of the increased costs that could result from an increase in the cost of natural gas.

Environmental compliance costs and liabilities could reduce our earnings and cash available for operations.

We are subject to increasingly stringent laws and regulations relating to environmental protection, including laws and regulations governing air emissions, water discharges and waste management. The technical requirements of complying with these environmental laws and regulations are becoming increasingly expensive and complex, and may affect the Company’s ability to expand its operations. Our ability to continue the expansion of our manufacturing capacity to meet market demand is contingent upon obtaining required environmental permits and compliance with their terms, which continue to be more restrictive and require longer lead times to obtain in anticipation of any efforts to expand and increase capacity. We incur, and expect to continue to incur, capital and operating costs to comply with environmental laws and regulations.

In addition, we use some hazardous substances and generate certain industrial wastes in our operations. Many of our current and former properties are, or have been, used for industrial purposes. Accordingly, we could become subject

to potentially material liabilities relating to the investigation and cleanup of contaminated properties, and to claims alleging personal injury or property damage as the result of exposures to, or releases of, hazardous substances. These laws also may provide for “strict liability” for damages to natural resources or threats to public health and safety. Strict liability can render a party liable for environmental damage without regard to negligence or fault on the part of the party. Some environmental laws provide for joint and several strict liability for remediation of spills and releases of hazardous substances.

Stricter enforcement of existing laws and regulations, new laws and regulations, the discovery of previously unknown contamination or the imposition of new or increased requirements could restrict our expansion efforts, require us to incur costs, or become the basis of new or increased liabilities. Any of these events could reduce our earnings and our cash available for operations.

Our international operations subject us to risks inherent in doing business on an international level that could adversely impact our results of operations.

International revenues accounted for approximately 19% and 21% of our total revenues in 2018 and 2017, respectively. We may not succeed in overcoming the risks that relate to or arise from operating in international markets. Risks inherent in doing business on an international level include, among others, the following:

- economic and political instability (including as a result of the threat or occurrence of armed international conflict or terrorist attacks);
- potential declines or increased volatility in oil and natural gas prices that would adversely affect our customers, the energy industry or our production costs;
- changes in regulatory requirements, economic sanctions, tariffs, customs, duties and other trade barriers;
- transportation delays and costs;
- power supply shortages and shutdowns;
- difficulties in staffing and managing foreign operations and other labor problems;
- currency rate fluctuations, convertibility and repatriation;
- taxation of our earnings and the earnings of our personnel;
- potential expropriation of assets by foreign governments and
- other risks relating to the administration of or changes in, or new interpretations of, the laws, regulations and policies of the jurisdictions in which we conduct our business.

Undetected defects in our fracture simulation software could adversely affect our business.

Despite extensive testing, our software could contain defects, bugs or performance problems. If any of these problems are not detected, the Company could be required to incur extensive development costs or costs related to product recalls or replacements. The existence of any defects, errors or failures in our software products may subject us to liability for damages, delay the development or release of new products and adversely affect market acceptance or perception of our software products or related services, any one of which could materially and adversely affect the Company's business, results of operations and financial condition.

The market price of our common stock will fluctuate, and could fluctuate significantly.

The market price of the Company's common stock will fluctuate, and could fluctuate significantly, in response to various factors and events, including the following:

- the liquidity of the market for our common stock;
- seasonal or quarterly sales fluctuations;
- differences between our actual financial or operating results and those expected by investors and analysts;
- changes in analysts' recommendations or projections;
- a substantial short position in our stock;
- new statutes or regulations or changes in interpretations of existing statutes and regulations affecting our business;
- changes in general economic or market conditions; and
- broad market fluctuations.

Our actual results could differ materially from results anticipated in forward-looking statements we make.

Some of the statements included or incorporated by reference in this Form 10-K are forward-looking statements. These forward-looking statements include statements relating to trends in the natural gas and oil industries, the demand for ceramic proppant and our performance in the "Management's Discussion and Analysis of Financial Condition and Results of Operations" and "Business" sections of this Form 10-K. In addition, we have made and may continue to make forward-looking statements in other filings with the SEC, and in written material,

press releases and oral statements issued by us or on our behalf. Forward-looking statements include statements regarding the intent, belief or current expectations of the Company or its officers. Our actual results could differ materially

from those anticipated in these forward-looking statements, and our financial forecasts are particularly sensitive to changes in the current market conditions. Further, our financial forecasts have been less accurate during the recent downturn. See "Business—Forward-Looking Information."

The success of our business depends on achieving our strategic objectives, including the diversification of our product and service portfolio.

As we continue to expand our portfolio of product and service offerings to industrial and other new markets, we face certain risks associated with these new business strategies, including unknown regulatory changes and product acceptance by these new markets, that could affect our future financial results. In addition, lower than expected sales in these new markets could have a material adverse effect on our results from operations and financial condition.

Item 1B. Unresolved Staff Comments

Not applicable.

Item 2. Properties

We maintain our corporate headquarters in leased office space in Houston, Texas and also lease space for our technology center in Houston. We own our manufacturing facilities, land and substantially all of the related production equipment in New Iberia, Louisiana, and Eufaula, Alabama, and lease our McIntyre and Toombsboro, Georgia, facilities. We own the buildings and production equipment at our facility in Luoyang, China, and have been granted use of the land on which the facility is located through 2051 under the terms of a land use agreement with the People's Republic of China. The Luoyang, China facility was shut down during 2015, and we do not intend to resume production.

The facilities in McIntyre and Toombsboro, Georgia, include real property, plant and equipment that we lease from the Development Authority of Wilkinson County. The original lease was executed in 1997 and was last amended in 2008. The term of the current lease, which covers both locations was automatically extended through November 1, 2021. Under the terms of the lease, we are responsible for all costs incurred in connection with the premises, including costs of construction of the plant and equipment. At the termination of the lease, title to all of the real property, plant and equipment is to be conveyed to us in exchange for nominal consideration. We have the right to purchase the property, plant and equipment at any time during the term of the lease for a nominal price.

The Marshfield, Wisconsin sand processing plant, which became operational during 2012, is located on land owned by us.

We own or otherwise utilize distribution facilities in multiple locations around the world. See "Item 1. Business – Distribution."

We own approximately 2,957 acres of land and leasehold interests near our plants in Georgia and Alabama. The land contains raw material for use in the production of our lightweight ceramic proppants. We also hold approximately 469 acres of land and leasehold interests in Wisconsin.

AGPI owns its service facility located in Decatur, Texas, and leases other regional service facilities within the United States.

Item 3. Legal Proceedings

From time to time, we are the subject of legal proceedings arising in the ordinary course of business. We do not believe that any of these proceedings will have a material adverse effect on our business or our results of operations.

Item 4. Mine Safety Disclosure

Several of our U.S. manufacturing facilities process mined minerals, and therefore are viewed as mine operations subject to regulation by the federal Mine Safety and Health Administration under the Federal Mine Safety and Health Act of 1977. Information concerning mine safety violations or other regulatory matters required by section 1503(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act and the recently proposed Item 106 of Regulation S-K (17 CFR 229.106) is included in Exhibit 95 to this annual report.

PART II

Item 5. Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities
Common Stock

Our common stock is traded on the New York Stock Exchange (ticker symbol CRR). The number of record and beneficial holders of our common stock as of February 1, 2019 was approximately 9,562.

Securities Authorized for Issuance Under Equity Compensation Plans

For information regarding securities authorized for issuance under equity compensation plans, refer to "ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS" and "Note 11 — Stock Based Compensation" in the accompanying "Notes to Consolidated Financial Statements" in this Annual Report.

The following table provides information about our repurchases of common stock during the quarter ended December 31, 2018:

ISSUER PURCHASES OF EQUITY SECURITIES

				Maximum Number of Shares that May be Purchased
	Total Number of Shares	Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Plan (1)	Under the Plan (2)
Period	Purchased			
10/01/18 to 10/31/18	—	—	—	2,000,000
11/01/18 to 11/30/18	—	—	—	2,000,000
12/01/18 to 12/31/18	—	—	—	2,000,000
Total	—		—	

(1) On January 28, 2015, we announced the authorization by our Board of Directors for the repurchase of up to two million shares of our Common Stock.

(2) Represents the maximum number of shares that may be repurchased under the plan as of period end. As of February 28, 2019, a maximum of 2,000,000 shares may be repurchased under the plan.

Stock Performance Graph

Not required.

Item 6. Selected Financial Data

Not required.

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Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations
Executive Level Overview

CARBO Ceramics Inc. is a global technology company that provides products and services to the oil and gas, industrial, and environmental markets to enhance value for its clients.

The Company conducts its business within two operating segments: 1) Oilfield and Industrial Technologies and Services and 2) Environmental Technologies and Services.

The Company's Oilfield and Industrial Technologies and Services segment manufactures and sells ceramic technology products and services, base ceramic proppant and frac sand for both the oilfield and industrial sectors. The products have different technology features and product characteristics, which vary based on the application for which they are intended to be used. The various ceramic products' manufacturing processes are similar.

Oilfield ceramic technology products, base ceramic proppant and frac sand proppant are manufactured and sold to pressure pumping companies and oil and gas operators for use in the hydraulic fracturing of natural gas and oil wells. Hydraulic fracturing is the most widely used method of increasing production from oil and natural gas wells. The hydraulic fracturing process consists of pumping fluids down a natural gas or oil well at pressures sufficient to create fractures in the hydrocarbon-bearing rock formation. A granular material, called proppant, is suspended and transported in the fluid and fills the fracture, "propping" it open once high-pressure pumping stops. The proppant filled fracture creates a conductive channel through which the hydrocarbons can flow more freely from the formation to the well and then to the surface.

There are three primary types of proppant that can be utilized in the hydraulic fracturing process: sand, resin coated sand and ceramic. Sand is the least expensive proppant, resin-coated sand is more expensive and ceramic proppant is typically the most expensive. We believe the higher initial cost of ceramic proppant is justified by the fact that its use in certain well conditions typically results in an increase in the production rate of oil and natural gas, an increase in the total oil or natural gas that can be recovered from the well and, consequently, an increase in cash flow for the operators of the well. The increased production rates are primarily attributable to the higher strength and more uniform size and shape of ceramic proppant versus alternative materials. We are one of the world's largest suppliers of ceramic proppant.

Through our wholly-owned subsidiary StrataGen, Inc., we promote increased production and EUR of oil and natural gas by selling a widely used fracture stimulation software under the brand FracPro, and providing fracture design and consulting services to oil and natural gas E&P companies under the brand StrataGen.

FracPro provides a suite of stimulation software solutions used for designing fracture treatments and for on-site real-time analysis. Use of FracPro enables our clients to optimize stimulation jobs to enhance oil and gas production. FracPro has been integrated with third-party reservoir simulation software, furthering its reach and utility.

The StrataGen consulting team works with operators around the world to help optimize well placement, fracture treatment design and production enhancement. The broad range of expertise of the StrataGen consultants includes: fracture treatment design; completion support; on-site treatment supervision; quality control; post-treatment evaluation and optimization; reservoir and fracture studies; rock mechanics and software application and training.

Our industrial ceramic technology products are manufactured and sold to industrial companies. These products are designed for use in various industrial technology applications, including but not limited to casting and milling.

We also produce industrial products at our manufacturing facilities for third parties under tolling arrangements. These products so far have been primarily used in industrial, or agricultural applications. Contract manufacturing has led to increased revenue generation. We continue to develop additional opportunities within the industrial, agricultural and oil and gas industries to grow revenue, and reduce our plant's slowing and idling costs.

Our Environmental Technologies and Services segment is intended to protect operators' assets, minimize environmental risks, and lower lease operating expense ("LOE"). AGPI, the only subsidiary of ours to operate in this segment, provides spill prevention, containment and countermeasure systems for the oil and gas industry. AGPI uses proprietary technology to make products designed to enable its clients to extend the life of their storage assets, reduce the potential for hydrocarbon spills and provide containment of stored materials.

International revenues represented 19% and 21% of total revenues in 2018 and 2017, respectively.

Operating profit margin for our ceramic business is principally impacted by sales volume, product mix, sales price, distribution costs, manufacturing costs, including natural gas, and our production levels as a percentage of our capacity. The level of selling, general and administrative spending, as well as other operating expenses, can also impact operating profit margins.

As a result of the depressed commodity price we continued to experience in 2018, there has been a negative impact on industry activity levels which has in turn negatively impacted the demand for ceramic proppant, so we continue to focus on cash preservation and cost reduction strategies. See “Item 1 - Business” and “Item 1A - Risk Factors”.

Although most direct manufacturing expenses have been relatively stable or predictable over time, we have historically experienced volatility in the cost of natural gas used in the production of our products. In an effort to mitigate volatility in the cost of natural gas purchases and reduce exposure to short term spikes in the price of this commodity, we contracted in advance for portions of our future natural gas requirements. Due to the severe decline in industry activity beginning in early 2015, we significantly reduced production levels and consequently did not take delivery of all of the contracted natural gas quantities. As a result, we had accounted for the relevant contracts as derivative instruments. However, as of December 31, 2018, our last derivative contract expired and no future natural gas obligations existed.

General Business Conditions

The oilfield portion of our Oilfield and Industrial Technologies and Services segment is impacted by the number of natural gas and oil wells drilled in North America, and the need to hydraulically fracture these wells. Current demand for proppant is extremely dynamic. In addition to rig counts and commodity prices, the oilfield portion is also significantly affected by a host of other factors, including but not limited to (a) completion activity, which is not necessarily correlated with rig count, (b) customer preferences, (c) new product and technology adoption, (d) imports and competition, including the cost of competing products, (e) changes in the product mix of what we sell, (f) costs of developing our products and services and running our business, and (g) changes in our strategy and execution. In markets outside North America, sales of our products are also influenced by the overall level of drilling and hydraulic fracturing activity. Furthermore, because the decision to use ceramic proppant is based on comparing the higher initial costs to the future value derived from increased production and recovery rates, our business is influenced by the current and expected prices of natural gas and oil.

Beginning in late 2014, a severe decline in oil and continued decline in natural gas prices led to a significant decline in oil and natural gas industry drilling activities and capital spending. During 2018, however, the average price of West Texas Intermediate (“WTI”) crude oil rose 28% to \$64.94 per barrel compared to \$50.88 per barrel in 2017. The average North American rig count also rose 13% in 2018 to 1,222 rigs compared to 1,081 rigs in 2017. Despite these improvements, E&P operators continued to use lowest-cost completions, a trend that we expect to continue in 2019, as our customers remain under pressure to consider lower cost alternatives, notwithstanding the superior performance results of our products. These events, along with an oversupplied ceramic proppant market and depressed oil and natural gas prices, kept demand and average prices low for our proppants.

