MINERALS TECHNOLOGIES INC
Form 10-K
February 15, 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

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from ________ to _________

Commission file number 1-11430

MINERALS TECHNOLOGIES INC.
(Exact name of registrant as specified in its charter)

Delaware	25-1190717
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification Number)

622 Third Avenue, 38th Floor New York, New York	10017-6707
(Address of principal executive office)	(Zip Code)

(212) 878-1800
(Registrant's telephone number, including area code)

(212) 878-1800
(Registrant's telephone number, including area code)

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

Title of each class	Name of each exchange on which registered
Common Stock, $.10 par value	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 Registrant is not required to file reports pursuant to Section 13 or 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 the Registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. .

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, 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 voting stock held by non-affiliates of the Registrant, based upon the closing price at which the stock was sold as of July 1, 2018, was approximately $2.3 billion. Solely for the purposes of this calculation, shares of common stock held by officers, directors and beneficial owners of 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 4, 2019, the Registrant had outstanding 35,230,318 shares of common stock, all of one class.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant’s Proxy Statement for its 2019 Annual Meeting of Stockholders are incorporated herein by reference in Part III of this Annual Report on Form 10-K.

MINERALS TECHNOLOGIES INC.
2018 FORM 10-K ANNUAL REPORT
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PART I

Item 1. Business

Minerals Technologies Inc. (together with its subsidiaries, the "Company", “we”, “us” or “our”) is a resource- and technology-based company that develops, produces, and markets on a worldwide basis a broad range of specialty mineral, mineral-based and synthetic mineral products and supporting systems and services.

The Company has four reportable segments: Performance Materials, Specialty Minerals, Refractories and Energy Services.

The Performance Materials segment is a leading supplier of bentonite and bentonite-related products, chromite and leonardite. This segment also provides products for non-residential construction, environmental and infrastructure projects worldwide, serving customers engaged in a broad range of construction projects.

The Specialty Minerals segment produces and sells the synthetic mineral product precipitated calcium carbonate ("PCC") and processed mineral product quicklime ("lime"), and mines mineral ores then processes and sells natural mineral products, primarily limestone and talc. This segment is a leading supplier globally of PCC products to the paper industry. This segment's products are used principally in the paper, building materials, paint and coatings, glass, ceramic, polymer, food, automotive and pharmaceutical industries.

The Refractories segment produces monolithic and shaped refractory materials and specialty products. It also provides services and sells application and measurement equipment, calcium metal and metallurgical wire products. Refractories segment products are primarily used in high-temperature applications in the steel, non-ferrous metal and glass industries.

The Energy Services segment provides services to improve the production, costs, compliance, and environmental impact of activities performed in the oil and gas industry. This segment offers a range of services for off-shore filtration and well testing to the worldwide oil and gas industry.

The following table sets forth the percentage of our revenues generated from each segment for each of our last three fiscal years:

	2018	2017	2016
Percentage of Net Sales			
Performance Materials	46%	44%	42%
Specialty Minerals	33%	35%	36%
Refractories	17%	17%	17%
Energy Services	4%	4%	5%
Total	100%	100%	100%

The Company maintains a research and development focus. The Company's research and development capability for developing and introducing technologically advanced new products has enabled the Company to anticipate and satisfy changing customer requirements, creating market opportunities through new product development and product application innovations

Performance Materials Segment

The Performance Materials segment is a leading supplier of bentonite and bentonite-related products. Bentonite is a sedimentary deposit containing greater than 50% montmorillonite and is volcanic in origin. It is surface mined and then dried, crushed, sent through grinding mills where it is sized to customer requirements, and transferred to silos for automatic bagging or bulk shipment. The processed bentonite may be chemically modified. Bentonite's unique chemical structure gives it a diverse range of capabilities, enabling it to act as a thickener, sealant, binder, lubricant or absorption agent. There are two primary types of natural bentonite utilized by the business, sodium and calcium. Sodium-bentonite is characterized by its ability to absorb large amounts of water and form viscous, thixotropic suspensions. Calcium-bentonite, in contrast, is characterized by its low water absorption and swelling capabilities and its inability to stay suspended in water. Each type of bentonite has its own unique applications. This segment also supplies chromite and leonardite, which is primarily used in metalcasting, drilling fluid additive, and agricultural applications. The principal products of this segment are marketed under various registered trade names, including VOLCLAY®, PANTHER CREEK®, PREMIUM GEL®, ADDITROL®, PREMIUM CHOICE®, ENERSOL®, RAFINOL® and Hevi-Sand®.

In addition, the segment provides products for non-residential construction, environmental and infrastructure projects worldwide. It serves customers engaged in a broad range of construction projects, including site remediation, concrete waterproofing for underground structures, liquid containment on projects ranging from landfills to flood control, and drilling applications including foundation, slurry wall, tunneling, water well, and horizontal drilling.

The Performance Materials segment has five product lines – metalcasting; household, personal care and specialty products; basic minerals, environmental products and building materials.

Metalcasting – Products and Markets

The metalcasting product line produces custom-blended mineral and non-mineral products to strengthen sand molds for casting auto parts, farm and construction equipment, oil and gas production equipment, power generation turbine castings and rail car components. These products help our customers in the foundry and casting industry to improve productivity by reducing scrap from metalcasting defects and poor surface quality. The ADDITROL® blends also improve the efficiency and recycling of sand blends in mold sand systems by lowering clay consumption and improve air quality by reducing volatile organic compound emissions. Our mine to mold operational capability has resulted in providing a consistent high-quality product, technical support and reliable on-time delivery service valued by our customers.

In the ferrous casting market, the Company specializes in blending bentonite of various grades by themselves or with mineral binders containing sodium bentonite, calcium bentonite, seacoal and other ingredients. In the steel alloy casting market, the Company sells chromite products with a particle size distribution specific to customers' needs. One of chromite's qualities is its ability to conduct heat. The Company markets the product for use in making very large, high integrity, steel alloy castings where the chromite is better suited to withstand the high heat and pressure associated with the casting process.

The Company is the exclusive distributor of certain specialty sand chromite products supplied by the Glencore-Merafe joint venture in select territories, including the Americas. This product line was originally sold into the U.S. by the American Colloid Company (ACC) and over the past 90 years has grown in its use throughout the world including China, Thailand, Korea, Australia and Southeast Asia. Over the past three years, the Company has focused on further investment in China and India, where we saw significant sales growth in 2017 and 2018.

The Company's metalcasting product line net sales were $328.9 million in 2018, $294.3 million in 2017 and $258.0 million in 2016.

Household, Personal Care and Specialty Products – Products and Markets

The household, personal care and specialty products product line contains pet litter, fabric care, health and beauty, and agricultural specialty products.

The pet litter products include sodium bentonite-based scoopable (clumping), traditional and alternative cat litters sold to grocery and drug stores, mass merchandisers, wholesale clubs and pet specialty stores throughout North America, Europe and Asia. The Company's scoopable products' clump-forming capability traps urine, thereby reducing waste by allowing for easy removal of only the odor-producing elements from the litter box. The Company is a provider of private-label cat litter to retail partners, as well as a provider of bulk cat litter to national brands and other private label packaging companies. In North America, these products are sold from three principal sites from which we package and distribute finished goods, as well as ship bulk material via rail cars. The Company's internal transportation group provides logistics services and is a key component of our capability in supplying customers on a national basis.

On April 30, 2018, the Company completed the acquisition of Sivomatic Holding, B.V. ("Sivomatic"). Sivomatic is a leading European supplier of premium pet litter products and is a vertically integrated manufacturer with production facilities in the Netherlands, Austria and Turkey.

The Company supplies fabric care products and additives consisting of high-grade, agglomerated bentonite and other mineral additives that perform as softening agents in certain powdered-detergent formulations or act as carriers for colorants, surfactants and fragrances. These fabric care products are formulated to adapt to our customers' changing technical requirements.

The Company manufactures personal care products consisting of polymer delivery systems and purified grades of bentonite ingredients for sale to manufacturers of skin care products. The polymers are used to deliver high-value active ingredients and the bentonite-based materials act as thickening, suspension and dispersion agent emollients for topical skin care formulations. The personal care products range from ingredient sales to fully formulated finished goods.

Specialty Materials include bentonite and leonardite based proprietary solutions for agricultural and industrial applications. Agricultural uses include crop harvest enhancements, natural animal heath feed additives and vegetable cooking oil clarification.

The Company's household, personal care and specialty product line net sales were $248.8 million in 2018, $169.6 million in 2017 and $171.2 million in 2016.

Basic Minerals – Products and Markets

The basic minerals product line contains sales of bentonite and leonardite to a variety of end markets and industrial applications, including the following:

Drilling Fluid Additives: Sodium bentonite and leonardite are components of certain drilling fluids used in oil and gas well drilling. Bentonite imparts thickening and suspension properties that facilitate the transport of rock cuttings to the surface during the drilling process. It also contributes to a drilling fluid's ability to lubricate the drill bit and coat the underground formations to prevent hole collapse and drill-bit seizing. We market our drilling fluid additives under our own brand and private-label trade names. At least two drilling fluid service competitors have captive bentonite operations while others are party to long-term bentonite supply agreements. The potential customers for our products, therefore, are generally limited to those service organizations that are neither vertically integrated nor have long-term supply arrangements with other bentonite producers. Our primary trademark for this application is the trade name PREMIUM GEL®.

Drilling Products: Drilling products are used in environmental and geotechnical drilling applications, horizontal directional drilling, mineral exploration and foundation construction. The products are used to install monitoring wells, facilitate horizontal and water well drilling, and to seal abandoned exploration drill holes. VOLCLAY GROUT™, HYDRAUL-EZ®, BENTOGROUT® and VOLCLAY TABLETS™ are among the trade names for products used in these applications. Ground source heat loop systems utilizing GEOTHERMAL GROUT™ represent a developing area for drilling products. The Company also offers a range of drilling products used in the excavation of foundations for large buildings, bridges and dams; these products include SHORE PAC® and PREMIUM GEL®. The end-users for these products are typically small well drilling companies and general contractors.

Other Industrial: The Company produces bentonite and bentonite blends for the construction industry to be used as a plasticizing agent in cement, and plaster and bricks. The Company also supplies bentonite to help pelletize other materials for ease of use. Examples of this application include the pelletizing of iron ore.

This product line also includes sales from our internal transportation and logistics group. In 2018, we closed our chromite processing operations in South Africa and exited our bulk chromite business in this product line.

The Company's basic minerals product line net sales were $99.7 million in 2018, $125.0 million in 2017 and $103.9 million in 2016. The sales decline in 2018 was primarily driven by the decision to exit the bulk chromite business.

Environmental Products – Products and Markets

The environmental product line includes bentonite and polymer lining technologies, as well as, other environmental remediation applications.