Beginning early in 2015, we implemented a number of initiatives to preserve cash and lower costs, including: (1) reducing workforce across our organization, (2) lowering our production output levels in order to align with lower demand, including through idling and mothballing of some of our production facilities (3) limiting capital expenditures and (4) eliminating dividends. As a result of operating some of our plants below their normal production capacity, we expensed \$32.5 million of production overhead costs in excess of amounts that would have been allocated to each unit of production at normal production levels. We continue to rationalize headcount as needed.

Our Environmental Technologies and Services segment is also impacted by the global drilling and hydraulic fracturing activity, and has been negatively impacted by the significant decline in oil and natural gas industry drilling activities and capital spending.

On December 31, 2018, we received net proceeds of \$22.1 million relating to the sale of our Millen, Georgia plant. After consideration of certain post-closing matters and retained liabilities associated with the sale, we expect

net cash proceeds to approximate \$15.7 million.

Throughout our history, base ceramic was our dominant source of revenue. In 2014, base ceramic represented approximately 80% of our total revenue. In 2018, it represented approximately 20%. The decline is representative of the pressure operating companies are under to produce at the lowest cost possible, often at the expense of long term productivity. In response, we are undergoing a strategic transformation to (1) diversify revenue streams, (2) return the Company to profitability by growing revenue and reducing costs, and (3) growing the business with minimal capital investments. Our transformation strategy has showed solid progress as we continue to grow industrial and technology revenues, as well as reduce costs.

Critical Accounting Policies

Our Consolidated Financial Statements are prepared in accordance with accounting principles generally accepted in the U.S., which require us to make estimates and assumptions (see Note 1 to the Consolidated Financial Statements). We believe that, of our significant accounting policies, the following may involve a higher degree of judgment and complexity.

Revenue is recognized when title passes to the customer (generally upon delivery of products) or at the time services are performed. We generate a significant portion of our revenues and corresponding accounts receivable from sales to the petroleum pressure pumping industry. In addition, we generate a significant portion of our revenues and corresponding accounts receivable from sales to two major customers, both of which are in the petroleum pressure pumping industry. As of December 31, 2018, approximately 26% of the balance in trade accounts receivable was attributable to those two customers. We record an allowance for doubtful accounts based on our assessment of collectability risk and periodically evaluate the allowance based on a review of trade accounts receivable. Trade accounts receivable are periodically reviewed for collectability based on customers' past credit history and current financial condition, and the allowance is adjusted, if necessary. If the economic downturn in the petroleum pressure pumping industry worsens or does not materially improve or, for some other reason, any of our primary customers were to experience significant adverse conditions, our estimates of the recoverability of accounts receivable could be reduced by a material amount and the allowance for doubtful accounts could be increased by a material amount. As of December 31, 2018, the allowance for doubtful accounts totaled \$1.3 million.

We value inventory using the weighted average cost method. Assessing the ultimate realization of inventories requires judgments about future demand and market conditions. We regularly review inventories to determine if the carrying value of the inventory exceeds net realizable value and we record an adjustment to reduce the carrying value to net realizable value, as necessary. Future changes in demand and market conditions could cause us to be exposed to additional obsolescence or slow moving inventory. If actual market conditions are less favorable than those projected by management, lower of cost or net realizable value adjustments may be required. There were no lower of cost or net realizable value inventory adjustments for the years ended December 31, 2018 and 2017.

Income taxes are provided for in accordance with ASC Topic 740, "Income Taxes". This standard takes into account the differences between financial statement treatment and tax treatment of certain transactions. Deferred tax assets ("DTAs") and liabilities ("DTLs") are recognized for the future tax consequences attributable to differences between the financial statement carrying value of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect of a change in tax rates is recognized as income or expense in the period that includes the enactment date. This calculation requires us to make certain estimates about our future operations. Changes in state, federal and foreign tax laws, as well as changes in the Company's financial condition, could affect these estimates.

Accounting Standards Codification ("ASC") Topic 740, Income Taxes, provides the carrying value of DTAs should be reduced by the amount not expected to be realized. A company should reduce deferred tax assets by a valuation allowance if, based on the weight of all available evidence, it is no longer more likely than not that some portion or all of the deferred tax assets will be realized. The valuation allowance should be sufficient to reduce the deferred tax asset to the amount that is more likely than not to be realized. ASC 740 requires all available evidence, both positive and negative, be considered to determine whether a valuation allowance for deferred tax assets is needed in the financial statements. Additionally there can be statutory limitations and losses also assessed on the deferred tax assets should certain conditions arise.

We believe it is more likely than not that a portion of our deferred tax assets will not be realized in the future. Accordingly, we have a \$72.4 million valuation allowance against our deferred tax assets. Our assessment of the realizability of our deferred tax assets is based on the weight of all available evidence, both positive and negative, including future reversals of deferred tax liabilities. Income tax expense was \$0.9 million, or 1.2% of pretax loss, for the year ending December 31, 2018 compared to income tax benefit of \$2.0 million, or 0.8% of pretax loss, for the same period in 2017.

In December 2017, the Tax Cuts and Jobs Act ("Tax Legislation") was enacted. The Tax Legislation significantly revises the U.S. corporate income tax by, among other things, lowering corporate income tax rates, implementing the territorial tax system and imposing a repatriation tax on deemed repatriated earnings of foreign subsidiaries. In accordance with the Tax Legislation, we recorded \$28.2 million as additional income tax expense in the fourth quarter of 2017 related to the re-measurement of deferred tax assets and liabilities. Additionally, Staff Accounting Bulletin No. 118 ("SAB 118") was issued to address the application of U.S. GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Act. December 22, 2018 marked the end of the measurement period for purposes of SAB 118. As such, we have completed the analysis based on legislative updates relating to the Tax Legislation. No material changes to the provisional amounts recorded as of December 31, 2017 were identified. We continue to evaluate the impacts of the newly enacted global intangible low-taxed income ("GILTI") provisions, which subject our foreign earnings to a minimum level of tax.

While the Tax Legislation provides for a territorial tax system, beginning in 2018, it includes the global intangible low-taxed income ("GILTI") provision. The GILTI provisions require us to include in our U.S. income tax return foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. FASB guidance indicates that accounting for GILTI either as

part of deferred taxes or as a period cost are both acceptable methods. As of December 31, 2018, we have not recognized foreign earnings subject to GILTI. An accounting policy will be elected in the first period in which the GILTI provision becomes applicable to us.

Long-lived assets, which include net property, plant and equipment, goodwill, intangibles and other long-term assets, comprise a significant amount of the Company's total assets. The Company makes judgments and estimates in conjunction with the carrying values of these assets, including amounts to be capitalized, depreciation and amortization methods and useful lives. Additionally, the carrying values of these assets are periodically reviewed for impairment or whenever events or changes in circumstances indicate that the carrying amounts may not be recoverable. An impairment loss is recorded in the period in which it is determined that the carrying amount is not recoverable. This requires the Company to make long-term forecasts of its future revenues and costs related to the assets subject to review. These forecasts require assumptions about demand for the Company's products and services, future market conditions and technological developments. Significant and unanticipated changes to these assumptions could require a provision for impairment in a future period.

As a result of the sale of our Millen facility for less than the carrying value of each of our Toombsboro Georgia and Eufaula, Alabama facilities combined with the continued lowered demand for our base ceramic proppants, we evaluated those long-lived assets for possible impairment as of December 31, 2018. We prepared an undiscounted cash flow analysis for these two asset groups. The Eufaula, Alabama facility is part of our technology asset group which also includes our New Iberia, Louisiana facility, and as such, we evaluated the entire technology asset grouping for impairment. Key assumptions underlying our undiscounted cash flow analysis included, but were not limited to, facility utilization, production costs, major maintenance and long-term sales prices for products produced. Based on these analyses, we noted that, for each of these asset groups, the carrying value was below the sum of the undiscounted cash flows, and thus no impairment was required.

Low production levels triggered the component of our inventory accounting policy relating to operating at production levels below normal capacity. To determine the amount of production costs that we expense during each period, the Company allocates fixed production overheads to the costs of conversion based on the normal capacity of each production facility, generally considered to be 65% of a facility's stated capacity or higher.

When a production facility operates at normal capacity, all of its fixed production overheads are allocated to costs of conversion of each product manufactured, based on the actual level of production. This determination is made facility-by-facility on a monthly basis in order to calculate the initial measurement value to recognize as cost of goods produced in a month by a given facility.

When a facility's total production in a month drops below 65% of its normal capacity, it is considered to be operating at an abnormally low production level. In such cases, each unit of production receives an allocation of fixed overheads in the amount that would have been allocated at the lower-end of normal capacity. The remaining unallocated excess fixed overhead cost for the facility is recognized as expense in the period and classified as Cost of Sales.

Materials are the only variable component of production. Plant labor and all other overhead costs incurred in the production of the Company's products are either semi-fixed or fixed in nature, therefore all are included in the monthly evaluation of costs allocable to costs of conversion at normal capacity.

The Company maintains a rate for each production facility that represents the maximum fixed production overhead cost per unit of production allocable to costs of conversion. The rates are based on an analysis of a recent historical period considered representative of a normal operating environment in which the facility operated at normal capacity. The maximum rate is calculated by recasting the fixed production overhead cost per unit of production on a

pro forma basis as if the facility had operated at the lower-end threshold of its range of normal capacity, generally 65% of stated capacity. The current rates are based on 2014 as the representative year. Implied in this method is the assumption that 2014 production costs relative to sales prices yield a normal profit margin. A significant, permanent deterioration in the average selling prices of the Company's products could result in a significant lowering of the rates, thereby increasing the periodic charge. The most recent period in which normal capacity was achieved was the year-ended December 31, 2014.

Results of Operations

Net Loss

		Percent	
(\$ in thousands)	2018	Change	2017
Net Loss	\$(75,433)	70	% \$(253,116)

For the year ended December 31, 2018, we reported net loss of \$75.4 million, which was a 70% improvement compared to the \$253.1 million net loss reported in the previous year. Excluding the impact of income taxes, other operating (income) expense, and the loss on the sale of our Russian proppant business and Millen plant, net loss in 2018 improved by \$30.4 million, or 30%, primarily due to an increase in sales of technology and industrial products and services and an increase in sales of Environmental Technologies and Services. In addition, slowing and idling costs were reduced by \$8.2 million, which was partially offset by an increase of \$1.3 million in severance and other charges as compared to 2017.

Individual components of financial results by reportable operating segment are discussed below.

Revenues

		Percent	
(\$ in thousands)	2018	Change	2017
Consolidated revenues	\$210,745	12 %	\$188,756
Revenues by operating segment:			
Oilfield and Industrial Technologies and Services	\$178,609	8 %	\$165,557
Environmental Technologies and Services	\$32,136	39 %	\$23,199

Oilfield and Industrial Technologies and Services segment revenues of \$178.6 million for the year ended December 31, 2018 increased 8% compared to \$165.6 million in 2017. The increase was mainly attributable to a 17% increase in technology products and services sales, and a 24% increase in industrial products and services. These increases were offset by a 14% decrease in base ceramic revenue.

Environmental Technologies and Services segment revenues of \$32.1 million for the year ended December 31, 2018 increased 39% compared to \$23.2 million in 2017. These increases were mainly attributable to improved product sales and new client growth combined with an increase in oil and natural gas industry activity.

Gross (Loss) Profit

		Percent	
(\$ in thousands)	2018	Change	2017
Consolidated gross loss	\$(22,689)	57 %	\$(53,325)
Consolidated as a % of revenues	(11)%		(28)%
Gross (loss) profit by operating segment:			
Oilfield and Industrial Technologies and Services	\$(28,439)	50 %	\$(56,397)
Oilfield and Industrial Technologies and Services %	(16)%		(34)%
Environmental Technologies and Services	\$5,750	87 %	\$3,072
Environmental Technologies and Services %	18 %		13 %

Our cost of sales related to our Oilfield and Industrial Technologies and Services segment consists of manufacturing costs, packaging and transportation expenses associated with the delivery of our products to our customers and handling costs related to maintaining finished goods inventory and operating our remote stocking facilities. Variable manufacturing costs include raw materials, while labor, utilities and repair and maintenance supplies are semi-fixed. Fixed manufacturing costs include depreciation, property taxes on production facilities, insurance and factory overhead.

Oilfield and Industrial Technologies and Services segment gross loss for the year ended December 31, 2018 was \$28.4 million, or (16)% of revenues, compared to gross loss of \$56.4 million, or (34)% of revenues, for 2017. The improvement in gross loss in 2018 was primarily attributable to a shift in sales mix to more profitable technology and industrial products and lower slowing and idling production costs and derivative gains in the year due to changes in the fair value of the derivative liability and changes in the NYMEX forward price strip prices. We expect to incur slowing and idling production costs in the future until our production levels return to normal capacity.

Environmental Technologies and Services segment gross profit for the year ended December 31, 2018 was \$5.8 million, or 18% of revenues, compared to gross profit of \$3.1 million, or 13% of revenues, for 2017. This increase in gross profit was primarily the result of the increase in sales.

Depreciation and amortization was \$32.3 million for the year ended December 31, 2018 compared to \$41.7 million for the same period in 2017. This decrease was largely due to the impairment recorded on our Millen facility during the third quarter of 2017, which reduced future depreciation expense. The Millen facility was sold in December 2018.

Selling, General & Administrative (SG&A) and Other Operating Expenses

	Percent			
(\$ in thousands)	2018	Change	2017	
Selling, general and administrative expenses (SG&A) (exclusive of depreciation and amortization)	\$39,227	(2)%	\$39,981	
SG&A as a % of revenues	19 %		21 %	
Depreciation and amortization	\$2,336	(8)%	\$2,552	
Loss on sale of Millen plant	\$2,305		\$—	
Loss on sale of Russian proppant business	\$350	(99)%	\$26,747	
Other operating (income) expense	\$(332)	(100)%	\$125,778	
SG&A by operating segments:				
Oilfield and Industrial Technologies and Services	\$36,491	(3)%	\$37,438	
Oilfield and Industrial Technologies and Services %	20 %		23 %	
Environmental Technologies and Services	\$2,736	8 %	\$2,543	
Environmental Technologies and Services %	9 %		11 %	

Oilfield and Industrial Technologies and Services segment SG&A was \$36.5 million for the year ended December 31, 2018 compared to \$37.4 million for 2017. The decrease in SG&A expenses primarily resulted from a decrease in administrative and research and development expenses partially offset by an increase in sales and marketing expenses to support the growth of this segment.

Depreciation and amortization was \$2.3 million for the year ended December 31, 2018 compared to \$2.6 million for 2017. This decrease was the result of certain assets becoming fully depreciated and fully amortized. Loss on sale of Millen plant was \$2.3 million for the year ended December 31, 2018 compared to none in 2017. This was the result of the sale of our Millen plant that occurred in late 2018. Loss on sale of Russian proppant business was \$0.4 million for the year ended December 31, 2018 compared to \$26.7 million in 2017. Both periods related to the sale of our Russian proppant business. The loss in 2018 was related to settling a \$4.0 million receivable that was owed to us for \$3.6 million. Other operating income was \$0.3 million for the year ended December 31, 2018 compared to other operating expense of \$125.8 million for 2017. Other operating income in 2018 was primarily related to gain on asset sales partially offset by other operating expenses. Other operating expense in 2017 was related to an impairment of our Millen, Georgia proppant manufacturing facility. As a percentage of revenues, Oilfield and Industrial Technologies and Services segment SG&A expenses for 2018 decreased to 20% compared to 23% in 2017, primarily due to the increase in revenues.

Income Tax Expense (Benefit)

(\$ in thousands)	2018	2017
Income Tax Expense (Benefit)	\$892	\$(2,027)

Effective Income Tax Rate	(1.2)%	0.8	%
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Income taxes are not allocated between our operating segments. Consolidated income tax expense was \$0.9 million, or (1.2)% of pretax loss, for the year ended December 31, 2018 compared to income tax benefit of \$2.0 million, or 0.8% of pretax loss for 2017. Net operating losses generated are carried forward, a portion of which are reserved by a valuation allowance.

Outlook

We are very pleased with the profitable growth in our Industrial and Environmental business sectors. The growth of these two sectors should result in a balanced portfolio that is less susceptible to swings in oil and gas commodity prices. We are also pleased with the oilfield technology products and services profitable growth, and expect to retain our leadership position in those products and services.

In the Oilfield sector, E&P operators' focus on free cash flow, coupled with recent oil price volatility, creates a less than certain environment with regard to drilling and completion spend in 2019. Some industry analysts are predicting 2019 drilling and completion spend to be down high single digits on a percentage basis compared to 2018. However, we are seeing positive signs internationally that should bode well for our oilfield sector products.

The Industrial sectors provide a large, multi-year growth opportunity for CARBO. In the mining sector, more companies have started increasing their operating and capital spend, which supports our CARBOGRIND product growth. In the foundry industry, the value our products bring to improve our client's end-product quality, along with the need to comply with OSHA Permissible Exposure Limits (PEL) silicosis regulations, supports our ACCUCAST product growth. In both these sectors, and in numerous other Industrial sectors, our ceramic technology products are seeing market share growth.

The Environmental sector continues to see growth, as companies in various industry sectors continue to be more environmentally conscious. This provides us with a multi-year growth opportunity, in which we will put a strong focus on growing at high rates in Industrial sectors.

We anticipate our 2019 consolidated revenue to be similar to 2018.

We expect continued strong growth for our international ceramic technology sales in 2019. Demand for our technology continues to increase in South America, as well as in Europe, Africa and the Middle East. In North America, the opportunity set for our ceramic technology sales remains strong, with KRYPTOSPHERE HD projects currently weighted more to the second half of the year.

On the fracture technology design and analysis front, demand for our StrataGen consultants, and our FracPro software, is expected to remain strong as our clients utilize these offerings to optimize their completion designs and return economics.

At this time, we anticipate base ceramic sales and frac sand sales to decrease single digits on a percentage basis, similar to the lower industry expectations for drilling and completion spend. For base ceramics, we continue to drive business model changes towards production on demand, along with upfront cash commitments. For frac sand, a high percentage of our sand capacity is under contract, from which we are also benefiting from the use of our rail cars and distribution center.

We expect strong double digit growth in industrial revenues in 2019 through continued growth of our ceramic media in both the grinding and foundry markets. Our industrial ceramic client list is expanding globally, and should lead to improved market share for our technology products. We are also developing new markets while expanding the existing markets we sell into through a broader range of technology product offerings.

Our PicOnyx Inc. investment is off to a strong start. We recently initiated the first phase of the manufacturing process. M-Tone pigment is expected to be in the market during the first half of 2019, and we expect production to ramp up over the course of the year.

CARBO has world class manufacturing expertise. This manufacturing expertise is used to develop solutions for our clients. There are a number of contract manufacturing opportunities in the queue. We expect to grow both in revenue and by expanding the types of products we produce. The benefit of expanding our products has the potential to be significant as these projects take idled assets and turn them from cash consumers to cash producers.

Growth in product sales and expanding our reach outside the oilfield should result in revenue growth for ASSETGUARD in 2019. We are increasing resources specifically dedicated to growing industrial and other end market sales. ASSETGUARD continues to lead the industry in developing technology products to address the ongoing challenges of our clients.

Progress on our transformation strategy will continue in 2019 as we continue to focus on diversifying our revenue streams, maximizing profitability across the businesses, and maintaining healthy cash levels. We expect to be cash neutral in 2019, excluding planned debt repayments.

Liquidity and Capital Resources

At December 31, 2018, we had cash and cash equivalents and restricted cash of \$83.3 million compared to cash and cash equivalents and restricted cash of \$78.4 million at December 31, 2017. During the year ended December 31, 2018, we received net proceeds from asset sales of \$27.5 million primarily related to the sale of our Millen plant, additional proceeds received from the sale of our Russian proppant business, as well as other asset sales. Net cash provided by financing activities was \$1.0 million for the year ended December 31, 2018. Uses of cash included \$21.6 million in operating activities and \$2.0 million for capital expenditures. There were no major capital spending projects in 2018. Capital spending in 2018 primarily related to various plant maintenance as well as equipment purchases for the environmental business.

We estimate our total capital expenditures in 2019 will be less than \$5.0 million. In April 2019, we are required to repay the Notes with two of our directors totaling \$27 million. In addition, within 270 days of completion of all post-closing matters relating to the sale of our Millen, Georgia plant, we are required to use 100% of the Net Cash Proceeds (as defined in the credit agreement) from the sale to either (1) prepay the outstanding principal amount of the Term Loans or (2) reinvest in fixed or capital assets of any Credit Party. We are currently evaluating these options, and we may engage in negotiations with our lenders with respect to other options. As of December 31, 2018, the Company has classified \$15.7 million of the outstanding debt as current liabilities, which represents an estimate of the Net Cash Proceeds, including all post-closing matters and retained liabilities that will be repaid over a multi-year period, that we would be required to prepay if we do not reinvest in fixed or capital assets. As a result of the required repayment of the Director Notes and required use of the Millen Net Cash Proceeds, we are committed to using approximately \$43 million of our unrestricted cash and cash equivalents during 2019.

The Company anticipates that cash on hand will be sufficient to meet planned operating expenses, debt payments, and other cash needs for the next 12 months from the date of this Form 10-K. The Company's view regarding sufficiency of cash and liquidity is primarily based on our financial forecast for the next twelve months, which is impacted by various assumptions regarding demand and sales prices for our products. Generally, we expect demand for our products and the sales prices to remain consistent in 2019 and the first quarter of 2020 compared to 2018. We also expect to decrease our operating costs in 2019 and the first quarter of 2020 compared to 2018 while improving our cash position through continued balance sheet management. Our financial forecasts are based on estimates of customer demand, which is highly volatile in the current operating environment, and we have no committed sales backlog with our customers. As a result, there is inherent uncertainty in our forecasts. In the event that we experience lower customer demand, lower prices for our products and services, or higher expenses than we have forecasted or if we underperform relative to our forecast, we could experience negative cash flows from operations, as has been the case in prior years, which would reduce our cash balances and liquidity. See Item 1A. Risk Factors – We may not have sufficient cash and/or be able to access liquidity alternatives in the credit and capital markets to meet our liquidity needs.

Off-Balance Sheet Arrangements

We had no off-balance sheet arrangements as of December 31, 2018.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk
Not required.

Item 8. Financial Statements and Supplementary Data

The information required by this Item is contained in pages F-3 through F-24 of this Report.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure

Not applicable.

Item 9A. Controls and Procedures

(a) Evaluation of Disclosure Controls and Procedures

Disclosure controls and procedures are designed to ensure that information required to be disclosed in the reports filed or submitted under the Securities Exchange Act of 1934 (the “Exchange Act”) is recorded, processed, summarized and reported, within the time periods specified in the SEC’s rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed in the reports filed under the Exchange Act is accumulated and

communicated to management, including the Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

As of December 31, 2018, management carried out an evaluation, under the supervision and with the participation of the Chief Executive Officer and Chief Financial Officer, of the effectiveness of the design and operation of the Company's disclosure controls and procedures. There are inherent limitations to the effectiveness of any system of disclosure controls and procedures. Accordingly, even effective disclosure controls and procedures can only provide reasonable assurances of achieving their control objectives. Based upon and as of the date of that evaluation, the Chief Executive Officer and Chief Financial Officer have concluded that the Company's disclosure controls and procedures were effective to ensure that information required to be disclosed by the Company in the reports it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the SEC's rules and forms, and to ensure that information required to be disclosed by the Company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the Company's management, including its Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

(b) Management's Report on Internal Control Over Financial Reporting

For Management's Report on Internal Control Over Financial Reporting, see page F-1 of this Report.

(c) Report of Independent Registered Public Accounting Firm

For the Report of Independent Registered Public Accounting Firm on the Company's internal control over financial reporting, see page F-2 of this Report.

(d) Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting during the quarter ended December 31, 2018 that materially affected or are reasonably likely to materially affect, those controls.

Item 9B. Other Information

Not applicable.

PART III

Certain information required by Part III is omitted from this Report. We will file a definitive proxy statement pursuant to Regulation 14A (the "Proxy Statement") not later than 120 days after the end of the fiscal year covered by this Report and certain information included therein is incorporated herein by reference. Only those sections of the Proxy Statement that specifically address the items set forth herein are incorporated by reference. Such incorporation does not include the Compensation Committee Report included in the Proxy Statement.

Item 10. Directors, Executive Officers and Corporate Governance

Information concerning executive officers under Item 401 of Regulation S-K is set forth in Part I of this Form 10-K. The other information required by this Item is incorporated by reference to the portions of the Company's Proxy Statement entitled "Security Ownership of Certain Beneficial Owners and Management," "Election of Directors," "Board of Directors, Committees of the Board of Directors and Meeting Attendance," "Code of Business Conduct and Ethics," "Section 16(a) Beneficial Ownership Reporting Compliance" and "Report of the Audit Committee."

Item 11. Executive Compensation

The information required by this Item is incorporated by reference to the portions of the Company's Proxy Statement entitled "Compensation of Executive Officers," "Director Compensation" and "Potential Termination and Change in Control Payments."

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters

The information required by this Item is incorporated by reference from our Proxy Statement under the captions "Securities Ownership of Certain Beneficial Owners and Management" and "Equity Compensation Plan Information."

Item 13. Certain Relationships and Related Transactions, and Director Independence

The information required by this Item is incorporated by reference to the portion of our Proxy Statement entitled "Election of Directors."

Item 14. Principal Accounting Fees and Services

The information required by this Item is incorporated by reference to the portion of our Proxy Statement entitled "Ratification of Appointment of our Independent Registered Public Accounting Firm."

PART IV

Item 15. Exhibits, Financial Statement Schedules

(a) Exhibits, Financial Statements and Financial Statement Schedules:

1. Consolidated Financial Statements

The Consolidated Financial Statements of CARBO Ceramics Inc. listed below are contained in pages F-3 through F-24 of this Report:

Report of Independent Registered Public Accounting Firm

Consolidated Balance Sheets at December 31, 2018 and 2017

Consolidated Statements of Operations for each of the two years ended December 31, 2018 and 2017

Consolidated Statements of Comprehensive Loss for each of the two years ended December 31, 2018 and 2017

Consolidated Statements of Shareholders' Equity for each of the two years ended December 31, 2018 and 2017

Consolidated Statements of Cash Flows for each of the two years ended December 31, 2018 and 2017

2. Consolidated Financial Statement Schedules

All schedules have been omitted since they are either not required or not applicable.

3. Exhibits

The exhibits listed on the accompanying Exhibit Index are filed as part of, or incorporated by reference into, this Report.

Item 16. Form 10-K Summary

None

MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Management is responsible for establishing and maintaining adequate internal control over financial reporting, as defined in Rules 13a-15(f) and 15d-15(f) under the Securities Exchange Act of 1934. The Company's internal control over financial reporting is designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external reporting purposes in accordance with U.S. generally accepted accounting principles.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Management, including our Chief Executive Officer and our Chief Financial Officer, assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2018. In making this assessment, it used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in Internal Control-Integrated Framework (2013). Based on its assessment and those criteria, management has concluded that the Company maintained effective internal control over financial reporting as of December 31, 2018.

The Company's independent registered public accounting firm, Ernst & Young LLP, has issued an attestation report on the Company's internal control over financial reporting. That report is included herein.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Shareholders of CARBO Ceramics Inc.

Opinion on Internal Control over Financial Reporting

We have audited CARBO Ceramics Inc.'s internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, CARBO Ceramics Inc. (the Company) maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive loss, shareholders' equity and cash flows for the years then ended, and the related notes and our report dated February 28, 2019 expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Management's Report on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ Ernst & Young LLP

New Orleans, Louisiana

February 28, 2019

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Shareholders of CARBO Ceramics Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of CARBO Ceramics Inc. (the Company) as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive loss, shareholders' equity and cash flows for the years then ended, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2018 and 2017, and the results of its operations and its cash flows for the years then ended in conformity with U.S. generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) and our report dated February 28, 2019 expressed an unqualified opinion thereon.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 1987.

New Orleans, Louisiana

February 28, 2019

CARBO CERAMICS INC.