The Company helps customers protect ground water and soil through the sale of geosynthetic clay liner products containing bentonite. These products are marketed under the RESISTEX® and BENTOMAT® trade names principally for lining and capping landfills, mine waste disposal sites and industrial waste storage sites, such as, bauxite residue and coal ash waste. The Company also provides associated geosynthetic materials for these applications, including geotextiles and drainage geocomposites.

Environmental Products also includes specialized technologies to mitigate vapor intrusion in new building construction. The Company's innovative vapor barrier systems prevent potentially harmful vapors from entering occupied space, thus facilitating low-risk redevelopment. The Company also provides reactive capping technologies and solutions to effectively contain residual contamination, to reduce costs associated with ex-situ remedies, and aid in environmental protection. Products offered include Liquid Boot®, a liquid applied vapor barrier system; REACTIVE CORE-MAT™, an in-situ sediment capping material and QUIK-SOLID®, a super absorbent media. The Company specializes within the remediation market providing technologies to treat a variety of hazardous compounds in soil, groundwater, leachate and sediment. These products are marketed under the ORGANOCLAY® trade name. The Company also specializes in treating soil, groundwater, surface water and drinking water contaminated with Per-and polyfluoroalkyl substances (PFAS) and Perfluorooctane sulfonate (PFOS) under the FLUORO-SORB® trade name.

The Company’s environmental product line net sales were $80.3 million in 2018, $67.7 million in 2017 and $78.9 million in 2016.

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Building Materials – Products and Markets

The building materials product line includes various active and passive products for waterproofing of underground structures, commercial building envelopes and tunnels.

The Company offers a wide variety of active and passive waterproofing and greenroof technologies for use in protecting the building envelope of non-residential construction, including buildings, subways, and parkway systems. Our products include VOLTEX®, a waterproofing composite comprised of two polypropylene geotextiles filled with sodium bentonite; ULTRASEAL®, an advanced membrane using a unique active polymer core; and COREFLEX®, featuring heat-welded seams for protection of critical infrastructure. In addition to these membrane materials, we also provide a variety of sealants and other accessories required to create a functional waterproofing system. The end-users of these products are generally building sub-contractors who are responsible for installing the products.

The Company's building materials product line net sales were $70.4 million in 2018, $78.2 million in 2017 and $74.1 million in 2016.

Specialty Minerals Segment

PCC Products and Markets

The Company's PCC product line net sales were $445.4 million, $443.7 million and $452.2 million for the years ended December 31, 2018, 2017 and 2016, respectively. The Company's sales of PCC have been, and are expected to continue to be, made primarily to the printing and writing papers segment of the paper industry. The Company also produces PCC for sale to companies in the polymer, food and pharmaceutical industries.

PCC Products – Paper

In the paper industry, the Company's PCC is used:

as a filler in the production of coated and uncoated wood-free printing and writing papers, such as office papers;

as a filler in the production of coated and uncoated groundwood (wood-containing) paper such as magazine and catalog papers; and

as a coating pigment for both wood-free and groundwood papers.

The Company's Paper PCC product line net sales were $378.5 million, $377.7 million and $387.9 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Approximately 21% of the Company's sales consist of PCC sold to papermakers from "satellite" PCC plants. A satellite PCC plant is a PCC manufacturing facility located near a paper mill, thereby eliminating costs of transporting PCC from remote production sites to the paper mill. The Company believes the competitive advantages offered by improved economics and superior optical characteristics of paper produced with PCC manufactured by the Company's satellite PCC plants resulted in substantial growth in the number of the Company's satellite PCC plants since the first such plant was built in 1986. For information with respect to the locations of the Company's PCC plants as of December 31, 2018, see Item 2, "Properties," below.

The Company currently manufactures several customized PCC product forms using proprietary processes. Each product form is designed to provide optimum balance of paper properties including brightness, opacity, bulk, strength and improved printability. The Company's research and development and technical service staff focuses on expanding sales from its existing and potential new satellite PCC plants, as well as, developing new technologies for new applications. These technologies include, among others, acid-tolerant ("AT®") PCC, which allows PCC to be introduced to the large wood-containing segment of the printing and writing paper market, OPACARB® PCC, a family of products for paper coating, our FulFill® family of products, a system of high-filler technologies that offers papermakers a variety of efficient, flexible solutions which decrease dependency on natural fibers, and NewYield® and ENVIROFIL®, innovative technologies that convert a paper and pulp mill waste stream into functional pigments for filling paper.

The Company owns, staffs, operates and maintains all of its satellite PCC facilities, and owns or licenses the related technology. Generally, the Company and its paper mill customers enter into long-term evergreen agreements, initially ten years in length, pursuant to which the Company supplies substantially all of the customer's precipitated calcium carbonate filler requirements. The Company is generally permitted to sell to third-parties PCC produced at a satellite plant in excess of the host paper mill's requirement.

The Company also sells a range of PCC products to paper manufacturers from production sites not associated with paper mills. These merchant facilities are located at Adams, Massachusetts and Lifford, United Kingdom.

PCC Markets – Paper

Uncoated Wood-Free Printing and Writing Papers – North America. Beginning in the mid-1980's, as a result of a concentrated research and development effort, the Company's satellite PCC plants facilitated the conversion of a substantial percentage of North American uncoated wood-free printing and writing paper producers to lower-cost alkaline papermaking technology. The Company estimates that during 2018, more than 90% of North American uncoated wood-free paper was produced employing alkaline technology. Presently, the Company owns and operates 17 commercial satellite PCC plants located at paper mills that produce uncoated wood-free printing and writing papers in North America.

Uncoated Wood-Free Printing and Writing Papers – Outside North America. The Company estimates the amount of uncoated wood-free printing and writing papers produced outside of North America at facilities that can be served by satellite and merchant PCC plants is more than twice as large (measured in tons of paper produced) as the North American uncoated wood-free paper market currently served by the Company. The Company believes that the superior brightness, opacity and bulking characteristics offered by its PCC products allow it to compete with suppliers of ground limestone and other filler products outside of North America. Presently, the Company owns and operates 34 commercial satellite PCC plants located at paper mills that produce uncoated wood-free printing and writing papers outside of North America.

Uncoated Groundwood Paper. The uncoated groundwood paper market, including newsprint, represents approximately 17% of worldwide paper production. Paper mills producing wood-containing paper still generally employ acid papermaking technology. The conversion to alkaline technology by these mills has been hampered by the tendency of wood-containing papers to darken in an alkaline environment. The Company has developed proprietary application technology for the manufacture of high-quality groundwood paper in an acidic environment using PCC (AT® PCC). Furthermore, as groundwood or wood-containing paper mills use larger quantities of recycled fiber, there is a trend toward the use of neutral papermaking technology in this segment for which the Company presently supplies traditional PCC chemistries. The Company now supplies PCC at 5 groundwood paper mills around the world and licenses its technology to a ground calcium carbonate producer to help accelerate the conversion from acid to alkaline papermaking.

Coated Paper. The Company continues to pursue satellite PCC opportunities in coated paper markets where our products provide unique performance and/or cost reduction benefits to papermakers and printers. Our Opacarb product line is designed to create value to the papermaker and can be used alone or in combination with other coating pigments. PCC coating products are produced at 7 of the Company's PCC plants worldwide.

Specialty PCC Products and Markets

The Company also produces and sells a full range of dry PCC products on a merchant basis for non-paper applications. The Company's Specialty PCC product line net sales were $66.9 million, $66.0 million and $64.3 million for the years ended December 31, 2018, 2017 and 2016, respectively. The Company sells surface-treated and untreated grades of PCC to the polymer industry for use in automotive and construction applications, and to the adhesives and printing inks industries. The Company's PCC is also used by the food and pharmaceutical industries as a source of calcium in tablets and food applications, as a buffering agent in tablets, and as a mild abrasive in toothpaste. The Company produces PCC for specialty applications from production sites at Adams, Massachusetts and Lifford, England.

Processed Minerals – Products and Markets

The Company mines and processes natural mineral products, primarily limestone and talc. The Company also manufactures lime, a limestone-based product. The Company's net sales of processed mineral products were $143.9 million, $141.1 million and $139.3 million for the years ended December 31, 2018, 2017 and 2016, respectively. Net sales of talc products were $52.9 million, $53.8 million and $55.7 million for the years ended December 31, 2018, 2017 and 2016, respectively. Net sales of ground calcium carbonate ("GCC") products, which are principally lime and limestone, were $91.0 million, $87.3 million and $83.6 million for the years ended December 31, 2018, 2017 and 2016, respectively.

The Company mines and processes GCC products at its reserves in the eastern and western parts of the United States. GCC is used and sold in the construction, automotive and consumer markets.

Lime produced at the Company's Adams, Massachusetts, and Lifford, United Kingdom, facilities is used primarily as a raw material for the manufacture of PCC at these sites and is sold commercially to various chemical and other industries.

The Company mines, beneficiates and processes talc at its Barretts site, located near Dillon, Montana. Talc is sold worldwide in finely ground form for ceramic applications and in North America for paint and coatings and polymer applications. Because of the exceptional chemical purity of the Barretts ore, a significant portion of worldwide automotive catalytic converter ceramic substrates contain the Company's Barretts talc.

Our high-quality limestone, dolomitic limestone, and talc products are defined primarily by the chemistry and color characteristics of the ore bodies. Ore samples are analyzed by x-ray fluorescence (XRF) and other techniques to determine purity and more generally by Hunter brightness measurement to determine dry brightness and the Hunter yellowness (b) value. We serve multiple markets from each of our operations, each of which has different requirements relating to a combination of chemical and physical properties.

Refractories Segment

Refractory – Products and Markets

The Company offers a broad range of monolithic and pre-cast refractory products and related systems and services. The Company's Refractory segment net sales were $311.9 million, $279.4 million and $274.5 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Refractory product sales are often supported by Company-supplied proprietary application equipment, laser measurement systems and on-site technical service support. The Company's proprietary application equipment is used to apply refractory materials to the walls of steel-making furnaces and other high temperature vessels to maintain and extend their useful life. Net sales of refractory products, including those for non-ferrous applications, were $261.1 million, $226.9 million and $219.0 million for the years ended December 31, 2018, 2017 and 2016, respectively. The Company's proprietary application systems, such as its MINSCAN®, allow for remote-controlled application of the Company's refractory products in steel-making furnaces, as well as, in steel ladles. Since the steel-making industry is characterized by intense price competition, which results in a continuing emphasis on increased productivity, these application systems and the technologically advanced refractory materials developed in the Company's research laboratories have been well accepted by the Company's customers. These products allow steel makers to improve their performance through, among other things, the application of monolithic refractories to furnace linings while the furnace is at operating temperature, thereby eliminating the need for furnace cool-down periods and steel-production interruption. The result is a lower overall cost for steel produced by steel makers. The Company also pursues cost-per-ton refractory contracts, where, together with other refractory companies, the Company is responsible for coordinating refractory maintenance of the steel furnaces and other steel production vessels. These opportunities provide longer-term stability and a closer working relationship with the customer.