CONSOLIDATED BALANCE SHEETS

(\$ in thousands, except per share data)

	December 31,	
	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	\$72,752	\$68,169
Restricted cash	1,725	6,935
Trade accounts and other receivables, net	35,693	37,705
Inventories:		
Finished goods	41,422	59,519
Raw materials and supplies	22,592	19,480
Total inventories	64,014	78,999
Prepaid expenses and other current assets	4,754	3,989
Income tax receivable	2,319	—
Total current assets	181,257	195,797
Restricted cash	8,840	3,281
Income tax receivable	—	2,389
Property, plant and equipment:		
Land and land improvements	39,584	41,590
Land-use and mineral rights	19,696	19,696
Buildings	75,815	72,427
Machinery and equipment	432,906	455,863
Construction in progress	29,129	36,138
Total	597,130	625,714
Less accumulated depreciation and amortization	323,511	301,528
Net property, plant and equipment	273,619	324,186
Goodwill	3,500	3,500
Intangible and other assets, net	7,150	11,445
Total assets	\$474,366	\$540,598
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	\$12,174	\$19,417
Accrued payroll and benefits	6,950	6,056
Accrued freight	2,434	2,292
Accrued utilities	1,012	1,552
Other accrued expenses	14,020	10,577
Derivative instruments	—	2,537
Notes payable, related parties	27,040	—
Long-term debt, current portion	15,733	—
Other current liabilities	1,192	—
Total current liabilities	80,555	42,431
Deferred income taxes	1,114	230

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Long-term debt, net	45,650	60,698
Notes payable, related parties	—	27,040
Other long-term liabilities	10,764	4,434
Shareholders' equity:		
Preferred stock, par value \$0.01 per share, 5,000 shares authorized, none outstanding	—	—
Common stock, par value \$0.01 per share, 80,000,000 shares authorized; 27,710,861		
and 27,133,614 shares issued and outstanding at December 31, 2018 and 2017,		
respectively	277	271
Additional paid-in capital	132,080	125,715
Retained earnings	203,926	279,779
Accumulated other comprehensive loss	—	—
Total shareholders' equity	336,283	405,765
Total liabilities and shareholders' equity	\$474,366	\$540,598

See accompanying notes to consolidated financial statements.

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CARBO CERAMICS INC.

CONSOLIDATED STATEMENTS OF OPERATIONS

(\$ in thousands, except per share data)

	Years ended December 31,	
	2018	2017
Revenues	\$ 210,745	\$ 188,756
Cost of sales (exclusive of depreciation and amortization shown below)	201,165	200,351
Depreciation and amortization	32,269	41,730
Gross loss	(22,689)	(53,325)
Selling, general and administrative expenses (exclusive of depreciation and amortization shown below)	39,227	39,981
Depreciation and amortization	2,336	2,552
Loss on sale of Millen plant	2,305	—
Loss on sale of Russian proppant business	350	26,747
Other operating (income) expense	(332)	125,778
Operating loss	(66,575)	(248,383)
Other expense:		
Interest expense, net	(8,503)	(7,700)
Other income, net	537	940
	(7,966)	(6,760)
Loss before income taxes	(74,541)	(255,143)
Income tax expense (benefit)	892	(2,027)
Net loss	\$ (75,433)	\$ (253,116)
Loss per share:		
Basic	\$ (2.79)	\$ (9.49)
Diluted	\$ (2.79)	\$ (9.49)

See accompanying notes to consolidated financial statements.

CARBO CERAMICS INC.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS

(\$ in thousands)

	Years ended December 31,	
	2018	2017
Net loss	\$ (75,433)	\$ (253,116)
Other comprehensive income:		
Foreign currency translation adjustment	—	979
Reclassification of Russia cumulative translation loss to Net Loss upon sale	—	33,347
Other comprehensive income	—	34,326
Comprehensive loss	\$ (75,433)	\$ (218,790)

See accompanying notes to consolidated financial statements.

CARBO CERAMICS INC.

CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

(\$ in thousands, except per share data)

	Additional			Accumulated	
	Common	Paid-In	Retained	Other	
	Stock	Capital	Earnings	Comprehensive	Total
				Income (Loss)	
Balances at January 1, 2017	\$ 269	\$ 117,192	\$ 533,435	\$ (34,326)	\$ 616,570
Net loss	—	—	(253,116)	—	(253,116)
Foreign currency translation adjustment	—	—	—	979	979
Reclassification of Russia cumulative translation loss to					
Net Loss upon sale	—	—	—	33,347	33,347
Comprehensive loss					(218,790)
Issuance of warrant	—	3,870	—	—	3,870
Stock granted under restricted stock plan, net	2	398	—	—	400
Stock based compensation	—	4,255	—	—	4,255
Shares surrendered by employees to pay taxes	—	—	(540)	—	(540)
Balances at December 31, 2017	\$ 271	\$ 125,715	\$ 279,779	\$ —	\$ 405,765
Net loss	—	—	(75,433)	—	(75,433)
Stock sold under ATM program	3	2,846	—	—	2,849
Stock granted under restricted stock plan, net	4	316	—	—	320
Stock based compensation	—	3,203	—	—	3,203
Shares surrendered by employees to pay taxes	(1)	—	(420)	—	(421)
Balances at December 31, 2018	\$ 277	\$ 132,080	\$ 203,926	\$ —	\$ 336,283

See accompanying notes to consolidated financial statements.

CARBO CERAMICS INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS

(\$ in thousands)

	Years ended December 31,	
	2018	2017
Operating activities		
Net loss	\$ (75,433)	\$ (253,116)
Adjustments to reconcile net loss to net cash (used in) provided by		
operating activities:		
Depreciation and amortization	34,605	44,282
Amortization of debt issuance costs and original issue discount	685	1,055
Provision for doubtful accounts	561	589
Deferred income taxes	884	(2,134)
(Gain) on disposal or impairment of assets	(1,089)	125,778
Loss on sale of Millen plant	2,305	—
Loss on sale of Russian proppant business	350	25,101
Foreign currency transaction gain, net	—	(35)
Stock compensation expense	3,565	4,892
PIK accrual on notes payable, related parties	—	2,040
Change in fair value of derivative instruments	(2,537)	(930)
Changes in operating assets and liabilities:		
Trade accounts and other receivables	1,451	(20,533)
Inventories	14,156	10,524
Prepaid expenses and other current assets	717	724
Accounts payable	(8,759)	11,666
Accrued expenses	3,710	8,687
Income tax receivable, net	69	(357)
Other, net	3,162	2,949
Net cash used in operating activities	(21,598)	(38,818)
Investing activities		
Capital expenditures	(2,039)	(2,598)
Net proceeds from asset sales	27,526	21,600
Net cash provided by investing activities	25,487	19,002
Financing activities		
Proceeds from long-term debt	—	12,349
Proceeds from issuance of common stock under ATM program	2,849	—
Repayments on long-term debt	—	(3,250)
Repayments on insurance financing agreement	(1,385)	(1,296)
Payment of debt issuance costs	—	(989)
Purchase of common stock	(421)	(539)
Net cash provided by financing activities	1,043	6,275
Effect of exchange rate changes on cash	—	246
Net increase (decrease) in cash and cash equivalents and restricted cash	4,932	(13,295)

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Cash and cash equivalents and restricted cash at beginning of year	78,385	91,680
Cash and cash equivalents and restricted cash at end of year	\$ 83,317	\$ 78,385
Supplemental cash flow information		
Interest paid	\$ 7,700	\$ 2,319
Income taxes paid	\$ —	\$ 457

See accompanying notes to consolidated financial statements.

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CARBO CERAMICS INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

(\$ in thousands, except per share data)

1. Significant Accounting Policies

Description of Business

CARBO Ceramics Inc. (the “Company”) was formed in 1987 and is a global technology company that provides products and services to the oil and gas, industrial, and environmental markets to enhance value for its clients. The Company has production plants in: New Iberia, Louisiana; Eufaula, Alabama; McIntyre, Georgia; and Toombsboro, Georgia; and a sand processing facility in Marshfield, Wisconsin. The Company sold its Millen, Georgia production plant in December 2018. The Company sells its proppant products through pumping service companies that perform hydraulic fracturing for oil and gas companies. In addition, the Company sells ceramic media to industrial markets. Finished goods inventories are stored at the plant sites and various domestic and international remote distribution facilities. The Company also provides one of the industry’s most widely used hydraulic fracture simulation software FracPro, as well as hydraulic fracture design and consulting services. In addition, the Company provides a broad range of technologies for spill prevention, containment and countermeasures to oil and gas and industrial markets.

Beginning in late 2014, a severe decline in oil and natural gas prices led to a significant decline in oil and natural gas industry drilling activities and capital spending. Beginning in 2015, the Company implemented a number of initiatives to preserve cash and lower costs, including: reducing workforce across the organization, lowering production output levels in order to align with lower demand, limiting capital expenditures and reducing dividends. The Company incurred severance costs of \$924 and \$287 during 2018 and 2017, respectively, as a result of these actions.

As of December 31, 2018, we are producing technology ceramic proppants from our Eufaula, Alabama manufacturing facility, base ceramic proppants from our Toombsboro, Georgia manufacturing facility, and processing sand at our Marshfield, Wisconsin facility. We are also producing ceramic media at our McIntyre, Georgia and Eufaula, Alabama facilities. We are also using our Toombsboro, Georgia facility for contract manufacturing. In addition, we produce resin-coated ceramic proppants at our New Iberia, Louisiana facility. The Company continues to assess liquidity needs and manage cash flows. As a result of the steps the Company has taken to enhance its liquidity, the Company currently believes that cash on hand and cash flows from operations will enable the Company to meet its working capital, capital expenditure, debt service and other funding requirements for at least one year from the date this Form 10-K is issued. The Company’s view regarding sufficiency of cash and liquidity is primarily based on our financial forecast for 2019 and the first quarter of 2020, which is impacted by various assumptions regarding demand and sales prices for our products. Generally, we expect demand for our products and the sales prices to remain consistent in 2019 and the first quarter of 2020 compared to 2018, and this expectation is included within our financial forecast for 2019 and the first quarter of 2020. We also expect to decrease our operating costs in 2019 and the first quarter of 2020 compared to 2018 while improving our cash position through continued balance sheet management. Our financial forecasts in recent periods have proven less reliable given customer demand, which is highly volatile in the current operating environment and no committed sales backlog exists with our customers. As a result, there is no guarantee that our financial forecast, which projects sufficient cash will be available to meet planned operating expenses and other cash needs, will be accurate. In the event that the Company experiences lower customer demand, lower prices for its products and services, or higher expenses than it forecasted or if the Company underperforms

relative to its forecast, the Company could experience negative cash flows from operations, as has been the case in prior years, which would reduce its cash balances and liquidity.

The second phase of the retrofit of our Eufaula, Alabama plant with the new KRYPTOSPHERE® technology has been suspended until such time that market conditions improve enough to warrant completion. As of December 31, 2018, the value of the assets relating to this project totaled approximately 82% of the Company's total construction in progress and the project is approximately 75% complete.

Principles of Consolidation

The consolidated financial statements include the accounts of CARBO Ceramics Inc. and its operating subsidiaries. All significant intercompany transactions have been eliminated.

Concentration of Credit Risk, Accounts Receivable and Other Receivables

The Company performs periodic credit evaluations of its customers' financial condition and generally does not require collateral. Receivables are generally due within 30 days. The majority of the Company's receivables are from customers in the petroleum pressure pumping industry, as well as industrial and environmental industries. The Company establishes an allowance for

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doubtful accounts based on its assessment of collectability risk and periodically evaluates the balance in the allowance based on a review of trade accounts receivable. Trade accounts receivable are periodically reviewed for collectability based on customers' past credit history and current financial condition, and the allowance is adjusted if necessary. Credit losses historically have been insignificant. The allowance for doubtful accounts at December 31, 2018 and 2017 was \$1,279 and \$1,602, respectively. Other receivables were \$442 and \$546 as of December 31, 2018 and 2017, respectively, of which related mainly to miscellaneous receivables in the United States.

Cash Equivalents

The Company considers all highly liquid investments with a maturity of three months or less when purchased to be cash equivalents. The carrying amounts reported in the balance sheet for cash equivalents approximate fair value.

Restricted Cash

A portion of the Company's cash balance is restricted to its use in order to provide collateral primarily for letters of credit and funds held in escrow relating to the sale of its Millen plant. As of December 31, 2018 and 2017, total restricted cash was \$10,565 and 10,216, respectively.

Inventories

Inventories are stated at the lower of net realizable value or cost. Finished goods inventories include costs of materials, plant labor and overhead incurred in the production of the Company's products and costs to transfer finished goods to distribution centers.

The Company evaluated the carrying values of its inventories and concluded that no adjustments were required in 2018 or 2017.

Property, Plant and Equipment

Property, plant and equipment are stated at cost. Repair and maintenance costs are expensed as incurred. Depreciation is computed on the straight-line method for financial reporting purposes using the following estimated useful lives:

Buildings and improvements	15 to 30 years
Machinery and equipment	3 to 30 years
Land-use rights	30 years

The Company holds approximately 2,957 acres of land and leasehold interests containing kaolin reserves near its plants in Georgia and Alabama. The Company also holds approximately 469 acres of land and leasehold interests containing sand reserves near its sand processing facility in Marshfield, Wisconsin. The capitalized costs of land and mineral rights as well as costs incurred to develop such property are amortized using the units-of-production method based on estimated total tons of these reserves.

Impairment of Long-Lived Assets and Intangible Assets

Long-lived assets to be held and used and intangible assets that are subject to amortization are reviewed for impairment whenever events or circumstances indicate their carrying amounts might not be recoverable. Recoverability is assessed by comparing the undiscounted expected future cash flows from the assets

with their carrying amount. If the carrying amount exceeds the sum of the undiscounted future cash flows an impairment loss is recorded. The impairment loss is measured by comparing the fair value of the assets with their carrying amounts. Intangible assets that are not subject to amortization are tested for impairment at least annually by comparing their fair value with the carrying amount and recording an impairment loss for any excess of carrying amount over fair value. Fair values are generally determined based on discounted expected future cash flows or appraised values, as appropriate. For additional information on the Company's long-lived assets and intangible assets impairment assessment, please refer to Note 5 – Other Operating (Income) Expense.

Manufacturing Production Levels Below Normal Capacity

As a result of the Company substantially reducing manufacturing production levels, including by idling and mothballing certain facilities, the component of the Company's accounting policy for inventory relating to operating at production levels below normal capacity was triggered and resulted in certain production costs being expensed instead of being capitalized into inventory. The Company expenses fixed production overhead amounts in excess of amounts that would have been allocated to each unit of

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production at normal production levels. For the years ended December 31, 2018 and 2017, the Company expensed \$32,509 and \$40,664, respectively, in production costs.

Capitalized Software

The Company capitalizes certain software costs, after technological feasibility has been established, which are amortized utilizing the straight-line method over the economic lives of the related products, generally not to exceed five years.

Goodwill

Goodwill represents the excess of the cost of companies acquired over the fair value of their net assets at the date of acquisition. Goodwill relating to each of the Company's reporting units is tested for impairment annually, during the fourth quarter, as well as when an event, or change in circumstances, indicates an impairment is more likely than not to have occurred. For additional information on the Company's goodwill impairment assessment, please refer to Note 5 – Other Operating (Income) Expense.

Revenue Recognition

Revenue from proppant sales is recognized when title passes to the customer, generally upon delivery. Revenue from consulting and contract manufacturing is recognized at the time service is performed. Revenue from the sale of fracture simulation software is recognized when title passes to the customer at time of shipment. Revenue from the sale of spill prevention services is recognized at the time service is performed. Revenue from the sale of containment goods is recognized at the time goods are delivered.

Shipping and Handling Costs

Shipping and handling costs are classified as cost of sales. Shipping costs consist of transportation costs to deliver products to customers. Handling costs include labor and overhead to maintain finished goods inventory and operate distribution facilities.

Cost of Start-Up Activities

Start-up activities, including organization costs, are expensed as incurred. There were no start-up costs for 2018 and 2017.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the amounts reported in the financial statements and accompanying notes. Actual results could differ from those estimates.

Research and Development Costs

Research and development costs are charged to operations when incurred and are included in Selling, General and Administrative expenses. The amounts incurred in 2018 and 2017 were \$3,823 and \$4,417, respectively.

New Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, "Leases (Topic 842)," which amends current lease guidance. This guidance requires, among other things, that lessees recognize the following for all leases (with the exception of short-term leases) at the commencement date: (1) a lease liability, which is a lessee's obligation to make lease payments arising from a lease, measured on a discounted basis; and (2) a right-of-use asset, which is an asset that represents the lessee's right to use, or control the use of, a specified asset for the lease term. Lessees and lessors must apply a modified retrospective transition approach for leases existing at, or entered into after, the beginning of the earliest comparative period presented in the financial statements. In July 2018, the FASB issued ASU No. 2018-11, "Leases (Topic 842): Targeted Improvements", which simplifies the implementation by allowing entities the option to instead apply the provisions of the new guidance at the effective date, without adjusting the comparative periods presented. The new lease guidance will be effective for the interim and annual periods beginning after December 15, 2018 with early adoption permitted. The Company adopted this guidance effective January 1, 2019 without adjusting the comparative periods. During the first quarter of 2019, the Company expects its ROU asset will be within a range of \$54,000 to \$60,000 and its total lease liability will be within a range of \$62,000 to \$68,000. In addition, upon implementation, the Company's deferred rent balances, recorded primarily within other long-term liabilities and accrued expenses as of December 31, 2018, of approximately \$8,300 will be

offset with the lease liability. The Company has implemented a lease accounting system for accounting for leases under the new standard. There were no significant impacts to the consolidated statement of operations and consolidated statement of cash flows.

In August 2015, the FASB issued ASU No. 2015-14, "Revenue from Contracts with Customers (Topic 606) – Deferral of the Effective Date," which revises the effective date of ASU No. 2014-09, "Revenue from Contracts with Customers (Topic 606)," ("ASU 2014-09") to interim and annual periods beginning after December 15, 2017, with early adoption permitted no earlier than interim and annual periods beginning after December 15, 2016. In May 2014, the FASB issued ASU 2014-09, which amends current revenue guidance. The core principle of the guidance is that an entity should recognize revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. The Company's analysis of sales contracts under ASC 606 supports the recognition of revenue at a point in time, typically when title passes to the customer upon delivery, for the majority of contracts, which is consistent with the current revenue recognition model. The Company utilized the modified retrospective approach, which requires a cumulative adjustment to retained earnings and no adjustments to prior periods. The Company adopted this guidance as of January 1, 2018. There was no material impact on the Company's consolidated financial statements or disclosures.

2. Disaggregated Revenue

The following table disaggregates revenue by product line for the years ended December 31:

	2018	2017
Technology products and services	\$50,917	\$43,383
Industrial products and services	14,873	12,030
Base ceramic and sand proppants	112,819	110,144
Oilfield and Industrial Technologies and Services segment	178,609	165,557
Environmental Technologies and Services segment	32,136	23,199
	\$210,745	\$188,756

Sales of oilfield technology products and services, consulting services, and FracPro software sales are included within Technology products and services. Sales of industrial ceramic products, industrial technology products and contract manufacturing are included within Industrial products and services. Sales of oilfield base ceramic and sand proppants, as well as railcar usage fees are included within Base ceramic and sand proppants.

3. Intangible and Other Assets

Following is a summary of intangible assets as of December 31:

	2018			2017	
	Weighted				
	Average	Gross	Accumulated	Gross	Accumulated
	Life	Amount	Amortization	Amount	Amortization
Intangibles:					
Patents and licenses, software and hardware designs	6 years	\$5,177	\$ 3,430	\$5,320	\$ 3,540
Developed technology	10 years	2,782	2,573	2,782	2,295
Customer relationships and non-compete	9 years	2,838	2,838	2,838	2,621
		\$10,797	\$ 8,841	\$10,940	\$ 8,456

Amortization expense for 2018 and 2017 was \$889 and \$921, respectively. Estimated amortization expense for each of the ensuing years through December 31, 2023 is \$602, \$341, \$324, \$40 and \$0, respectively.

Following is a summary of other assets as of December 31:

	2018	2017
Other assets:		
Inventories - bauxite raw materials	\$4,160	\$3,527
Other	1,034	5,434
	\$5,194	\$8,961

Bauxite raw materials are used in the production of heavyweight ceramic products. As of December 31, 2018 and 2017, the Company has classified as long-term assets those bauxite raw materials inventories that are not expected to be consumed in production during the upcoming twelve month period. For additional information, refer to Note 5 – Other Operating (Income) Expense. Other assets as of December 31, 2017 includes a \$4,000 receivable relating to additional money owed us relating to the sale of our Russian proppant business. This receivable was settled for \$3,650 during 2018 and we recognized an additional loss on the sale of \$350. For additional information, refer to Note 18 – Sale of Russian Proppant Business.

4. Long-Term Debt and Notes Payable

On March 2, 2017, the Company entered into an Amended and Restated Credit Agreement (the “New Credit Agreement”) with Wilks Brothers, LLC (“Wilks”) to replace its term loan with Wells Fargo Bank, National Association (“Wells Fargo”) and provide the Company with additional liquidity for a longer term. The New Credit Agreement is a \$65,000 facility maturing on December 31, 2022, that consists of a \$52,651 term loan that was made at closing to pay off Wells Fargo and an additional term loan of \$12,349 that was made to the Company after the Company satisfied certain post-closing conditions. The \$52,651 term loan was a non-cash transaction to the Company as Wilks directly paid Wells Fargo and assumed the New Credit Agreement. The Company’s obligations bear interest at 9.00% and are guaranteed by its two operating subsidiaries. No principal repayments are required until maturity (except in certain circumstances), and there are no financial covenants.

The loan cannot be prepaid during the first three years without making the lenders whole for interest that would have been payable over the entire remaining term of the loan. The Company’s obligations under the New Credit Agreement are secured by: (i) a pledge of all accounts receivable and inventory, (ii) cash in certain accounts, (iii) domestic distribution assets residing on owned real property, (iv) the Company’s Marshfield, Wisconsin and Toombsboro, Georgia plant facilities and equipment, and (v) certain real property interests in mines and minerals. Other liens previously in favor of Wells Fargo were released.

As of December 31, 2018, the Company’s outstanding debt under its New Credit Agreement was \$65,000. Within 270 days of completion of all post-closing matters relating to the sale of our Millen, Georgia plant, the Company is required to use 100% of the Net Cash Proceeds (as defined in the New Credit Agreement) from the sale to either (1) prepay the outstanding principal amount of the Term Loans or (2) reinvest in fixed or capital assets of any Credit Party. The Company is currently evaluating these options, and the Company may engage in negotiations with its lenders with respect to other options. As of December 31, 2018, the Company has classified \$15,733 of the outstanding debt as current liabilities, which represents an estimate of the Net Cash Proceeds that the Company would be required to prepay if it did not reinvest in fixed or capital assets. See Note 19 for details on the sale of our Millen, Georgia plant.

As of December 31, 2018, the Company had \$683 of unamortized debt issuance costs relating to the New Credit Agreement that are presented as a direct reduction from the carrying amount of the long-term debt obligation. The Company had \$2,625 and \$9,230 in standby letters of credit issued through its banks as of December 31, 2018 and 2017, respectively, primarily as collateral relating to railcar leases for December 31, 2018 and our natural gas commitments and railcar leases for December 31, 2017.

On March 2, 2017, in connection with entry into the New Credit Agreement, the Company issued a Warrant (the “Warrant”) to Wilks. Subject to the terms of the Warrant, the Warrant entitles the holder thereof to purchase up to 523,022 shares of the Common Stock, at an exercise price of \$14.91 per share, payable in cash. The Warrant expires on December 31, 2022. Based on a Form 4 filing with the SEC on December 29, 2017, as of December 31, 2018, Wilks owned approximately 11.2% of the Company’s outstanding common stock, and should Wilks fully exercise the Warrant to purchase an additional 523,022 shares, it would hold approximately 12.8% of the Company’s outstanding common stock. Upon issuance of the Warrant, the Company recorded an increase to additional paid-in capital of \$3,871. As of December 31, 2018, the unamortized original issue discount was \$2,934.

In May 2016, the Company received proceeds of \$25,000 from the issuance of separate unsecured Promissory Notes (the “Notes”) to two of the Company’s Directors. Each Note matures on April 1, 2019 and bears interest at 7.00%. On March 2, 2017, in connection with the New Credit Agreement, the Notes were amended to provide for payment-in-kind, or PIK, interest payments at 8.00% until the lenders under the New Credit Agreement receive two consecutive semi-annual cash interest payments. On April 1, 2017, the Company made a \$997 interest payment as PIK, and capitalized the resulting amount to the outstanding principal balance. On October 1, 2017, the Company made a \$1,043 interest payment as PIK, and capitalized the resulting amount to the outstanding principal balance. As of December 31, 2018, the outstanding principal balance of the Notes of \$27,040 was recorded within current liabilities based on the April 1, 2019 maturity date.

Interest cost for the years ended December 31, 2018 and 2017 was \$8,612 and \$8,058, respectively. Interest cost primarily includes interest expense relating to the Company’s debts as well as amortization and the write-off of debt issuance costs and amortization of the original issue discount associated with the New Credit Agreement and Warrant.

5. Other Operating (Income) Expense

Other operating income for the year ended December 31, 2018 primarily consisted of gains on asset sales, including one of the Company's distribution centers, and was partially offset by other operating expenses. Other operating expense for the year ended December 31, 2017 was primarily related to an impairment related to the Company's Millen, Georgia plant.

As of September 30, 2017, the Company had concluded that the Company's Toombsboro and Millen, Georgia facilities should no longer be evaluated together as a group of assets because the facilities are no longer interchangeable and will not manufacture like products.

Given the change in the asset groupings of the two facilities and lack of estimated future cash flows associated with the base ceramic production at the Millen facility, the Company identified indicators of impairment at the Millen, Georgia facility as of September 30, 2017. The Company determined that the projected cash flows attributable to the Millen, Georgia facility did not exceed the carrying value of the assets; therefore the Company concluded there was an impairment at that facility. The Company engaged the services of a third party consulting firm to assist with the determination of the fair value of the related assets, which concluded that the assets were impaired. The key assumptions and inputs impacting the fair value include third party data and commentary with respect to the property and equipment at our Millen facility. For machinery and equipment and construction in progress, we used a cost approach to estimate the valuation. We applied a 65 percent downward adjustment to calculated replacement cost based on an analysis of construction documents and historical expenditures to remove non-saleable soft costs such as engineering and installation that would have no value to a market participant. Based on discussions with market participants, a salvage value multiplier ranging from 12 percent to 50 percent of the remaining replacement cost basis was applied to arrive at the estimated fair value for the machinery and equipment and construction in progress subject to impairment. For real property, we used a market and cost approach and reconciled the two approaches. In using the market approach, we determined that the value of comparable property ranged from approximately \$30 to \$40 per square foot, and the concluded value of the property at the Millen facility was approximately \$35 per square foot. In using the cost approach, we applied a 94% downward adjustment to the calculated value for the buildings and site improvements as a representation of economic obsolescence. As a result of these valuation procedures, which included the use of Level 3 inputs as defined in Note 10, the Company recognized a \$125,759 impairment of long-lived assets, primarily relating to buildings, machinery and equipment, and construction in progress. As of September 30, 2017, the fair value of the Millen facility was estimated to be \$18,756 using Level 3 inputs as defined in Note 10. The Millen facility was sold in December 2018 for \$23,000. At the time of the sale, the Millen facility was classified as held for sale with a recorded value of \$17,842. See Note 19 for additional information.

As a result of the sale of the Company's Millen facility for less than the carrying value of each of its Toombsboro Georgia and Eufaula, Alabama facilities combined with the continued lowered demand for our base ceramic proppants, the Company evaluated those long-lived assets for possible impairment as of December 31, 2018. We prepared an undiscounted cash flow analysis for these two asset groups. The Eufaula, Alabama facility is part of our technology asset group which also includes our New Iberia, Louisiana facility, and as such, we evaluated the entire technology asset grouping for impairment. Key assumptions underlying our undiscounted cash flow analysis included, but were not limited to, facility utilization, production costs, major maintenance and long-term sales prices for products produced. Based on these analyses, we noted that, for each of these asset groups, the carrying value was below the sum of the undiscounted cash flows, and thus no impairment was required.

If there are changes to our material assumptions, it is possible that we may have to recognize impairments in the future. However, we believe that the material assumptions used in our impairment analysis were reasonable and were based on available information and forecasts at the time. We continue to monitor whether or not events or circumstances would indicate that the carrying value of any of our long-lived assets might not be recoverable.

The Company assesses goodwill for possible impairment annually or sooner if circumstances indicate possible impairment may have occurred. There were no such impairments during 2018 or 2017.

6. Leases

The Company leases certain property, plant and equipment under operating leases, primarily consisting of railroad equipment leases. Net minimum future rental payments due under non-cancelable operating leases with remaining terms in excess of one year as of December 31, 2018 are as follows:

2019	\$ 15,331
2020	16,893
2021	16,484
2022	12,562
2023	9,216
Thereafter	16,458
Total	\$86,944

Leases of railroad equipment generally provide for renewal options at their fair rental value at the time of renewal. In the normal course of business, operating leases for railroad equipment are generally renewed or replaced by other leases. However, we expect to reduce our fleet of railcars as our current railcar leases expire. Rent expense for all operating leases was \$16,936 in 2018 and \$20,310 in 2017. For the years ended December 31, 2018 and 2017, rent expense was stated net of sublease income of \$4,142 and \$3,040, respectively.