The Company's technical service staff and application equipment assist customers to achieve desired productivity objectives. The Company's technicians are also able to conduct laser measurement of refractory wear, sometimes in conjunction with robotic application tools, to improve refractory performance at many customer locations. The Company believes that these services, together with its refractory product offerings, provide it with a strategic marketing advantage.

Over the past several years, the Refractories segment has continued to develop, reformulate, and optimize its products and application technology to maintain its competitive advantage in the market place. Some of the products the Company has developed and optimized in the past several years include:

HOTCRETE®: High durability shotcrete products for applications at high temperatures in ferrous applications, such as, steel ladles, electric arc furnaces (EAF) and basic oxygen furnaces (BOF) furnaces.
FASTFIRE®: High durability castable and shotcrete products in the non-ferrous and ferrous industries with the added benefit of rapid dry-out capabilities.
OPTIFORM®: A system of products and equipment for the rapid continuous casting of refractories for applications, such as, steel ladle safety linings.
ENDURATEQ®: A high durability refractory shape for glass contact applications, such as, plungers and orifice rings.
DECTEQ™: A system for the automatic control of electrical power feeding electrodes used in electric arc steel making furnaces.
LACAM® Torpedo: A laser scanning system that measures the refractory lining thickness inside a Hot Iron (Torpedo) Ladle. The torpedo ladles transport liquid iron from a blast furnace to the steel plant.
LACAM® LI Explorer: A laser scanning system that measures the refractory lining thickness from the interior of a Hot Steel Ladle. By entering the interior, the explorer provides the ability to see all areas of the ladle and identify the smallest flaws in the refractory lining.
LACAM®: A new, fourth generation Lacam® laser measurement device for use in the worldwide steel industry that is 17 times faster than the previous version. This new technology provides the fastest and most accurate laser scanning for hot surfaces available today.

The principal market for the Company's refractory products is the steel industry. Management believes that certain trends in the steel industry will provide growth opportunities for the Company. These trends include growth and quality improvements regarding the development of improved manufacturing processes, such as, thin-slab casting, the trend in North America to shift production from integrated mills to electric arc furnaces (mini-mills) and the ever-increasing need for improved productivity and longer lasting refractories.

The Company sells its refractory products in the following markets:

Steel Furnace. The Company sells gunnable monolithic refractory products and application systems to users of basic oxygen furnaces and electric arc furnaces for application on furnace walls to prolong the life of furnace linings.

Other Iron and Steel. The Company sells monolithic refractory materials and pre-cast refractory shapes for iron and steel ladles, vacuum degassers, continuous casting tundishes, blast furnaces and reheating furnaces. The Company offers a full line of materials to satisfy most continuous casting refractory applications. This full line consists of gunnable materials, refractory shapes and permanent linings.

Industrial Refractory Systems. The Company sells refractory shapes and linings to the glass, cement, aluminum, petrochemicals, power generation and other non-steel industries. The Company also produces a specialized line of carbon composites and pyrolitic graphite sold under the PYROID® trademark, primarily to the aerospace and electronics industries.

Metallurgical Products and Markets

The Company produces a number of other technologically advanced products for the steel industry, including calcium metal, metallurgical wire products and a number of metal treatment specialty products. Net sales of metallurgical products were $50.8 million, $52.5 million and $55.5 million for the years ended December 31, 2018, 2017 and 2016, respectively. The Company manufactures calcium metal at its Canaan, Connecticut, facility and purchases calcium in international markets. Calcium metal is used in the manufacture of the Company's PFERROCAL® solid-core calcium wire and is also sold for use in the manufacture of batteries and magnets. We also manufacture cored wires at our Canaan, Connecticut and Hengelo, Netherlands, manufacturing sites. The Company sells metallurgical wire products and associated wire-injection equipment, including SURECAL®, for use in the production of high-quality steel. These metallurgical wire products are injected into molten steel to improve castability and reduce imperfections.

Energy Services Segment

The Energy Services segment provides services to improve the production, cost, compliance, and environmental impact of activities performed in the oil and gas industry. The composition of customers within this segment varies from year to year and is significantly dependent on the type of activities each customer is undertaking within the year, regulations, and overall dynamics of the oil and gas industry. The Company provides services for off-shore filtration and well testing to the worldwide oil and gas industry. Services are provided through subsidiaries located in Australia, Brazil, Malaysia, Nigeria, Mexico, Indonesia, Saudi Arabia, the United Kingdom, and the U.S., in the Gulf of Mexico. Energy Services segment’s net sales were $78.3 million, $76.7 million and $85.9 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Principal Services

The Company provides the following principal services:

Water Treatment / Filtration: The Company helps customers comply with regulatory requirements by providing equipment, technologies, personnel and filtration media to treat waste water generated during oil production.

The Company specializes in water treatment processes and technologies to remove oil, hydrocarbons, heavy metals, solids, toxic materials and other contaminants from customers' operation wastewater stream through mechanical and chemical means.

Well Testing: The Company provides equipment and personnel to help customers control well production, as well as, to clean up, unload, separate, measure component flow, and capture fluids from oil and gas wells.

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The Company delivers complete well testing solutions and effective operations in all testing environments.

Marketing and Sales

The Company relies principally on its worldwide direct sales force to market its products. The direct sales force is augmented by technical service teams that are familiar with the industries to which the Company markets its products, and by several regional distributors. The Company's sales force works closely with the Company's technical service staff to solve technical and other issues faced by the Company's customers.

In the Performance Materials segment, the Company relies on industry-specialized technically oriented sales persons. In Metalcasting, these sales teams provide expertise to educate our customers on the bentonite blend properties and to aid them in producing castings efficiently. Certain other products are distributed through networks of distributors and representatives, who warehouse specific products at strategic locations. In addition, the sales and distribution of environmental products and building materials are primarily performed through the Company’s own personnel and facilities. Our staff includes sales professionals and technical support engineers who analyze the suitability of our products in relation to the customer’s specific application and the conditions that products will endure or the environment in which they will operate.

In the Specialty Minerals segment, the Company's sales team and technical services staff assist paper producers in ongoing evaluations of the use of PCC for paper coating and filling applications as well as PCC, GCC and talc use in the automotive, construction and household goods markets.

In the Refractory segment, the Company's technical service personnel advise on the use of refractory materials, and, in many cases pursuant to service agreements, apply the refractory materials to the customers' furnaces and other vessels.

In the Energy Services segment, the Company’s sales team sell the services on a direct basis.

Continued use of skilled technical service teams is an important component of the Company's business strategy. The Company works closely with its customers to ensure that their requirements are satisfied, and it often trains and supports customer personnel in the use of the Company's products. The Company oversees domestic marketing and sales activities principally from Bethlehem, Pennsylvania and Hoffman Estates, Illinois, and from regional sales offices located elsewhere in the United States. The Company's international marketing and sales efforts are directed from regional centers located in India, the United Kingdom, Brazil, and China. The Company believes that its worldwide network of sales personnel and manufacturing sites facilitates continued international expansion.

Raw Materials

The Company depends in part on having an adequate supply of raw materials for its manufacturing operations, particularly lime and carbon dioxide for the PCC product line, and magnesia and alumina for its Refractory operations. We also depend on having an adequate supply of bentonite, leonardite and chromite for our Performance Materials segment and limestone and talc for our Processed Minerals product line. Supplies of bentonite, leonardite, chromite, limestone and talc are provided through the Company’s own mining operations and we depend on having adequate access to ore reserves of appropriate quality at such mining operations.

The Company uses lime in the production of PCC and is a significant purchaser of lime worldwide. Generally, the lime utilized in our business is readily available from numerous sources and we purchase lime under long-term supply contracts from unaffiliated suppliers located in close geographic proximity to the Company's PCC plants. We also produce lime at our Adams, Massachusetts facility and our Lifford, UK facility, although most of the lime produced at our Adams facility and all of the lime produced at our Lifford facility is consumed in the production of Specialty PCC at the plant. We currently supply some quantities of lime to third parties that are in close proximity to our Adams plant and could supply small quantities of lime to certain of our PCC satellite facilities that are in close geographic proximity to the Adams plant. Carbon dioxide is readily available in exhaust gas from the host paper mills, or other operations at our merchant facilities.

The principal raw materials used in the Company's monolithic refractory products are refractory-grade magnesia and various forms of alumina silicates. Approximately 42% percent of the Company's magnesia requirements were purchased from sources in China over the past five years. The price and availability of bulk raw materials from China are subject to fluctuations that could affect the Company's sales to its customers. In addition, the volatility of transportation costs has also affected the delivered cost of raw materials imported from China to North America and Europe. The Company has developed alternate sources of magnesia over the past few years that have reduced our reliance on China-sourced magnesia. The amount sourced from China and other locations can vary from year to year depending upon price and availability from each source. The alumina we utilize in our business is readily available from numerous sources. The Company also purchases calcium metal, calcium silicide, graphite, calcium carbide and various alloys for use in the production of metallurgical wire products and uses lime and aluminum in the production of calcium metal.

In addition to bentonite, leonardite and chromite provided through our mining operations, our Performance Materials segment's principal raw materials are coal, soda ash and woven and unwoven polyester material, all of which are readily available from numerous sources.

Mineral Reserves and Mining Process

The Company relies on access to bentonite reserves to support its Performance Materials segment. The Company has reserves of sodium and calcium bentonite at various locations in the U.S., including Wyoming, South Dakota, Montana and Alabama, as well as in Australia, China, and Turkey. Through the Company's affiliations and joint ventures, the Company also has access to bentonite deposits in India, and Mexico. Assuming the continuation of 2018 annualized usage rates, the Company has reserves of commercially usable sodium bentonite for the next 49 years. Under the same assumptions, the Company has reserves of commercially usable calcium bentonite for the next 30 years. The Company owns or controls the properties on which the bentonite reserves are located through long-term leases, royalty agreements (including easement and right of way agreements) and patented and unpatented mining claims. No single or group of mining claims or leases is significant or material to the financial condition or operations of our Company or our segments. The majority of our current bentonite mining in the U.S. occurs on reserves where our rights to such reserves accrue to us through over 80 mining leases and royalty agreements and 2,000 mining claims. A majority of these are with private parties and located in Montana, South Dakota and Wyoming. The bentonite deposits underlying these claims and leases generally lie in parcels of land varying between 20 and 40 acres.

In general, our bentonite reserves are immediately adjacent to, or within sixty miles of, one of the related processing plants. All of the properties on which our reserves are located are either physically accessible for the purposes of mining and hauling or the cost of obtaining physical access would not be material. Access to processing facilities from the mining areas is generally by private road, public highways, or railroads. For most of our leased properties and mining claims, there are multiple means of access.