7. Income Taxes

Deferred income taxes reflect the net tax effects of temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and the amounts used for income tax purposes. Significant components of the Company's deferred tax assets and liabilities as of December 31 are as follows:

	2018	2017
Deferred tax assets:		
Employee benefits	\$829	\$836
Inventories	3,902	2,309
Natural gas derivatives	—	610
Goodwill & other intangibles	2,350	3,179
Net operating loss	88,341	59,536
Foreign tax credits	667	667
Interest	2,200	552
Accrued expenses	3,496	—
Other	352	1,477
Total deferred tax assets	102,137	69,166
Deferred tax liabilities:		
Depreciation	30,054	14,332
Indefinite-lived intangibles	817	209
Foreign	—	26

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Total deferred tax liabilities	30,871	14,567
Valuation Allowance	72,380	54,829
Net deferred tax liabilities	\$(1,114)	\$(230)

Significant components of the provision for income taxes for the years ended December 31 are as follows:

	2018	2017
Current:		
Federal	\$—	\$(375)
State	(34)	(99)
Foreign	42	581
Total current	8	107
Deferred	884	(2,134)
	\$892	\$(2,027)

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The reconciliation of income taxes computed at the U.S. statutory tax rate to the Company's income tax expense for the years ended December 31 is as follows:

	2018		2017	
	Amount	Percent	Amount	Percent
U.S. statutory rate	\$(15,658)	(21.0)%	\$(89,300)	(35.0)%
State income taxes, net of federal tax benefit	(2,152)	(2.9)	(5,684)	(2.2)
Mining depletion	(163)	(0.2)	(619)	(0.2)
Change in election for foreign tax credits	32	—	(667)	(0.3)
Foreign investments	271	0.4	8,569	3.4
Stock compensation excess tax deficiency	348	0.5	876	0.3
Other permanent differences	663	0.9	1,806	0.7
Tax reform deferred rate change	—	—	28,163	11.0
Valuation allowance	17,551	23.5	54,829	21.5
	\$892	1.2 %	\$(2,027)	(0.8)%

As a result of the significant decline in oil and gas activities and net losses incurred over the past few years, the Company determined during the year ended December 31, 2017 that it was more likely than not that a portion of its deferred tax assets will not be realized in the future. Accordingly, the Company established a \$72,380 valuation allowance against its deferred tax assets as of December 31, 2018. The Company's assessment of the realizability of its deferred tax assets is based on the weight of all available evidence, both positive and negative, including future reversals of deferred tax liabilities.

In December 2017, the Tax Cuts and Jobs Act ("Tax Legislation") was enacted. The Tax Legislation significantly revises the U.S. corporate income tax by, among other things, lowering corporate income tax rates, implementing the territorial tax system and imposing a repatriation tax on deemed repatriated earnings of foreign subsidiaries. In accordance with the Tax Legislation, the Company recorded \$28,163 as additional income tax expense in the fourth quarter of 2017 related to the re-measurement of deferred tax assets and liabilities. Additionally, Staff Accounting Bulletin No. 118 ("SAB 118") was issued to address the application of U.S. GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Act. December 22, 2018 marked the end of the measurement period for purposes of SAB 118. As such, the Company has completed the analysis based on legislative updates relating to the Tax Legislation. No material changes to the provisional amounts recorded as of December 31, 2017 were identified.

While the Tax Legislation provides for a territorial tax system, beginning in 2018, it includes the global intangible low-taxed income ("GILTI") provision. The GILTI provisions require the Company to include in its U.S. income tax return foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. FASB guidance indicates that accounting for GILTI either as part of deferred taxes or as a period cost are both acceptable methods. As of December 31, 2018, the Company has not recognized foreign earnings subject to GILTI. An accounting policy will be elected in the first period in which the GILTI provision becomes applicable to the Company.

During the years ended December 31, 2018 and 2017, the Company did not recognize benefits on foreign investments due to the uncertainty of the Company being able to realize the foreign tax assets in light of current market conditions in China and Russia. This treatment decreased income tax benefit by \$271 and \$8,569 for the years ended December 31, 2018 and 2017, respectively.

During 2015 through 2018, the Company incurred net operating losses in the United States. Net operating losses associated with the 2015 tax return have been carried back in full, while certain of the net operating losses incurred in 2016, 2017, and 2018 are carried forward to offset future taxable income. The cumulative recorded tax benefit of these net operating loss carryforwards totals \$88,341 and \$59,536 as of December 31, 2018 and 2017, respectively, and is included in the deferred income tax asset on those respective dates. These recorded tax benefits include the impact of the change in corporate income tax rate following the enactment of the Tax Legislation. After finalization of the 2015 Federal return and a change in the attribute of the NOL carryback, additional refunds for 2012 through 2014 tax years are being claimed in the amount of \$2,107. These amounts are included within income tax receivable as of December 31, 2018 and 2017. The federal NOLs generated in 2017 and 2016 will be carried forward until they are utilized or their expiration in 2037 and 2036, respectively. The federal NOLs generated in 2018 will be carried forward until they are utilized as they do not expire per the Tax Cuts and Jobs Act. The Company has not recognized any uncertain tax positions as of December 31, 2018.

The Company files its tax returns as prescribed by the tax laws of the jurisdictions in which it operates, the most significant of which are U.S. federal and certain state jurisdictions. In 2016, the Company received an audit notice from the Internal Revenue

Service for periods 2013-2015. The Company does not anticipate any material findings. The 2016 federal tax year is also subject to examination. Various U.S. state jurisdiction tax years remain open to examination as well, although the Company believes assessments, if any, would be immaterial to its consolidated financial statements.

8. Shareholders' Equity

Common Stock

Holders of Common Stock are entitled to one vote per share on all matters to be voted on by shareholders and do not have cumulative voting rights. Subject to preferences of any Preferred Stock, the holders of Common Stock are entitled to receive ratably such dividends, if any, as may be declared from time to time by the Board of Directors out of funds legally available for that purpose. The Company does not expect to pay dividends in the foreseeable future. In the event of liquidation, dissolution or winding up of the Company, holders of Common Stock are entitled to share ratably in all assets remaining after payment of liabilities, subject to prior distribution rights of any Preferred Stock then outstanding. The Common Stock has no preemptive or conversion rights or other subscription rights. There are no redemption or sinking fund provisions applicable to the Common Stock. All outstanding shares of Common Stock are fully paid and non-assessable.

Preferred Stock

The Company's charter authorizes 5,000 shares of Preferred Stock. The Board of Directors has the authority to issue Preferred Stock in one or more series and to fix the rights, preferences, privileges and restrictions thereof, including dividend rights, conversion rights, voting rights, terms of redemption, redemption prices, liquidation preferences and the number of shares constituting any series or the designation of such series, without further vote or action by the Company's shareholders.

Equity Offering Program

On July 28, 2016, the Company filed a prospectus supplement and associated sales agreement related to an at-the-market ("ATM") equity offering program pursuant to which the Company may sell, from time to time, common stock with an aggregate offering price of up to \$75,000 through Cowen and Company LLC, as sales agent, for general corporate purposes. During the year ended December 31, 2018, the Company sold a total of 300,227 shares of its common stock under the ATM program for \$2,914, or an average of \$9.71 per share, and received proceeds of \$2,849, net of commissions of \$65. As of December 31, 2018, the Company had sold a total of 3,705,936 shares of its common stock under the ATM program for \$49,527, or an average of \$13.36 per share, and received proceeds of \$48,412, net of commissions of \$1,114.

9. Natural Gas Derivative Instruments

Natural gas is used to fire the kilns at the Company's manufacturing plants. In an effort to mitigate volatility in the cost of natural gas purchases and reduce exposure to short term spikes in the price of this commodity, we contracted in advance for portions of our future natural gas requirements. Due to the severe decline in industry activity beginning in early 2015, we significantly reduced production levels and consequently did not take delivery of all of the

contracted natural gas quantities. As a result, we had accounted for the relevant contracts as derivative instruments. However, as of December 31, 2018, our last derivative contract expired and no future natural gas obligations existed.

The Company used the income approach in determining the fair value of these derivative instruments. The model used considers the difference, as of each balance sheet date, between the contracted prices and the New York Mercantile Exchange (“NYMEX”) forward strip price for each contracted period. The estimated cash flows from these contracts were discounted using a discount rate of 8.0%, which reflects the nature of the contracts as well as the timing and risk of estimated cash flows associated with the contracts. The discount rate had an immaterial impact on the fair value of the contracts for the year ended December 31, 2017. During the year ended December 31, 2018 and 2017, the Company recognized a gain on derivative instruments of \$1,195 and a loss on derivative instruments of \$917, respectively, in cost of sales. The cumulative present value of the natural gas derivative contracts as of December 31, 2017 were classified as current liabilities in the Consolidated Balance Sheet. As a result of the expiration of the last natural gas contract on December 31, 2018, there is no remaining liability as of December 31, 2018.

10. Fair Value Measurements

The Company’s derivative instruments are measured at fair value on a recurring basis. U.S. GAAP establishes a fair value hierarchy that has three levels based on the reliability of the inputs used to determine the fair value. These levels include: Level 1, defined as inputs such as unadjusted quoted prices in active markets for identical assets or liabilities; Level 2, defined as inputs other

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than quoted prices in active markets that are either directly or indirectly observable; and Level 3, defined as unobservable inputs for use when little or no market data exists, therefore requiring an entity to develop its own assumptions.

The Company's natural gas derivative instruments are included within the Level 2 fair value hierarchy. For additional information on the derivative instruments, refer to Note 9 – Natural Gas Derivative Instruments. The following table sets forth by level within the fair value hierarchy the Company's assets and liabilities that were accounted for at fair value:

	Fair value as of December 31, 2018			
	Level 1	Level 2	Level 3	Total
Liabilities:				
Derivative instruments	\$—	\$ —	\$ —	\$ —
Total fair value	\$—	\$ —	\$ —	\$ —

	Fair value as of December 31, 2017			
	Level 1	Level 2	Level 3	Total
Liabilities:				
Derivative instruments	\$—	\$(2,537)	\$ —	\$(2,537)
Total fair value	\$—	\$(2,537)	\$ —	\$(2,537)

At December 31, 2018, the fair value of the Company's long-term debt approximated the carrying value.

11. Stock Based Compensation

On May 20, 2014, the shareholders approved the 2014 CARBO Ceramics Inc. Omnibus Incentive Plan (the "2014 Omnibus Incentive Plan"). The 2014 Omnibus Incentive Plan replaces the expired 2009 Omnibus Incentive Plan. In May 2017, the shareholders approved the Amended and Restated 2014 CARBO Ceramics Inc. Omnibus Incentive Plan (the "Amended 2014 Omnibus Plan"). Under the Amended 2014 Omnibus Incentive Plan, the Company may grant cash-based awards, stock options (both non-qualified and incentive) and other equity-based awards (including stock appreciation rights, phantom stock, restricted stock, restricted stock units, performance shares, deferred share units or share-denominated performance units) to employees and non-employee directors. The amount paid under the Amended 2014 Omnibus Incentive Plan to any single participant in any calendar year with respect to any cash-based award shall not exceed \$5,000. Awards may be granted with respect to a number of shares of the Company's Common Stock that in the aggregate does not exceed 1,450,000 shares prior to the fifth anniversary of its effective date, plus (i) the number of shares that are forfeited, cancelled or returned and (ii) the number of shares that are withheld from the participants to satisfy an option exercise price or minimum statutory tax withholding obligations. No more than 100,000 shares may be granted to any single participant in any calendar year. Equity-based awards may be subject to

performance-based and/or service-based conditions. With respect to stock options and stock appreciation rights granted, the exercise price shall not be less than the market value of the underlying Common Stock on the date of grant. The maximum term of an option is ten years. Restricted stock awards granted generally vest (i.e., transfer and forfeiture restrictions on these shares are lifted) proportionately on each of the first three anniversaries of the grant date, but subject to certain limitations, awards may specify other vesting periods. As of December 31, 2018, 481,883 shares were available for issuance under the Amended 2014 Omnibus Incentive Plan.

A summary of restricted stock activity and related information for the year ended December 31, 2018 is presented below:

	Shares	Weighted-Average Grant-Date Fair Value Per Share
Nonvested at January 1, 2018	441,119	\$ 14.87
Granted	334,638	\$ 12.16
Vested	(200,394)	\$ 18.20
Forfeited	(33,803)	\$ 11.99
Nonvested at December 31, 2018	541,560	\$ 12.14

As of December 31, 2018, there was \$3,644 of total unrecognized compensation cost related to restricted shares granted under Amended and Restated 2014 Omnibus Incentive Plan. That cost is expected to be recognized over a weighted-average period of 1.6 years. The weighted-average grant date fair value of restricted stock granted during the years ended December 31, 2018 and 2017 was

\$12.16 and \$10.30, respectively. The total fair value of shares vested during the years ended December 31, 2018 and 2017 was \$1,567 and \$2,023, respectively.

As of December 31, 2018, the Company's outstanding market-based cash awards to certain executives of the Company had a total Target Award of \$3,034. The amount of awards that will ultimately vest can range from 0% to 200% based on the Company's Relative Total Shareholder Return calculated over a three year period beginning January 1 of the year each grant was made. During the year ended December 31, 2018, a total of \$526 was paid relating to the 2015 grant, which was approximately 76% of the target award. We expect to pay \$708 in 2019 relating to the 2016 grant, which is approximately 61% of the target award.

The Company also made phantom stock awards to key employees pursuant to the Amended 2014 Omnibus Incentive Plan. The units subject to an award vest and cease to be forfeitable in equal annual installments over a three-year period. Participants awarded units of phantom stock are entitled to a lump sum cash payment equal to the fair market value of a share of Common Stock on the vesting date. In no event will Common Stock of the Company be issued with regard to outstanding phantom stock awards. As of December 31, 2018, there were 214,616 units of phantom stock granted under the Amended 2014 Omnibus Incentive Plan, of which 54,020 have vested and 23,511 have been forfeited. As of December 31, 2018, nonvested units of phantom stock under the Amended 2014 Omnibus Incentive Plan have a total value of \$477, a portion of which is accrued as a liability within Accrued Payroll and Benefits.

12. Loss Per Share

ASC Topic 260, "Earnings Per Share", provides that unvested share-based payment awards that contain non-forfeitable rights to dividends or dividend equivalents (whether paid or unpaid) are participating securities and shall be included in the computation of earnings per share pursuant to the two-class method. The Company's outstanding non-vested restricted stock awards are participating securities. Accordingly, earnings per common share are computed using the two-class method. The impact of the Company's Warrant issued to Wilks in March 2017 was not included in the computation of diluted loss per share because the average price for our common stock was less than the strike price of the Warrant and, therefore, the Warrant was not dilutive for 2018 or 2017. The Warrant entitles the holder thereof to purchase up to 523,022 shares of the Common Stock, at an exercise price of \$14.91 per share, payable in cash. Refer to Note 4.