Bentonite is surface mined, generally with large earthmoving bulldozers and scrapers, and then loaded into trucks and off-highway-haul wagons for movement to processing plants. The mining and hauling of our bentonite is done by us and by independent contractors. At the processing plants, bentonite is dried, crushed and sent through grinding mills, where it is sized to customer requirements, then chemically modified, where needed, and transferred to silos for automatic bagging or bulk shipment. Most of the production is shipped as processed rather than stored for inventory.

For our Performance Materials segment, we also mine leonardite, a form of oxidized lignite, in North Dakota, and transport it to nearby processing facilities. Assuming the continuation of 2018 annualized usage rates, the Company has reserves of commercially usable leonardite for the next 30 years. In 2018, we closed our chromite mine and processing operations in South Africa.

The Processed Minerals product line of our Specialty Minerals segment is supported by the Company's limestone reserves located in the western and eastern parts of the United States, and talc reserves located in Montana. The Company generally owns and surface mines these reserves and processes its products at nearby processing plants. The Company estimates these reserves, at current usage levels, to be in excess of 36 years at its limestone production facilities and in excess of 14 years at its talc production facility.

The Company has ongoing exploration and development activities for all of its mineral interests with the intent to increase its proven and probable reserves.

See Item 2, "Properties," for more information with respect to these facilities and mines.

The Company relies on shipping bulk cargos of bentonite within and from the United States, Turkey and China to customers, as well as our own subsidiaries, and we are sensitive to our ability to recover these shipping costs. In the last few years, bulk cargo shipping rates have been very volatile, and, to a lesser extent, the availability of bulk cargo containers has been sporadic.

Competition

The Company is continually engaged in efforts to develop new products and technologies and refine existing products and technologies in order to remain competitive and to position itself as a market leader.

For the Performance Materials segment, the Company competes on the basis of product quality, service, technical support, price, product availability and logistics. There are numerous major producers of competing products and various regional suppliers in the areas the Company serves. The Company is the world leader in bentonite, including number one positions in metalcasting and pet litter. Some of the competitors are companies primarily in other lines of business with substantially greater financial resources than ours. With respect to the environmental products product line, the Company competes with geosynthetic clay liner manufacturers worldwide, several suppliers of alternative lining technologies, and providers of soil and environmental remediation solutions and products. The building materials product line competes in a highly fragmented market comprised of a wide variety of alternative technologies. A number of integrated bentonite companies compete with our drilling products.

With respect to its PCC products, the Company competes for sales to the paper industry with other minerals, such as GCC and kaolin, based in large part upon technological know-how, patents and processes that allow the Company to deliver PCC that it believes imparts gloss, brightness, opacity and other properties to paper on an economical basis. The Company is the leading manufacturer and supplier of PCC to the paper industry.

The Company competes in sales of its limestone and talc based primarily upon quality, price, and geographic location.

With respect to the Company's refractory products, competitive conditions vary by geographic region. Competition is based upon the performance characteristics of the product (including strength, consistency and ease of application), price, and the availability of technical support.

The Energy Services segment competes with other oil and gas services companies. However, the Company believes that the Company offers several competitive advantages, especially in the area of water treatment services, due to superior and innovative technologies that the Company has developed internally and the combination of services that the Company can provide.

Seasonality

Some of our product lines and operations in the Performance Materials segment are impacted by weather and soil conditions. Many of the products cannot be applied in wet or winter weather conditions and, as such, sales and profits tend to be greater during the period from April through October. As a result, we consider the business of this segment to be seasonal. Our Processed Minerals product line of our Specialty Minerals segment is subject to similar seasonal patterns.

Much of the business in the Energy Services segment can be impacted by weather conditions. Our business is concentrated in the Gulf of Mexico where our customers' oil and gas production facilities are subject to natural disasters, such as hurricanes. Given this, our Energy Services sales could be lower in the June to November months.

Research and Development

Many of the Company's product lines are technologically advanced. The Company's internal research team has dedicated years of experience into analyzing properties of minerals and synthetic materials while developing processes and applications to enhance their performance. Our expertise in inorganic chemistry, crystallography and structural analysis, fine particle technology and other aspects of materials science apply to and support all of our product lines. The Company's business strategy for growth in sales and profitability depends, to a large extent, on the continued success of its research and development activities.

The Company's Performance Materials segment also offers a strong portfolio of custom blended compounds, formulations and technology, which have been primarily developed internally by the Company's research and development efforts. The ADDITROL® formulation, a custom blend, meets the need of both ferrous and non-ferrous applications. The Volclay® application is used in green sand molding applications ranging from the production of iron and steel castings to the production of non-ferrous castings. The Hevi-Sand® specialty chromite blend prevents metal penetration and can be used with most foundry binders in molds and cores. In addition, the Company's RESISTEX™ and CONTINUUM® formulation enables withstanding aggressive leachates. The ORGANOCLAY® technology offers highly effective solutions in effective in removing oils, greases and other high molecular weight, low solubility organic compounds from aqueous streams. The Company will also continue to seek out promising compounds and innovative technologies, developed mainly by our internal research team, to incorporate into our product lines.

In the Specialty Minerals segment, the significant achievements of the Company's research and development efforts include: the satellite PCC plant concept; PCC crystal morphologies for paper filling and coating; FulFill® high filler technology systems; NewYield® Waste Stream Process Technology; ENVIROFIL® Waste Stream Process

Technology; Thixocarb® PCC, Vicality® USP PCC, EMforce®, and Optibloc® for the Processed Minerals and Specialty PCC product lines.

The FulFill® brand High Filler Technology is a portfolio of high-filler technologies that offers papermakers a variety of efficient, flexible solutions that decreases dependency on natural fiber and reduces costs. The FulFill® E and V series allows papermakers to increase filler loading levels of precipitated calcium carbonate (PCC), which replaces higher cost pulp, and increases PCC usage. Depending on paper grades, this PCC volume increase may range from 15 to 30 percent. NewYield® Waste Stream Process Technology cost-effectively converts a problematic pulp mill waste stream into a functional pigment for filling paper, eliminating the cost of environmental disposal and remediation of certain waste streams to papermakers. The product and technology have been validated on a commercial scale in a pulping operation and papermaking system in China, with several current projects underway. ENVIROFIL® Waste Stream Process Technology cost-effectively converts a problematic de-inked sludge waste into a functional pigment for filling paper, eliminating the cost of environmental disposal and remediation.

In the Refractories segment, the Company's achievements include the development of FASTFIRE® and OPTIFORM® shotcrete refractory products; LACAM® laser-based refractory measurement systems; and the MINSCAN® and HOTCRETE® application systems. The Company will continue to reformulate its refractory materials to be more competitive.

For the years ended December 31, 2018, 2017 and 2016, the Company spent approximately $22.7 million, $23.7 million and $23.8 million, respectively, on research and development. The Company's research and development spending for 2018, 2017 and 2016 was approximately 1.3%, 1.4% and 1.5% of net sales, respectively.

The Company maintains its primary research facilities in Bethlehem and Easton, Pennsylvania; Houston, Texas; and Hoffman Estates, Illinois. It also has research and development facilities in China, England, Germany, Ireland, Japan and Turkey. Approximately 202 employees worldwide are engaged in research and development. In addition, the Company has access to some of the world's most advanced papermaking and paper coating pilot facilities.

Patents and Trademarks

The Company owns or has the right to use approximately 403 patents and approximately 1,710 trademarks related to its business. Our patents expire between 2019 and 2036. Our trademarks continue indefinitely. The Company believes that its rights under its existing patents, patent applications and trademarks are of value to its operations, but no one patent, application or trademark is material to the conduct of the Company's business as a whole.

Insurance

The Company maintains liability and property insurance and insurance for business interruption in the event of damage to its production facilities and certain other insurance covering risks associated with its business. The Company believes such insurance is adequate for the operation of its business. There is no assurance that in the future the Company will be able to maintain the coverage currently in place or that the premiums will not increase substantially.

Employees

At December 31, 2018, the Company employed 3,720 persons, of whom 1,995 were employed outside of the United States.

Environmental, Health and Safety Matters

The Company's operations are subject to federal, state, local and foreign laws and regulations relating to the environment and health and safety. In particular, we are subject to certain requirements under the Clean Air Act. In addition, certain of the Company's operations involve and have involved the use and release of substances that have been and are classified as toxic or hazardous within the meaning of these laws and regulations. Environmental operating permits are, or may be, required for certain of the Company's operations and such permits are subject to modification, renewal and revocation. We are also subject to land reclamation requirements. The Company regularly monitors and reviews its operations, procedures and policies for compliance with these laws and regulations. The Company believes its operations are in substantial compliance with these laws and regulations and that there are no violations that would have a material effect on the Company. Despite these compliance efforts, some risk of environmental and other damage is inherent in the Company's operations, as it is with other companies engaged in similar businesses, and there can be no assurance that material violations will not occur in the future. The cost of compliance with these laws and regulations is not expected to have a material adverse effect on the Company.

Laws and regulations are subject to change. See Item 1A, Risk Factors, for information regarding the possible effects that compliance with new environmental laws and regulations, including those relating to climate change, may have on our businesses and operating results.

Under the terms of certain agreements entered into in connection with the Company's initial public offering in 1992, Pfizer Inc. ("Pfizer") agreed to indemnify the Company against certain liabilities being retained by Pfizer and its subsidiaries including, but not limited to, pending lawsuits and claims, and any lawsuits or claims brought at any time in the future alleging damages or injury from the use, handling of or exposure to any product sold by Pfizer's specialty minerals business prior to the closing of the initial public offering.

Available Information

The Company maintains an internet website located at http://www.mineralstech.com. Its reports on Forms 10-K, 10-Q and 8-K, and amendments to those reports, as well as its Proxy Statement and filings under Section 16 of the Securities Exchange Act of 1934 are available free of charge through the Investor Relations page of its website, as soon as reasonably practicable after they are filed with the Securities and Exchange Commission ("SEC"). Investors may access these reports through the Company's website by navigating to "Investor Relations" and then to "SEC Filings."

Item 1A. Risk Factors

Our business faces significant risks. Set forth below are all risks that we believe are material at this time. Our business, financial condition and results of operations could be materially adversely affected by any of these risks. These risks should be read in conjunction with the other information in this Annual Report on Form 10-K.

Worldwide general economic, business, and industry conditions have had, and may continue to have, an adverse effect on the Company’s results.

The global economic instability experienced in recent years had caused, among other things, declining consumer and business confidence, volatile raw material prices, instability in credit markets, high unemployment, fluctuating interest and exchange rates, and other challenges in the countries in which we operate. The Company’s business and operating results had been and could once again be adversely affected by these global economic conditions. The Company’s customers and potential customers may experience deterioration of their businesses, cash flow shortages, and difficulty obtaining financing. As discussed below, the industries we serve have in the past been adversely affected by the uncertain global economic climate due to the cyclical nature of their businesses. As a result, existing or potential customers may reduce or delay their growth and investments and their plans to purchase products and may not be able to fulfill their obligations in a timely fashion. Further, suppliers could experience similar conditions, which could affect their ability to fulfill their obligations to the Company. Adversity within capital markets may also impact the Company’s results of operations by negatively affecting the amount of expense the Company records for its pension and other postretirement benefit plans. Actuarial valuations used to calculate income or expense for the plans reflect assumptions about financial market and other economic conditions – the most significant of which are the discount rate and the expected long-term rate of return on plan assets. Such actuarial valuations may change based on changes in key economic indicators. Global economic markets remain uncertain, and there can be no assurance that market conditions will improve in the near future. Future weakness in the global economy could materially and adversely affect our business and operating results.

Our customers’ businesses are cyclical or have changing regional demands. Our operations are subject to these trends and we may not be able to mitigate these risks.

Our Performance Materials segment’s sales are predominantly derived from the metalcasting market. The metalcasting market is dependent upon the demand for castings for automobile components, farm and construction equipment, oil and gas production equipment, power generation turbine castings, and rail car components. Many of these types of equipment are sensitive to fluctuations in demand during periods of recession or difficult economic conditions, which ultimately may affect the demand for our Performance Materials segment’s products and services.

In the paper industry, which is served by our Paper PCC product line, production levels for uncoated freesheet within North America and Europe, our two largest markets are projected to continue to decrease. The reduced demand for premium writing paper products has also caused recent paper mill closures.

Our Refractories segment primarily serves the steel industry. European steel production continues to be affected by global volatility and overcapacity in the market. North American steel tariffs have stabilized current production in the United States, however, the tariffs are subject to change.

Demand for our Energy Services segment's products and services is affected by the level of exploration, development, and production activity of, and the corresponding capital spending by, oil and natural gas companies, which are heavily influenced by the benchmark price of these commodities. Oil and natural gas prices decreased significantly in 2014 and 2015, with West Texas Intermediate (WTI) oil spot prices declining from a high of $108 per barrel in June 2014 to a low of $26 per barrel in February 2016. This has caused oil and natural gas companies to reduce their capital expenditures and production and exploration activities. This has the effect of decreasing the demand and increasing competition for the services we provide. In addition, the performance of our Energy Services segment is affected by changes in technologies, locations of customers' targeted reserves, and competition in various geographic markets.

Our Environmental Products and Building Materials products sales are predominantly derived from the commercial construction and infrastructure markets. In addition, our Processed Minerals and Specialty PCC product lines are affected by the domestic building and construction markets, as well as the automotive market.

Demand for our products is subject to trends in these markets. During periods of economic slowdown, our customers often reduce their capital expenditures and defer or cancel pending projects. Such developments occur even amongst customers that are not experiencing financial difficulties. In addition, these trends could cause our customers to face liquidity issues or bankruptcy, which could deteriorate the aging of our accounts receivable, increase our bad debt exposure and possibly trigger impairment of assets or realignment of our businesses. The Company has taken steps to reduce its exposure to variations in its customers' businesses, including by diversifying its portfolio of products and services; through geographic expansion, and by structuring most of its long-term satellite PCC contracts to provide a degree of protection against declines in the quantity of product purchased, since the price per ton of PCC generally rises as the number of tons purchased declines. In addition, many of the Company's product lines lower its customers' costs of production or increase their productivity, which should encourage them to use its products. However, there can be no assurance that these efforts will mitigate the risks of our dependence on these industries. Continued weakness in the industries we serve has had, and may in the future have, an adverse effect on sales of our products and our results of operations. A continued or renewed economic downturn in one or more of the industries or geographic regions that the Company serves, or in the worldwide economy, could cause actual results of operations to differ materially from historical and expected results.

The Company’s results could be adversely affected if it is unable to effectively achieve and implement its growth initiatives.

Sales and income growth of the Company depends upon a number of uncertain events, including the outcome of the Company's strategies of increasing its penetration into geographic markets such as Brazil, Russia, India and China as well as other Asian and Eastern European countries; increasing its penetration into product markets such as the market for papercoating pigments and the market for groundwood paper pigments; increasing sales to existing PCC customers by increasing the amount of PCC used per ton of paper produced; developing, introducing and selling new products such as the FulFill® family of products for the paper industry. Difficulties, delays or failure of any of these strategies could affect the future growth rate of the Company. Our strategy also anticipates growth through future acquisitions. However, our ability to identify and consummate any future acquisitions on terms that are favorable to us may be limited by the number of attractive acquisition targets, internal demands on our resources and our ability to obtain financing. Our success in integrating newly acquired businesses will depend upon our ability to retain key personnel, avoid diversion of management’s attention from operational matters, and integrate general and administrative services. In addition, future acquisitions could result in the incurrence of additional debt, costs and contingent liabilities. Integration of acquired operations may take longer, or be more costly or disruptive to our business, than originally anticipated, and it is also possible that expected synergies from future acquisitions may not materialize. We also may incur costs and divert management attention with regard to potential acquisitions that are never consummated.

Servicing the Company’s debt will require a significant amount of cash. This could reduce the Company’s flexibility to respond to changing business and economic conditions or fund capital expenditures or working capital needs. Our ability to generate cash depends on many factors beyond our control.

At December 31, 2018, the Company had outstanding borrowings of $1.0 billion pursuant to our senior secured credit facility. This financing will require a significant amount of cash to make interest payments. Further, the interest rate on a significant portion of our borrowings under our senior secured credit facility is based on LIBOR interest rates, which could result in higher interest expense in the event of an increase in interest rates. Our ability to pay interest on our debt and to satisfy our other debt obligations will depend in part upon our future financial and operating performance and upon our ability to renew or refinance borrowings. Prevailing economic conditions and financial, business, competitive, regulatory and other factors, many of which are beyond our control, will affect our ability to make these payments. We cannot guarantee that our business will generate sufficient cash flow from operations or that future borrowings will be available to us in an amount sufficient to enable us to fund our liquidity needs. If we are unable to generate sufficient cash flow to meet our debt service obligations, we will have to pursue one or more alternatives, such as reducing or delaying capital or other expenditures, refinancing debt, selling assets, or raising equity capital. Further, the requirement to make significant interest payments may reduce the Company's flexibility to respond to changing business and economic conditions or fund capital expenditure or working capital needs and may increase the Company's vulnerability to adverse economic conditions.

Our senior secured credit facility contains various covenants that limit our ability to take certain actions and our revolving credit facility, if used, also requires us to meet financial maintenance tests, failure to comply with which could have a material adverse effect on us.

The agreement governing our senior secured credit facility contains a number of significant covenants that, among other things, limit our ability to: incur additional debt or liens, consolidate or merge with any other person, alter the business we conduct, make investments, use the proceeds of asset sales or sale/leaseback transactions, enter into hedging arrangements, pay dividends or make certain other restricted payments, create dividend or other payment restrictions with respect to subsidiaries, and enter into transactions with affiliates. In addition, our revolving credit facility, if used, requires us to comply with specific financial ratios, including a maximum net leverage ratio, under which we are required to achieve specific financial results. Commencing with the second quarter of 2018, we had borrowings under our revolving credit facility, and are therefore required to comply with such financial ratios. Our ability to comply with these provisions may be affected by events beyond our control. A breach of any of these covenants would result in a default under the agreements. In the event of any default, our lenders could elect to declare all amounts borrowed under the agreements, together with accrued interest thereon, to be due and payable. In such an event, we cannot assure you that we would have sufficient assets to pay debt then outstanding under the agreements governing our debt. Any future refinancing of the senior secured credit facility is likely to contain similar restrictive covenants.

The Company’s sales of PCC could be adversely affected by our failure to renew or extend long term sales contracts for our satellite operations.

The Company's sales of PCC to paper customers are typically pursuant to long-term evergreen agreements, initially ten years in length, with paper mills where the Company operates satellite PCC plants. Sales pursuant to these contracts represent a significant portion of our worldwide Paper PCC sales, which were $378.5 million in 2018, or approximately 21% of the Company’s net sales. The terms of many of these agreements have been extended or renewed in the past, often in connection with an expansion of the satellite plant. However, failure of a number of the Company's customers to renew or extend existing agreements on terms as favorable to the Company as those currently in effect, or at all, could have a substantial adverse effect on the Company's results of operations, and could also result in impairment of the assets associated with the PCC plant.

The Company’s sales could be adversely affected by consolidation in customer industries, principally paper, foundry and steel.

Several consolidations in the paper industry have taken place in recent years and such consolidation could continue in the future. These consolidations could result in partial or total closure of some paper mills where the Company operates PCC satellites. Such closures would reduce the Company's sales of PCC, except to the extent that they resulted in shifting paper production and associated purchases of PCC to another location served by the Company. Similarly, consolidations have occurred in the foundry and steel industries. Such consolidations in the major industries we serve concentrate purchasing power in the hands of a smaller number of manufacturers, enabling them to increase pressure on suppliers, such as the Company. This increased pressure could have an adverse effect on the Company's results of operations in the future.

The Company is subject to stringent regulation in the areas of environmental, health and safety, and tax, and may incur unanticipated costs or liabilities arising out of claims for various legal, environmental and tax matters or product stewardship issues.

The Company’s operations are subject to international, federal, state and local governmental environmental, health and safety, tax and other laws and regulations. We have expended, and may be required to expend in the future, substantial funds for compliance with such laws and regulations. In addition, future events, such as changes to or modifications of interpretations of existing laws and regulations, or enforcement polices, or further investigation or evaluation of the potential environmental impacts of operations or health hazards of certain products, may affect our mining rights or give rise to additional compliance and other costs that could have a material adverse effect on the Company. Further, certain of our customers are subject to various federal and international laws and regulations relating to environmental and health and safety matters, especially our Energy Services customers who are subject to drilling permits, waste water disposal and other regulations. To the extent that these laws and regulations affecting our customers change, demand for our products and services could also change and thereby affect our financial results. State, national, and international governments and agencies have been evaluating climate-related legislation and regulation that would restrict emissions of greenhouse gases in areas in which we conduct business, and some such legislation and regulation have already been enacted or adopted. Enactment of climate-related legislation or adoption of regulation that restrict emissions of greenhouse gases in areas in which we conduct business could have an adverse effect on our operations or demand for our products. Our manufacturing processes, particularly the manufacturing process for PCC, use a significant amount of energy and, should energy prices increase as a result of such legislation or regulation, we may not be able to pass these increased costs on to purchasers of our products. We cannot predict if or when currently proposed or additional laws and regulations regarding climate change or other environmental or health and safety concerns will be enacted or adopted.