The following table sets forth the computation of basic and diluted loss per share under the two-class method:

	2018	2017
Numerator for basic and diluted loss per share:		
Net loss	\$(75,433)	\$(253,116)
Effect of reallocating undistributed earnings of		
participating securities	—	—
Net loss available under the two-class		
method	\$(75,433)	\$(253,116)
Denominator:		
Denominator for basic loss per	27,015,994	26,664,247

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share—weighted-average shares		
Effect of dilutive potential common shares	—	—
Denominator for diluted loss per		
share—adjusted weighted-average shares	27,015,994	26,664,247
Basic loss per share	\$(2.79) \$(9.49
Diluted loss per share	\$(2.79) \$(9.49

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13. Quarterly Operating Results—(Unaudited)

Quarterly results for the years ended December 31, 2018 and 2017 were as follows:

	Three Months Ended			
	March 31	June 30	September 30	December 31
2018				
Revenues	\$49,367	\$57,989	\$53,819	\$49,570
Gross loss	(10,015)	(1,152)	(4,753)	(6,769)
Net loss	(22,272)	(14,812)	(16,736)	(21,613)
Loss per share:				
Basic	\$(0.83)	\$(0.55)	\$(0.62)	\$(0.80)
Diluted	\$(0.83)	\$(0.55)	\$(0.62)	\$(0.80)
2017				
Revenues	\$34,670	\$43,572	\$50,173	\$60,341
Gross loss	(19,458)	(13,433)	(14,523)	(5,911)
Net loss	(32,444)	(24,822)	(178,465)	(17,384)
Earnings per share:				
Basic	\$(1.22)	\$(0.93)	\$(6.69)	\$(0.65)
Diluted	\$(1.22)	\$(0.93)	\$(6.69)	\$(0.65)

Quarterly data may not sum to full year data reported in the Consolidated Financial Statements due to rounding.

14. Segment Information

The Company has two operating segments: 1) Oilfield and Industrial Technologies and Services and 2) Environmental Technologies and Services. Discrete financial information is available for each operating segment. Management of each operating segment reports to our Chief Executive Officer, the Company's chief operating decision maker, who regularly evaluates income before income taxes as the measure to evaluate segment performance and to allocate resources. The accounting policies of each segment are the same as those described in the summary of significant accounting policies in Note 1.

The Company's Oilfield and Industrial Technologies and Services segment manufactures and sells technology ceramic products and services, base ceramic proppant and frac sand for both the oilfield and industrial sectors. These products have different technology features and product characteristics, which vary based on the application for which they are intended to be used. The various ceramic products' manufacturing processes are similar.

Oilfield ceramic technology products, base ceramic proppant and frac sand proppant are manufactured and sold to pressure pumping companies and oil and gas operators for use in the hydraulic fracturing of natural gas and oil wells. This segment also promotes increased production and Estimated Ultimate Recovery ("EUR") of oil and natural gas by providing industry-leading technology to Design, Build, and Optimize the Frac®. Through our wholly-owned subsidiary StrataGen, Inc., we sell one of the most widely used fracture stimulation software under the brand FracPro and provide fracture design and consulting services to oil and natural gas E&P companies under the brand

StrataGen.

Our industrial ceramic technology products are manufactured at the same facilities and using the same machinery and equipment as the oilfield products, however they are sold to industrial companies. These products are designed for use in various industrial technology applications, including, but not limited to, casting and milling. Our chief operating decision maker reviews discreet financial information as a whole for all of our manufacturing, consulting and software businesses. Manufacturing includes the manufacture of technology products, base ceramics, industrial ceramics, sand and contract manufacturing, regardless of the industry the products are ultimately sold to. See Note 2 for disaggregated revenue information.

Our Environmental Technologies and Services segment designs, manufactures and sells products and services intended to protect operators' assets, minimize environmental risks, and lower lease operating expense ("LOE"). AGPI, a wholly-owned subsidiary of ours, provides spill prevention, containment and countermeasure systems for the oil and gas industry. AGPI uses proprietary technology designed to enable its clients to extend the life of their storage assets, reduce the potential for hydrocarbon spills and provide containment of stored materials.

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Summarized financial information for the Company's operating segments for the two-year period ended December 31, 2018 is shown in the following tables. Intersegment sales are not material.

	Oilfield and Industrial Technologies and Services	Environmental Technologies and Services	Total
	(\$ in thousands)		
2018			
Revenue from external customers	\$ 178,609	\$ 32,136	\$ 210,745
(Loss) income before income taxes	(77,264)	2,723	(74,541)
Total assets	456,416	17,950	474,366
Capital expenditures	1,093	946	2,039
Depreciation and amortization	33,452	1,153	34,605
2017			
Revenue from external customers	\$ 165,557	\$ 23,199	\$ 188,756
Loss before income taxes	(255,097)	(46)	(255,143)
Total assets	524,952	15,646	540,598
Capital expenditures	2,371	227	2,598
Depreciation and amortization	43,005	1,277	44,282

Geographic Information

Long-lived assets, consisting of net property, plant and equipment and other long-term assets, as of December 31 in the United States and other countries are as follows:

	2018	2017
Long-lived assets:		
United States	\$ 272,903	\$ 326,665
International	5,910	6,482
Total	\$ 278,813	\$ 333,147

Revenues outside the United States accounted for 19% and 21% of the Company's revenues for 2018 and 2017, respectively. Revenues for the years ended December 31 in the United States, Canada and other countries are as follows:

	2018	2017
Revenues:		
United States	\$ 171,167	\$ 149,041

Canada	6,086	7,439
Other international	33,492	32,276
Total	\$210,745	\$188,756

Sales to Customers

The following schedule presents customers, primarily from the Oilfield and Industrial Technologies and Services segment, from whom the Company derived 10% or more of total revenues for the years ended December 31:

	A	B
2018	12.7 %	13.7 %
2017	16.1 %	10.2 %

15. Benefit Plans

The Company has defined contribution savings and profit sharing plans pursuant to Section 401(k) of the Internal Revenue Code. Benefit costs recognized as expense under these plans consisted of the following for the years ended December 31:

	2018	2017
Contributions:		
Profit sharing	\$—	\$—
Savings	1,142	953
	\$1,142	\$953

All contributions to the plans are 100% participant directed. During 2018, participants were allowed to invest up to 10% of contributions in the Company's Common Stock. As of January 1, 2019, participants may not make any new contributions in the Company's Common Stock.

16. Commitments

The Company has an agreement with a supplier to purchase at least 50 percent of the annual kaolin requirements for the Eufaula, Alabama plant at specified contract prices. In May 2017, the agreement was extended for an additional three years. For the years ended December 31, 2018 and 2017, the Company purchased from the supplier \$1,141 and \$2,207, respectively, of kaolin under the agreement.

The Company has a mining agreement with a contractor to purchase 100% percent of the annual kaolin requirements for the Company's McIntyre and Toombsboro, Georgia plants at specified contract prices, from lands owned or leased by either the Company or the contractor. The agreement remains in effect until such time as all Company-owned minerals have been depleted. For the years ended December 31, 2018 and 2017, the Company purchased \$2,161 and \$950, respectively, of kaolin under the agreement.

The Company had an agreement with a supplier to provide frac sand for the Company's Marshfield, Wisconsin plant at a specified contract price. The terms of the agreement required the Company to purchase minimum annual amounts and remained in effect until the specified sand was depleted. For the years ended December 31, 2018 and 2017, the Company purchased \$2,452 and \$3,837, respectively, of frac sand under this agreement. The mine was depleted in 2018 and there are no future commitments under this agreement.

The Company has an agreement with a supplier to purchase wet sand at specified contract prices. The two-year agreement began January 1, 2018 and requires the Company to purchase 720,000 tons over the two-year contract. Any shortfall would be due from the Company at two dollars per ton. As of December 31, 2018, there was approximately 435,000 remaining to be purchased under the agreement. For the year ended December 31, 2018, the Company purchased \$4,586 of wet sand under this agreement. In addition, the Company has an agreement with a sand processing company to process sand at specified prices. The two year agreement also began January 1, 2018 and requires the Company to process at least 10,000 tons per month on a rolling three-month average. Any shortfall would be due from the Company at seven dollars per ton. The Company provided an upfront capital infusion to the sand processing company to facilitate the processing of wet sand and will be repaid to the Company as an offset to

future sand processing charges. As of December 31, 2018, the total amount due to the Company relating to the unrecovered capital infusion and other receivables was approximately \$716, which is recorded within prepaid expenses and other current assets. For the year ended December 31, 2018, the Company spent \$2,369 in net sand processing charges under this agreement.

The Company had an agreement with a supplier to provide hydro sized sand for the Company's Marshfield, Wisconsin plant at a specified contract price. The Company agreed to purchase a minimum of 40,000 tons with the option to purchase additional hydro sized sand at the Company's discretion. As of December 31, 2018, the Company purchased \$1,077 of hydro sized sand under this agreement. As of December 31, 2017, the Company had not yet purchased any hydro sized sand under this agreement. There are no further commitments under this agreement.

The Company entered into a lease agreement dated November 1, 2008 ("2008 Agreement") with the Development Authority of Wilkinson County (the "Wilkinson County Development Authority"). Pursuant to the 2008 Agreement, the Wilkinson County Development Authority holds the title to the real and personal property of the Company's McIntyre and Toombsboro manufacturing facilities and leases the facilities to the Company for an annual administrative fee of \$50 per year. The Company elected the renewal option on November 1, 2017, which extended the lease through November 1, 2021. At any time prior to the scheduled termination of the lease, the Company has the option to terminate the lease and purchase the property for a nominal fee plus the payment of any rent payable through the balance of the lease term. Furthermore, the Company has security interests in the titles held by the Development

Authority. The Company has also entered into a Memorandum of Understanding (the “MOU”) with the Development Authority and other local agencies, under which the Company receives tax incentives in exchange for its commitment to invest in the county and increase employment. The Company is required to achieve certain employment levels in order to retain its tax incentives. In the event the Company does not meet the agreed-upon employment targets or the MOU is otherwise terminated, the Company would be subjected to additional property taxes annually. Based on adverse economic conditions beyond the Company’s control that negatively impacted employment levels, a notice dated February 1, 2016 sent by the Company to the Development Authority of Wilkinson County declared a force majeure, which suspended employment levels defined in the original agreement and preserved tax incentives until further notification of the restart of plant operations. The Development Authority of Wilkinson County has not challenged the Company’s declaring a force majeure. The properties subject to these lease agreements are included in Property, Plant and Equipment (net book value of \$104,179 at December 31, 2018) in the accompanying consolidated financial statements.

17. Employment Agreements

The Company has an employment agreement through December 31, 2019 with its President and Chief Executive Officer. The agreement provides for an annual base salary and incentive bonus. If the President and Chief Executive Officer is terminated early without cause, the Company will be obligated to pay two years base salary and a prorated incentive bonus. Under the agreement, the timing of the payment of severance obligations to the President in the event of the termination of his employment under certain circumstances has been conformed so that a portion of such obligations will be payable in a lump sum, with the remainder of the obligations to be paid over an 18 month period. The agreement also contains a two-year non-competition covenant that would become effective upon termination for any reason. The employment agreement extends automatically for successive one-year periods without prior written notice.

18. Sale of Russian Proppant Business

On July 21, 2017, subsidiaries of the Company Carbo Ceramics (Mauritius) Inc. and Carbo LLC (together, the “Sellers”) entered into a Share Purchase Agreement with Petro Welt Technologies AG and PeWeTe Evolution Limited (together, the “Purchasers”) to sell the Company’s Russian proppant business. The adjusted purchase price was approximately \$26,000 for all of the shares of CARBO Ceramics Cyprus Limited held by the Sellers. The transaction received local regulatory approval and closed on September 21, 2017.

The net assets included in the calculation of the loss on the sale were \$17,754, including cash and cash equivalents of \$846, accounts receivable of \$6,047, total inventory of \$8,573, net PP&E of \$2,763, other net assets of \$670, and accrued expenses of \$1,145. The Company incurred approximately \$1,646 in expenses relating to the sale. Gain on the sale before consideration of the cumulative translation adjustment was approximately \$6,599. However, as a result of the sale, the Company reclassified the foreign currency cumulative translation loss of \$33,347 from accumulated other comprehensive loss within shareholders’ equity to net loss which offset the initial gain on the sale. As a result, the Company’s net loss on the sale was approximately \$26,747, presented as a separate line item within operating loss on the consolidated statement of operations.

As of December 31, 2017, the Company was owed \$4,000 related to net debt and net working capital purchase price adjustments. In January 2018, the Company filed a Notice of Arbitration related to this purchase price adjustment against the Purchasers. During the second quarter of 2018, the Company settled the dispute with the Purchasers. Terms of the settlement required the Purchasers to pay \$3,650, and as a result we recorded a loss of \$350. In July 2018, we received the settlement proceeds of approximately \$3,650, which is included within investing cash flows on the consolidated statement of cash flows for the year ended December 31, 2018.

As of December 31, 2018, the Company does not have a material net investment that is subject to foreign currency fluctuations.

19.Sale of Millen Facility

On December 31, 2018, the Company entered into a Purchase and Sale Agreement with a Buyer to sell the Company's ceramic proppant manufacturing facility in Millen, Georgia for \$23,000. The transaction closed on December 31, 2018. Selling expenses, including certain post-closing matters and retained liabilities, totaled approximately \$7,267. As of December 31, 2018, the Company had paid approximately \$899 of the total selling expenses. As such, net proceeds of \$22,101 is included within investing cash flows on the consolidated statement of cash flows for the year ended December 31, 2018. The selling expenses that had not yet been paid as of December 31, 2018 primarily relate to the post-closing matters and retained liabilities, and are recorded as liabilities as of December 31, 2018 within other accrued expenses, other current liabilities and other long-term liabilities on the consolidated balance sheets. The payment of the post-closing matters will be an investing cash outflow when paid, and the repayment of the retained liabilities will be financing outflows when repaid over a multi-year period. Net Cash Proceeds, as defined in the New Credit

Agreement, is expected to approximate \$15,733, calculated as the gross proceeds of \$23,000 less the selling expenses of \$7,267. See Note 4. The retained liabilities, due to the City of Millen and the local electrical cooperative, are associated with their respective investments in the Millen facility's electrical and natural gas infrastructure during the construction of the plant. The Company also retained an existing liability associated with a long-term fixed natural gas transportation agreement. These retained liabilities, totaling approximately \$4,852, will be repaid over a multi-year period and are included in other current liabilities and other long-term liabilities. As of December 31, 2018, the fair value of these retained liabilities approximated the carrying value. Subsequent to the balance sheet date, the Company executed a note payable with the local electrical cooperative for its share of the retained liabilities with a principal balance equal to the liability recorded at December 31, 2018. The note bears interest at 5% annually and requires monthly principal and interest payments of \$35 until maturity in February 2024. In order to backstop the amounts due under these retained liabilities, the Company agreed to an escrow holdback of \$3,000 at closing and provided a letter of credit for an additional \$2,000. The letter of credit will be reduced by \$400 each year until maturity. The Company also agreed to a separate escrow holdback of \$1,200 pending completion of the post-closing matters. The book value of the assets held for sale was \$17,842, which after consideration of the selling price, the write-off of certain spare parts totaling \$196 and costs to sell the facility, resulted in a loss on the sale of \$2,305.