The Company is also subject to income tax laws and regulations in the United States and various foreign jurisdictions. Significant judgment is required in evaluating and estimating our provision and accruals for these taxes. Our income tax liabilities are dependent upon the location of earnings among these different jurisdictions. Our income tax provision and income tax liabilities could be adversely affected by the jurisdictional mix of earnings, changes in valuation of deferred tax assets and liabilities and changes in tax treaties, laws and regulations, including the U.S. Tax Cuts and Jobs Act of 2017, which effected significant changes to the U.S. corporate income tax system.

The Company is currently a party in various litigation matters and tax and environmental proceedings and faces risks arising from various unasserted litigation matters, including, but not limited to, product liability, patent infringement, antitrust claims, and claims for third party property damage or personal injury stemming from alleged environmental torts. Failure to appropriately manage safety, human health, product liability and environmental risks associated with the Company's products and production processes could adversely impact the Company's employees and other stakeholders, the Company's reputation and its results of operations. Public perception of the risks associated with the Company's products and production processes could impact product acceptance and influence the regulatory environment in which the Company operates. While the Company has procedures and controls to manage these risks, carries liability insurance, which it believes to be appropriate to its businesses, and has provided reserves for current matters, which it believes to be adequate, an unanticipated liability, arising out of a current matter or proceeding or from the other risks described above, could have a material adverse effect on the Company's financial condition or results of operations.

Delays or failures in new product development could adversely affect the Company's operations.

The Company's future business success will depend in part upon its ability to maintain and enhance its technological capabilities, to respond to changing customer needs, and to successfully anticipate or respond to technological changes on a cost-effective and timely basis. The Company is engaged in a continuous effort to develop new products and processes in all of its product lines. Difficulties, delays or failures in the development, testing, production, marketing or sale of such new products could cause actual results of operations to differ materially from our expected results.

The Company's ability to compete is dependent upon its ability to defend its intellectual property against inappropriate disclosure and infringement.

The Company's ability to compete is based in part upon proprietary knowledge, both patented and unpatented. The Company's ability to achieve anticipated results depends in part on its ability to defend its intellectual property against inappropriate disclosure as well as against infringement. In addition, development by the Company's competitors of new products or technologies that are more effective or less expensive than those the Company offers could have a material adverse effect on the Company's financial condition or results of operations.

The Company's operations could be impacted by the increased risks of doing business abroad.

The Company does business in many areas internationally. Approximately 47% of our sales in 2018 were derived from outside the United States and we have significant production facilities which are located outside of the United States. We have in recent years expanded our operations in emerging markets, and we plan to continue to do so in the future, particularly in China, India, Brazil, the Middle East, and Eastern Europe. Some of our operations are located in areas that have experienced political or economic instability, including Indonesia, Malaysia, Nigeria, Egypt, Russia, Saudi Arabia, Turkey, Brazil, Thailand, China and South Africa. The UK's decision to exit the European Union (referred to as Brexit) has caused additional volatility in the markets and currency exchange rates. Market conditions and exchange rates could continue to be volatile in the near term as this decision is implemented. As the Company expands its operations overseas, it faces increased risks of doing business abroad, including inflation, fluctuation in interest rates, changes in applicable laws and regulatory requirements, export and import restrictions, tariffs, nationalization, expropriation, limits on repatriation of funds, civil unrest, terrorism, unstable governments and legal systems, and other factors. Many of these risks are beyond our control and can lead to sudden, and potentially prolonged, changes in demand for our products, difficulty in enforcing agreements, and losses in the realizability of our assets. Adverse developments in any of the areas in which we do business could cause actual results to differ materially from historical and expected results. In addition, a significant portion of our raw material purchases and sales outside the United States are denominated in foreign currencies, and liabilities for non-U.S. operating expenses and income taxes are denominated in local currencies. Accordingly, reported sales, net earnings, cash flows and fair values have been and, in the future, will be affected by changes in foreign currency exchange rates. Our overall success as a global business depends, in part, upon our ability to succeed in differing legal, regulatory, economic, social and political conditions. We cannot assure you that we will implement policies and strategies that will be effective in each location where we do business.

The Company's operations are dependent on the availability of raw materials and access to ore reserves at its mining operations. Increases in costs of raw materials, energy, or shipping could adversely affect our financial results.

The Company depends in part on having an adequate supply of raw materials for its manufacturing operations, particularly lime and carbon dioxide for the PCC product line, and magnesia and alumina for its Refractory operations. Purchase prices and availability of these critical raw materials are subject to volatility. At any given time, we may be unable to obtain an adequate supply of these critical raw materials on a timely basis, on price and other terms, or at all. While most such raw materials are readily available, the Company has purchased approximately 42% of its magnesia requirements from sources in China over the past five years. The price and availability of magnesia have fluctuated in the past and they may fluctuate in the future. Price increases for certain other of our raw materials, including petrochemical products, as well as increases in energy prices, have also affected our business. Our production processes consume a significant amount of energy, primarily electricity, diesel fuel, natural gas and coal. We use diesel fuel to operate our mining and processing equipment and our freight costs are heavily dependent upon fuel prices and surcharges. Energy costs also affect the cost of raw materials. On a combined basis, these factors represent a large exposure to petrochemical and energy products which may be subject to significant price fluctuations. The contracts pursuant to which we construct and operate our satellite PCC plants generally adjust pricing to reflect the pass-through of increases in costs resulting from inflation, including energy. However, there is a time lag before such price adjustments can be implemented. The Company and its customers will typically negotiate reasonable price adjustments in order to recover these escalating costs, but there can be no assurance that we will be able to recover increasing costs through such negotiations.

The Company also depends on having adequate access to ore reserves of appropriate quality at its mining operations. There are numerous uncertainties inherent in estimating ore reserves including subjective judgments and determinations that are based on available geological, technical, contract and economic information.

The Company relies on shipping bulk cargos of bentonite from the United States, Turkey and China to customers, as well as our own subsidiaries, and we are sensitive to our ability to recover these shipping costs. In the last few years, bulk cargo shipping rates have been very volatile, and, to a lesser extent, the availability of bulk cargo containers have been suspect. If we cannot secure our container requirements or offset additional shipping costs with price increases to customers, our profitability could be impacted. We are also subject to other shipping risks. In particular, rail service interruptions have affected our ability to ship, and the availability of rail service, and our ability to recover increased rail costs, may be beyond our control.

The Company operates in very competitive industries, which could adversely affect our profitability.

The Company has many competitors. Some of our principal competitors have greater financial and other resources than we have. Accordingly, these competitors may be better able to withstand economic downturns and changes in conditions within the industries in which we operate and may have significantly greater operating and financial flexibility than we do. We also face competition for some of our products from alternative products, and some of the competition we face comes from competitors in lower-cost production countries like China and India. As a result of the competitive environment in the markets in which we operate, we currently face and will continue to face pressure on the sales prices of our products from competitors, which could reduce profit margins.

Production facilities are subject to operating risks and capacity limitations that may adversely affect the Company's financial condition or results of operations.

The Company is dependent on the continued operation of its production facilities. Production facilities are subject to hazards associated with the manufacturing, handling, storage, and transportation of chemical materials and products, including pipeline leaks and ruptures, explosions, fires, inclement weather and natural disasters, mechanical failure, unscheduled downtime, labor difficulties, transportation interruptions, and environmental risks. We maintain property, business interruption and casualty insurance but such insurance may not cover all risks associated with the hazards of our business and is subject to limitations, including deductibles and maximum liabilities covered. We may incur losses beyond the limits, or outside the coverage, of our insurance policies. Further, from time to time, we may experience capacity limitations in our manufacturing operations. In addition, if we are unable to effectively forecast our customers' demand, it could affect our ability to successfully manage operating capacity limitations. These hazards, limitations, disruptions in supply and capacity constraints could adversely affect financial results.

Operating results for some of our segments are seasonal.

Our Energy Services Segment and certain product lines within our Performance Materials segment are affected by seasonal weather patterns. A majority of our Energy Services revenues are derived from the Gulf of Mexico and surrounding states, which are susceptible to hurricanes that typically occur June 1st through November 30th. Actual or threatened hurricanes can result in volatile demand for sevices provided by our Energy Services segment. Our Environmental Products and Building Materials product lines within our Performance Materials segment are affected by weather patterns which determine the feasibility of construction activities. Typically, less construction activity occurs in winter months and thus this segment's revenues tend to be greatest in the second and third quarters when weather patterns in our geographic markets are more conducive to construction activities. Our Processed Minerals product line is subject to similar seasonal patterns.

Our operations are subject to cyber-attacks that could have a material adverse impact on our business, consolidated results of operations, and consolidated financial condition.

Our operations are becoming increasingly dependent on digital technologies and services. We use these technologies for internal purposes, including data storage, processing, and transmissions, as well as in our interactions with customers and suppliers. Digital technologies are subject to the risk of cyber-attacks. If our systems for protecting against cybersecurity risks prove not to be sufficient, we could be adversely affected by, among other things: loss of or damage to intellectual property, proprietary or confidential information, or customer, supplier, or employee data; interruption of our business operations; and increased costs required to prevent, respond to, or mitigate cybersecurity attacks. These risks could harm our reputation and our relationships with customers, suppliers, employees, and other third parties, and may result in claims against us. In addition, these risks could have a material adverse effect on our business, consolidated results of operations, and consolidated financial condition.

Item 1B. Unresolved Staff Comments

None.

Item 2. Properties

The Company's corporate headquarters, sales offices, research laboratories, plants, mines and other facilities are owned by the Company except as otherwise noted. Set forth below is certain information relating to the Company's principal plants and office and research facilities.

Location	Facility	Product Line	Segment
United States			
Alabama, Sandy Ridge	Plant; Mine	Metalcasting, basic minerals and specialty products	Performance Materials
Arizona, Pima County	Plant; Mine (1)	Limestone	Specialty Minerals
California, Lucerne Valley	Plant; Mine	Limestone	Specialty Minerals
Connecticut, Canaan	Plant; Mine	Limestone, Metallurgical Wire/Calcium	Specialty Minerals; Refractories
Georgia, Cartersville	Plant	Environmental products and other building materials products	Performance Materials
Illinois, Belvidere	Plant	Metalcasting products	Performance Materials
Illinois, Hoffman Estates	Research laboratories; Administrative office (2)	All Company Products	All Segments
Indiana, Portage	Plant	Refractories/Shapes	Refractories
Indiana, Troy	Plant	Metalcasting products	Performance Materials
Iowa, Shell Rock	Plant	Metalcasting products	Performance Materials
Louisiana, Baton Rouge	Plant	Monolithic Refractories	Refractories
Louisiana, Lafayette	Plant	Personal Care Products	Performance Materials
Louisiana, New Iberia	Operations base (2)	Filtration and Well testing services	Energy Services
Massachusetts, Adams	Plant; Mine	Limestone, Lime, PCC	Specialty Minerals
Michigan, Albion	Plant	Metalcasting products	Performance Materials
Mississippi, Aberdeen	Plant	Performance additive products	Performance Materials
Montana, Dillon	Plant; Mine	Talc	Specialty Minerals
Nebraska, Scottsbluff	Transportation terminal		Performance Materials
New York, New York	Headquarters (2)	All Company Products	Headquarters
North Dakota, Gascoyne	Plant; Mine	Metalcasting, basic minerals and specialty products	Performance Materials
Ohio, Archbold	Plant	Metalcasting products	Performance Materials
Ohio, Bryan	Plant	Monolithic Refractories	Refractories
Ohio, Dover	Plant	Monolithic Refractories/Shapes	Refractories
		All Company Products	All Segments

Pennsylvania, Bethlehem	Administrative Office; Research laboratories; Sales Offices		
Pennsylvania, Easton	Administrative Office; Research laboratories; Plant; Sales Offices	All Company Products	All Segments
Pennsylvania, Slippery Rock	Plant; Sales Offices	Monolithic Refractories/Shapes	Refractories
Pennsylvania, York	Plant	Metalcasting and pet care products	Performance Materials
Tennessee, Chattanooga	Plant	Metalcasting products	Performance Materials
Texas, Bay City	Plant	Talc	Specialty Minerals
Texas, Houston	Research laboratories (2)	Filtration and well testing services	Energy Services
Texas, Houston	Administrative Office (2)	Filtration and well testing services	Energy Services
Wisconsin, Neenah	Plant	Metalcasting products	Performance Materials
Wyoming, Colony	Plant; Mine	Metalcasting, pet litter, personal care, specialty and basic minerals products	Performance Materials
Wyoming, Lovell	Plant; Mine	Basic minerals, Specialty and pet care products; Environmental and building materials products	Performance Materials

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Location	Facility	Product Line	Segment
International			
Australia, Brisbane	Sales Office/Administrative Office	Metalcasting, specialty and pet care products	Performance Materials
Australia, Carlingford	Sales Office (2)	Monolithic Refractories	Refractories
Australia, Gurulmundi	Plant; Mine	Metalcasting, specialty and pet care products	Performance Materials
Australia, Perth	Operations base (2)	Filtration services	Energy Services
Austria, Rottersdorf	Plant	Pet care products	Performance Materials
Belgium, Brussels	Administrative Office	Monolithic Refractories	Refractories
Brazil, Macae	Operations base (2)	Filtration services	Energy Services
Brazil, Sao Jose dos Campos	Sales Office (2)/Administrative Office	PCC	Specialty Minerals
Canada, Pt. Claire	Administrative Office	PCC/Monolithic Refractories	Specialty Minerals; Refractories
China, Beijing	Sales Office/Administrative Office	Metalcasting, specialty, fabric care and pet care products	Performance Materials
China, Chao Yang, Liaoning	Plant; Mine	Metalcasting and fabric care products	Performance Materials
China, Shanghai	Administrative Office/Sales Office	PCC/Monolithic Refractories	Specialty Minerals; Refractories
China, Suzhou	Plant	Environmental and building materials products	Performance Materials
China, Suzhou	Plant/Sales Office/Research laboratories	PCC/Monolithic Refractories	Specialty Minerals; Refractories
China, Tianjin	Plant; Mine; Research laboratories	Metalcasting and fabric care products	Performance Materials
Germany, Duisburg	Plant/Sales Office/Research laboratories	Laser Scanning Instrumentation/ Probes/Monolithic Refractories	Refractories
India, Chennai	Plant	Metalcasting products	Performance Materials
India, Mumbai	Sales Office (2)/Administrative Office	PCC/Monolithic Refractories/ Metallurgical Wire	Specialty Minerals; Refractories
Indonesia, Jakarta	Operations base (2)	Filtration services	Energy Services
Ireland, Cork	Plant; Administrative Office (2)/ Research laboratories	Monolithic Refractories	Refractories
Italy, Brescia	Sales Office	Monolithic Refractories/Shapes	Refractories
Italy, Nave	Plant	Monolithic Refractories/Shapes	Refractories
Japan, Gamagori	Plant/Research laboratories	Monolithic Refractories/Shapes, Calcium	Refractories
Japan, Tokyo	Sales/Administrative Office	Monolithic Refractories	Refractories
Korea, Pyeongtaek	Plant	Environmental, building materials and other products	Performance Materials
Malaysia, Kemaman	Operations base (2)	Filtration and well testing services	Energy Services
Mexico, Villahermosa	Operations base (2)	Filtration services	Energy Services
Netherlands, Hengelo	Plant/Administrative Office	Metallurgical Wire	Refractories
Netherlands, Moerdjik	Plant/Administrative Office	Pet care products	Performance Materials
Nigeria, Port Harcourt	Operations base (2)	Well Testing services	Energy Services
Poland, Szczytno	Plant	Environmental products	

			Performance Materials
Scotland, Aberdeen	Operations base (2)	Filtration services	Energy Services
South Africa, Johannesburg	Sales Office/Administrative Office (2)	Monolithic Refractories	Refractories
South Africa, Pietermaritzburg	Plant	Monolithic Refractories	Refractories
South Korea, Yangbuk-Myeun, Kyeung-buk	Plant; Mine	Metalcasting products	Performance Materials
Spain, Santander	Administrative Office	Monolithic Refractories	Refractories

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Location	Facility	Product Line	Segment
Thailand, Laemchabang	Plant	Metalcasting and fabric care products	Performance Materials
Turkey, Enez	Plant; Mine	Metalcasting, specialty and basic minerals products	Performance Materials
Turkey, Gebze	Plant/Research Laboratories	Monolithic Refractories/Shapes/ Application Equipment	Refractories
Turkey, Istanbul	Sales Office/Administrative Office	Monolithic Refractories	Refractories
Turkey, Kutahya	Plant	Monolithic Refractories/Shapes	Refractories
Turkey, Ordu	Plant; Mine	Pet care Products	Performance Materials
Turkey, Usak	Plant; Mine	Specialty material products	Performance Materials
United Kingdom, Birkenhead	Research laboratories (2)	Environmental products	Performance Materials
United Kingdom, Lifford	Plant	PCC, Lime	Specialty Minerals
United Kingdom, Rotherham	Plant/Sales Office	Monolithic Refractories/Shapes	Refractories
United Kingdom, Winsford	Plant, Research laboratories	Fabric care and other products	Performance Materials

(1) This plant and quarry is leased to another company.

(2) Leased by the Company. The facilities in Cork, Ireland, are operated pursuant to a 99-year lease, the term of which commenced in 1963. The Company's headquarters in New York, New York, are held under a lease which expires in 2021.

Set forth below is the location of, and the main customer served by, each of the Company's satellite PCC plants in operation or, under construction, within the Specialty Minerals segment, as of December 31, 2018. Generally, the land on which each satellite PCC plant is located is leased at a nominal amount by the Company from the host paper mill pursuant to a lease, the term of which generally runs concurrently with the term of the PCC production and sale agreement between the Company and the host paper mill.

Location	Principal Customer
United States	
Alabama, Jackson	Boise Inc.
Alabama, Selma	International Paper Company
Arkansas, Ashdown	Domtar Inc.
Maine, Jay	Verso Paper Holdings LLC
Michigan, Quinnesec	Verso Paper Holdings LLC
Minnesota, Cloquet	Sappi Ltd.
Minnesota, International Falls	Boise Inc.
New York, Ticonderoga	International Paper Company
Ohio, Chillicothe	P.H. Glatfelter Co.
South Carolina, Eastover	International Paper Company
Washington, Longview	North Pacific Paper Corporation
Wisconsin, Kimberly	Appleton Coated
Wisconsin, Park Falls	Flambeau River Papers LLC
Wisconsin, Superior	New Page Corporation

Wisconsin, Wisconsin Rapids New Page Corporation

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Location	Principal Customer
International	
Brazil, Guaiba	CMPC - Celulose Rio Grandense
Brazil, Jacarei	Munksjo Brasil Ind e Com de Papeis Especiais Ltda.
Brazil, Luiz Antonio	International Paper do Brasil Ltda.
Brazil, Mucuri	Suzano Papel e Celulose S. A.
Brazil, Suzano	Suzano Papel e Celulose S. A.
Canada, St. Jerome, Quebec	Les Entreprises Rolland Inc
Canada, Windsor, Quebec	Domtar Inc.
China, Changshu	UPM Changshu
China, Dagang (1)	Gold East Paper (Jiangsu) Company Ltd.
China, Zhenjiang (1)	Gold East Paper (Jiangsu) Company Ltd.
China, Suzhou (1)	Gold HuaSheng Paper Company Ltd.
China, Henan	Henan Jianghe Paper Co., Ltd.
China, Shandong	Shandong Sun Paper Industry Joint Stock Company Ltd
China, Shouguang (2)	Shandong Meilun Paper Corporation
Finland, Äänekoski	M-real Corporation
Finland, Tervakoski	Trierenberg Holding
France, Alizay	Double A Paper Company Ltd.
France, Quimperle	PDM Industries
France, Saillat Sur Vienne	International Paper Company
Germany, Schongau	UPM Corporation
India, Ballarshah (1)	Ballarpur Industries Ltd.
India, Dandeli	West Coast Paper Mill Ltd.
India, Gaganapur (1)	Ballarpur Industries Ltd.
India, Kala Amb (2)	Ruchira Papers Limited
India, Saila Khurd	Kuantum Papers Ltd.
India, Rayagada (1)	JK Paper
Indonesia, Perawang (1)	PT Indah Kiat Pulp and Paper Corporation
Indonesia, Perawang 2 (2)	PT Indah Kiat Pulp and Paper Corporation
Indonesia, Pindo Deli (2)	PT Pindo Deli Pulp and Paper Mills
Japan, Shiraoi (1)	Nippon Paper Group Inc.
Malaysia, Sipitang	Ballarpur Industries Ltd.
Poland, Kwidzyn	International Paper – Kwidzyn, S.A
Portugal, Figueira da Foz (1)	Navigator Paper Figueira, S.A.
Slovakia, Ruzomberok	Mondi Business Paper SCP
South Africa, Merebank (1)	Mondi Paper Company Ltd.
Thailand, Namphong	Phoenix Pulp & Paper Public Co. Ltd.
Thailand, Tha Toom (1)	Double A Paper Company Ltd.
Thailand, Tha Toom 2 (1)	Double A Paper Company Ltd.

(1) These plants are owned through joint ventures.
(2) These plants are under construction.

The following table sets forth, for each of the quarries or mines we own or operate, our current estimate as to the amount of proven and probable reserves such quarry or mine holds, based on the most recent mine plan, its usage rate in 2018, and a conversion factor for the conversion of in-situ materials to saleable products, by major mineral category.