20. Legal Proceedings and Regulatory Matters

The Company is subject to legal proceedings, claims and litigation arising in the ordinary course of business. While the outcome of these matters is currently not determinable, management does not expect that the ultimate costs to resolve these matters will have a material adverse effect on the Company's consolidated financial position, results of operations, or cash flows.

21. Subsequent Events

In January 2019, the Company awarded the following:

468,984 shares of restricted stock to certain employees. The fair value of the stock award on the date of grant totaled \$2,298, which will be recognized as expense, less actual forfeitures as they occur, on a straight-line basis over the three-year vesting period.

105,276 units of phantom shares to certain employees. The fair value of the phantom shares on the date of grant totaled \$516. Compensation expense for these shares will be recognized over the three-year vesting period. The amount of compensation expense recognized each period will be based on the fair value of the Company's common stock at the end of each period.

Exhibit Index

- 3.1 Restated Certificate of Incorporation of CARBO Ceramics Inc. (incorporated by reference to Exhibit 3.1 of the Registrant's Form 10-Q filed for the period ending June 30, 2012)
- 3.2 Third Amended and Restated By-Laws of CARBO Ceramics Inc. (incorporated by reference to Exhibit 3.1 of the Registrant's Form 8-K Current Report filed January 24, 2019)
- 4.1 Form of Common Stock Certificate of CARBO Ceramics Inc. (incorporated by reference to Exhibit 4.1 of the Registrant's Form S-1 Registration Statement No. 333-1884 filed July 19, 1996) (P)
- 4.2 Certificate of Designations of Series A Preferred Stock (incorporated by reference to Exhibit 2 of the Registrant's Form 8-A12B Registration Statement No. 001-15903 filed February 25, 2002)
- **10.1 Amended and Restated Mining Agreement dated as of November 30, 2015 between CARBO Ceramics Inc. and Arcilla Mining & Land Co. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2015)
- **10.2 Proppant Supply Agreement dated as of August 28, 2008 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.3 of the Registrant's Form 10-Q Quarterly Report for the quarter ended September 30, 2008)
- **10.3 Amendment No. 1 to Proppant Supply Agreement dated as of February 28, 2011 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2011)
- 10.4 Side Letter to Proppant Supply Agreement dated as of August 26, 2011 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended September 30, 2011)
- 10.5 Amendment No. 3 to Proppant Supply Agreement dated as of March 24, 2014 by and between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2014)
- **10.6 Amendment No. 4 to Proppant Supply Agreement dated as of September 25, 2015 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended September 30, 2015)
- **10.7 Amendment No. 5 to Proppant Supply Agreement dated as of September 25, 2015 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.10 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2015)
- 10.8 Amendment No. 6 to Proppant Supply Agreement dated as of April 30, 2016 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2016)
- 10.9 Promissory Note between CARBO Ceramics Inc. and Williams C. Morris (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2016)
- 10.10 Promissory Note between CARBO Ceramics Inc. and Robert S. Rubin (incorporated by reference to Exhibit 10.3 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2016)
- **10.11 Master Purchase Agreement for Goods and Services dated as of January 18, 2017 between CARBO Ceramics Inc. and Halliburton Energy Services, Inc. (incorporated by reference to Exhibit 10.15 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2016)
- 10.12 Lease Agreement dated as of November 1, 2008 between the Development Authority of Wilkinson County and CARBO Ceramics Inc. (incorporated by reference to Exhibit 10.1 of the Registrant's Form 8-K Current Report filed December 30, 2008)
- 10.13 Option Agreement dated as of November 1, 2008 between the Development Authority of Wilkinson County and CARBO Ceramics Inc. (incorporated by reference to Exhibit 10.2 of the Registrant's Form 8-K Current Report filed December 30, 2008)

- 10.14 Lease Agreement dated as of November 1, 2012 between the Development Authority of Jenkins County and CARBO Ceramics Inc. (incorporated by reference to Exhibit 10.9 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2012)
 - *10.15 Amended and Restated 2014 CARBO Ceramics Inc. Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2017)
 - *10.16 Form of Officer Restricted Stock Award Agreement for Amended and Restated 2014 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.16 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2017)
 - *10.17 Form of Non-Employee Director Restricted Stock Award Agreement for Amended and Restated 2014 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.17 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2017)
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- *10.18 Form of Officer Restricted Stock Unit Award Agreement for Amended and Restated Omnibus 2014 Incentive Plan (incorporated by reference to Exhibit 10.18 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2017)
- *10.19 Description of Annual Non-Employee Director Stock Grants (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2010)
- *10.20 Description of Modification to Annual Non-Employee Director Stock Grants (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2011)
- *10.21 Description of Modification to the Annual Non-Employee Director Stock Grants (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2012)
- *10.22 Description of Modification to Annual Non-Employee Director Stock Grants (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2013)
- *10.23 Description of Modification to Annual Non-Employee Director Stock Grants (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2014)
- 10.24 Office Lease dated as of January 20, 2009 between I-10 EC Corridor #2 Limited Partnership and CARBO Ceramics Inc. (incorporated by reference to Exhibit 10.27 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2009)
- 10.25 First Amendment to Lease dated as of January 15, 2010 between I-10 EC Corridor #2 Limited Partnership and CARBO Ceramics Inc. (incorporated by reference to Exhibit 10.28 of the Registrant's Form 10-K Annual Report for the year ended December 31, 2009)
- 10.26 Second Amendment to Lease dated as of March 1, 2015 between I-10 EC Corridor #2 Limited Partnership and CARBO Ceramics Inc. (incorporated by reference to Exhibit 10.2 of the Registrant's Form 8-K Current Report filed March 16, 2015)
- 10.27 Credit Agreement, dated as of January 29, 2010, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.1 of the Registrant's Form 8-K Current Report filed February 4, 2010)
- 10.28 Amendment No. 1, dated as of March 5, 2012, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.1 of the Registrant's Form 8-K Current Report filed March 6, 2012)
- 10.29 Amendment No. 2 to Credit Agreement, dated as of July 25, 2013, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2013)
- 10.30 Amendment No. 3 to Credit Agreement, dated as of October 31, 2014, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended September 30, 2014)
- 10.31 Amendment No. 4 to Credit Agreement, dated as of July 27, 2015, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2015)
- 10.32 Amendment No. 5 to Credit Agreement, dated as of September 14, 2015, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended September 30, 2015)
- 10.33 Amendment No. 6 to Credit Agreement, dated as of February 26, 2016, among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.37 of the Registrant's

Form 10-K Annual Report for the year ended December 31, 2015)

- 10.34 Agreement and Amendment No. 7 to the Credit Agreement, dated as of April 27, 2016, by and among CARBO Ceramics Inc., as borrower, Wells Fargo Bank, National Association, as administrative agent, issuing lender and swing line lender, and the lenders named therein (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2016)
- 10.35 Amended and Restated Pledge and Security Agreement, dated as of April 27, 2016, by and between CARBO Ceramics Inc., as borrower and Wells Fargo Bank, National Association, as administrative agent (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2016)
- 10.36 Patent and Trademark Security Agreement dated as of April 27, 2016 by and among CARBO Ceramics Inc., as borrower, certain Material Domestic Subsidiaries of the Borrower and Wells Fargo Bank, National Association, as administrative agent (incorporated by reference to Exhibit 10.3 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2016)

- 10.37 Waiver Agreement dated as of April 27, 2016, by and among CARBO Ceramics Inc., as borrower, certain Lenders parties thereto and Wells Fargo Bank, National Association, as administrative agent (incorporated by reference to Exhibit 10.4 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2016)
- 10.38 Guaranty Agreement dated as of April 27, 2016, by and among certain Guarantors of CARBO Ceramics Inc. thereto and Wells Fargo Bank, National Association, as administrative agent (incorporated by reference to Exhibit 10.5 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2016)
- 10.39 Security Agreement, dated July 27, 2015, among CARBO Ceramics Inc., as borrower and Wells Fargo Bank, National Association, as administrative agent (incorporated by reference to Exhibit 10.3 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2015)
- *10.40 Form of Change in Control Severance Agreement (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2012)
- 10.41 Sales Agreement between CARBO Ceramics Inc. and Cowen and Company, LLC, dated July 28, 2016 (incorporated by reference to Exhibit 10.1 of the Registrant's Form 8-K Current Report filed July 28, 2016)
- 10.42 Amended and Restated Credit Agreement dated as of March 2, 2017, by and between CARBO Ceramics Inc., as borrower, and Wilks Brothers, LLC, as lender and administrative agent (incorporated by reference to Exhibit 10.1 of the Registrant's Form 8-K Current Report filed March 6, 2017)
- 10.43 Letter Agreement, dated as of March 2, 2017, by and between Carbo Ceramics Inc., Wilks Brothers, LLC, William C. Morris, Robert S. Rubin and Gary A. Kolstad (incorporated by reference to Exhibit 10.2 of the Registrant's Form 8-K Current Report filed March 6, 2017)
- 10.44 Registration Rights Agreement, dated as of March 2, 2017, by and between Carbo Ceramics Inc. and Wilks Brothers, LLC (incorporated by reference to Exhibit 10.3 of the Registrant's Form 8-K Current Report filed March 6, 2017)
- 10.45 Warrant, dated as of March 2, 2017, issued by Carbo Ceramics Inc. to Wilks Brothers, LLC (incorporated by reference to Exhibit 10.4 of the Registrant's Form 8-K Current Report filed March 6, 2017)
- 10.46 Second Amended and Restated Pledge and Security Agreement, dated as of March 2, 2017, by and among CARBO Ceramics Inc., as borrower, and Wilks Brothers, LLC, as administrative agent (incorporated by reference to Exhibit 10.5 of the Registrant's Form 8-K Current Report filed March 6, 2017)
- *10.47 Fifth Amended and Restated Employment Agreement dated as of March 20, 2017, by and between CARBO Ceramics Inc. and Gary A. Kolstad (incorporated by reference to Exhibit 10.6 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2017)
- 10.48 Letter Agreement, dated as of March 2, 2017, between CARBO Ceramics Inc. and William C. Morris (incorporated by reference to Exhibit 10.7 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2017)
- 10.49 Letter Agreement, dated as of March 2, 2017, between CARBO Ceramics Inc. and Robert S. Rubin (incorporated by reference to Exhibit 10.8 of the Registrant's Form 10-Q Quarterly Report for the quarter ended March 31, 2017)
- ***10.50 Share Purchase Agreement between Carbo Ceramics (Mauritius) Inc. and CARBO LLC and Petro Welt Technologies AG and PeWeTe Evolution Limited, dated as of July 21, 2017 (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2017)
- 10.51 Letter Agreement, executed September 26, 2018, by and between Carbo Ceramics Inc. and Buyer (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended September 30, 2018)
- 10.52 First Amendment to Amended and Restated Credit Agreement, dated as of June 7, 2018, by and between CARBO Ceramics Inc., as borrower, and Wilks Brothers, LLC, as lender and administrative agent (incorporated by reference to Exhibit 10.1 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2018)
- 10.53 First Amendment to Second Amended and Restated Pledge and Security Agreement, dated as of June 7, 2018, by and among CARBO Ceramics Inc., as borrower, and Wilks Brothers, LLC, as administrative agent (incorporated by reference to Exhibit 10.2 of the Registrant's Form 10-Q Quarterly Report for the quarter ended June 30, 2018)
- 21 Subsidiaries
- 23 Consent of Independent Registered Public Accounting Firm
- 31.1 Rule 13a-14(a)/15d-14(a) Certification by Gary A. Kolstad
- 31.2 Rule 13a-14(a)/15d-14(a) Certification by Ernesto Bautista III
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Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002

95 Mine Safety Disclosure

101 The following financial information from the Company's Annual Report on Form 10-K for the year ended December 31, 2017, formatted in XBRL: (i) Consolidated Balance Sheets; (ii) Consolidated Statements of Operations; (iii) Consolidated Statements of Comprehensive Loss; (iv) Consolidated Statements of Shareholders' Equity; (v) Consolidated Statements of Cash Flows; and (vi) Notes to the Consolidated Financial Statements.

* Management contract or compensatory plan or arrangement filed as an exhibit pursuant to Item 15(b) of the requirements for an Annual Report on Form 10-K.

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** Pursuant to Rule 24b-2 of the Securities Exchange Act of 1934, as amended, confidential portions of these exhibits have been omitted and filed separately with the Securities and Exchange Commission pursuant to a request for confidential treatment.

*** The schedules and Exhibit A to the Share Purchase Agreement have been omitted from this filing pursuant to Item 601(b)(2) of Regulation S-K. The Company agrees to furnish supplementally a copy of any omitted schedule to the SEC upon request.

(P) Paper exhibits

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this Report to be signed on its behalf by the undersigned, thereunto duly authorized.

CARBO Ceramics Inc.

By: /s/ Gary A Kolstad
Gary A. Kolstad
President and Chief Executive Officer

By: /s/ Ernesto Bautista III
Ernesto Bautista III
Vice President and
Chief Financial Officer

Dated: February 28, 2019

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Gary A. Kolstad and Ernesto Bautista III, jointly and severally, his attorneys-in-fact, each with the power of substitution, for him in any and all capacities, to sign any amendments to this Report on Form 10 K, and to file the same, with exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, hereby ratifying and confirming all that each of said attorneys-in-fact, or his substitute or substitutes, may do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this Report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the dates indicated.

Signature	Title	Date
/s/ William C. Morris William C. Morris	Chairman of the Board	February 28, 2019
/s/ Gary A. Kolstad Gary A. Kolstad	President, Chief Executive Officer and Director (Principal Executive Officer)	February 28, 2019
/s/ Ernesto Bautista III Ernesto Bautista III	Vice President and Chief Financial Officer (Principal Financial and Accounting Officer)	February 28, 2019
/s/ Sigmund L. Cornelius Sigmund L. Cornelius	Director	February 28, 2019
/s/ Chad C. Deaton Chad C. Deaton	Director	February 28, 2019
/s/ H.E. Lentz, Jr. H.E. Lentz, Jr.	Director	February 28, 2019
/s/ Randy L. Limbacher Randy L. Limbacher	Director	February 28, 2019
/s/ Carla S. Mashinski Carla S. Mashinski	Director	February 28, 2019