	2018 Tons Usage (000s)	Total Tons of Reserves (000s)	Assigned Reserves (000s)	Unassigned Reserves** (000s)	Conversion Factor	Mining Claims Owned	Unpatented *	Leased
Limestone								
Adams, MA	714	23,028	23,028	—	80%	23,028	—	—
Canaan, CT	578	17,734	17,734	—	90%	17,734	—	—
Lucerne Valley, CA	997	40,762	40,762		95%	40,762	—	—
Pima County, AZ	170	7,869	7,869	—	90%	7,869	—	—
Total Limestone	2,459	89,393	89,393	—		89,393	—	—
			100%	0%		100%	0%	0%
Talc								
Dillon, MT	189	2,728	2,728	—	85%	2,728	—	—
			100%	0%		100%	0%	0%
Sodium Bentonite								
Australia	67	1,007	1,007	—	80%			1,007
Belle/Colony, WY/SD	1,263	64,560	64,560	—	77%	3,595	12,214	48,751
Lovell, WY	751	36,462	36,462	—	86%	16,753	14,971	4,738
Other SD, WY, MT		72,831	—	72,831	79%	54,815	15,048	2,968
Total Sodium Bentonite	2,081	174,860	102,029	72,831		75,163	42,233	57,464
			58%	42%		43%	24%	33%
Calcium Bentonite								
Chao Yang, Liaoning, China	89	1,650	1,650	—	78%			1,650
Nevada	1	1,560	1,560	—	76%	1,016	44	500
Sandy Ridge, AL	93	6,525	6,525	—	75%	1,966		4,559
Turkey, Enez//Usak	236	3,608	3,608	—	77%			3,608
Turkey, Unye	187	4,750	4,750	—	80%			4,750
Total Calcium Bentonite	606	18,093	18,093	—		2,982	44	15,067
			100%	0%		16%	0%	83%
Leonardite								
Gascoyne, ND	89	2,652	2,652	—	72%	—	2,019	633
			100%	0%			76%	24%
Chromite								
South Africa	—	3,494	3,494	—	75%	—	—	3,494
			100%	0%		0%	0%	100%
Other								
Nevada**	—	2,997	0%	2,997	80%		2,997	—
			—	100%		0%	100%	0%
GRAND TOTALS	5,424	294,217	218,389	75,828		170,266	47,293	76,658
			74%	26%		58%	16%	26%

*Quantity of reserves that would be owned if patent was granted.
**Unassigned reserves are reserves which we expect will require additional expenditures for processing facilities.

Our estimates of total reserves in the table above require us to make certain key assumptions. These assumptions relate to consistency of deposits in relation to drilling samples obtained with respect to both quantity and quality of reserves contained therein; the ratio of overburden to mineral deposits; any environmental or social impact of mining the minerals; and profitability of extracting those minerals, including haul distance to processing plants, applicability of minerals to various end markets and selling prices within those markets, and our past experiences in the deposits, several of which we have been operating in for many decades.

The Company believes that its facilities, which are of varying ages and are of different construction types, have been satisfactorily maintained, are in good condition, are suitable for the Company's operations and generally provide sufficient capacity to meet the Company's production requirements. Based on past loss experience, the Company believes it is adequately insured with respect to these assets and for liabilities likely to arise from its operations.

Item 3. Legal Proceedings

The Company and its subsidiaries are the subject of various pending legal actions in the ordinary course of their businesses. Except as described below, none of such legal proceedings are material.

Silica and Asbestos Litigation

Certain of the Company's subsidiaries are among numerous defendants in a number of cases seeking damages for exposure to silica or to asbestos containing materials. The Company currently has three pending silica cases and thirty four pending asbestos cases. To date, 1,493 silica cases and 57 asbestos cases have been dismissed, not including any lawsuits against AMCOL International Corporation ("AMCOL") or American Colloid Company dismissed prior to our acquisition of AMCOL in 2014. Fourteen new asbestos cases were filed in 2018 and four additional cases were filed subsequent to the end of 2018. Four asbestos cases were dismissed during 2018 and no silica cases were dismissed during 2018. Most of these claims do not provide adequate information to assess their merits, the likelihood that the Company will be found liable, or the magnitude of such liability, if any. Additional claims of this nature may be made against the Company or its subsidiaries. At this time management anticipates that the amount of the Company's liability, if any, and the cost of defending such claims, will not have a material effect on its financial position or results of operations.

The Company has settled only one silica lawsuit, for a nominal amount, and no asbestos lawsuits to date (not including any that may have been settled by AMCOL prior to completion of the acquisition). We are unable to state an amount or range of amounts claimed in any of the lawsuits because state court pleading practices do not require identifying the amount of the claimed damage. The aggregate cost to the Company for the legal defense of these cases since inception continues to be insignificant. The majority of the costs of defense for these cases, excluding cases against AMCOL or American Colloid, are reimbursed by Pfizer Inc. pursuant to the terms of certain agreements entered into in connection with the Company's initial public offering in 1992. The Company is entitled to indemnification, pursuant to agreement, for sales prior to the initial public offering. Of the 34 pending asbestos cases, 25 of the non-AMCOL cases are subject to indemnification, in whole or in part, because the plaintiffs claim liability based on sales of products that occurred either entirely before the initial public offering, or both before and after the initial public offering. In five of the six remaining non-AMCOL cases, the plaintiffs have not alleged dates of exposure, and in the sixth remaining non-AMCOL case, exposure is alleged to have been after the Company's initial public offering in 1992. The remaining three cases involve AMCOL only, so no Pfizer indemnity is available. Our experience has been that the Company is not liable to plaintiffs in any of these lawsuits and the Company does not expect to pay any settlements or jury verdicts in these lawsuits.

Environmental Matters

On April 9, 2003, the Connecticut Department of Environmental Protection issued an administrative consent order relating to our Canaan, Connecticut, plant where both our Refractories segment and Specialty Minerals segment have operations. We agreed to the order, which includes provisions requiring investigation and remediation of contamination associated with historic use of polychlorinated biphenyls ("PCBs") and mercury at a portion of the site. We have completed the required investigations and submitted several reports characterizing the contamination and assessing site-specific risks. We are awaiting regulators' approval of the risk assessment report, which will form the basis for a proposal by the Company concerning eventual remediation.

We believe that the most likely form of overall site remediation will be to leave the existing contamination in place (with some limited soil removal), encapsulate it, and monitor the effectiveness of the encapsulation. We anticipate that a substantial portion of the remediation cost will be borne by the United States based on its involvement at the site from 1942 – 1964, as historic documentation indicates that PCBs and mercury were first used at the facility at a time of U.S. government ownership for production of materials needed by the military. Pursuant to a Consent Decree entered on October 24, 2014, the United States paid the Company \$2.3 million in the 4th quarter of 2014 to resolve the

Company’s claim for response costs for investigation and initial remediation activities at this facility through October 24, 2014. Contribution by the United States to any future costs of investigation or additional remediation has, by agreement, been left unresolved. Though the cost of the likely remediation remains uncertain pending completion of the phased remediation decision process, we have estimated that the Company’s share of the cost of the encapsulation and limited soil removal described above would approximate $0.4 million, which has been accrued as of December 31, 2018.

The Company is evaluating options for upgrading the wastewater treatment facilities at its Adams, Massachusetts plant. This work has been undertaken pursuant to an administrative Consent Order originally issued by the Massachusetts Department of Environmental Protection (“DEP”) on June 18, 2002. This order was amended on June 1, 2009 and on June 2, 2010. The amended Order includes the investigation by January 1, 2022 of options for ensuring that the facility's wastewater treatment ponds will not result in unpermitted discharge to groundwater. Additional requirements of the amendment include the submittal by July 1, 2022 of a plan for closure of a historic lime solids disposal area. Preliminary engineering reviews completed in 2005 indicate that the estimated cost of wastewater treatment upgrades to operate this facility beyond 2024 may be between $6 million and $8 million. The Company estimates that the remaining remediation costs would approximate $0.4 million, which has been accrued as of December 31, 2018.

Item 4. Mine Safety Disclosures

The 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 Item 104 of Regulation S-K is included in Exhibit 95 to this Annual Report on Form 10-K.

Executive Officers of the Company

Set forth below are the names and ages of all Executive Officers of the Registrant indicating all positions and offices with the Registrant held by each such person, and each such person's principal occupations or employment during the past five years.

Name	Age	Position
Douglas T. Dietrich	49	Chief Executive Officer
Brett Argirakis	54	Vice President and Managing Director, Minteq International Inc.
Michael A. Cipolla	61	Vice President, Corporate Controller and Chief Accounting Officer
Matthew E. Garth	44	Senior Vice President, Finance and Treasury, Chief Financial Officer
Jonathan J. Hastings	56	Group President, Performance Materials
Andrew M. Jones	60	Vice President and Managing Director, Energy Services
Douglas W. Mayger	61	Senior Vice President and Director – MTI Supply Chain
Thomas J. Meek	61	Senior Vice President, General Counsel, Human Resources, Secretary and Chief Compliance Officer
D.J. Monagle, III	56	Group President, Specialty Minerals and Refractories

Douglas T. Dietrich was elected Chief Executive Officer effective December 2016. He joined the Company in August 2007 as Vice President, Corporate Development and Treasury, and was appointed Senior Vice President, Finance and Treasury, Chief Financial Officer effective January 2011. Prior to joining the Company, Mr. Dietrich was Vice President, Alcoa Wheel Products since 2006 and President, Alcoa Latin America Extrusions and Global Rod and Bar Products since 2002.

Brett Argirakis was elected Vice President and Managing Director, Minteq International in January 2016. Mr. Argirakis joined the Company in 1987 and has held positions of increasing responsibility. Prior to his current position, he was Global Vice President & General Manager, Refractories effective August 2009. Prior to that, he served as Director, Marketing, Minteq Europe and as Director of Sales and Field Operations for Minteq U.S.

Michael A. Cipolla was elected Vice President, Corporate Controller and Chief Accounting Officer in July 2003. Prior to that, he served as Corporate Controller and Chief Accounting Officer of the Company since 1998. From 1992 to 1998 he served as Assistant Corporate Controller of the Company.

Matthew E. Garth was elected Senior Vice President, Finance and Treasury, Chief Financial Officer effective January 2017. Mr. Garth joined the Company from Arconic Inc. (formerly Alcoa Inc.), where most recently he had been Vice President, Financial Planning & Analysis and Investor Relations since 2015. Prior to his most recent position, he was Vice President, Finance & CFO Operations-Alcoa Global Packing from 2014 to 2015; Vice President, Finance- Alcoa Global Packing from 2011 to 2014; Vice President, Finance – Alcoa North American Rolled Products from 2010 to 2011; Director, Investor Relations Alcoa Inc. from 2009 to 2010; and Director, Corporate Treasury Alcoa Inc. from 2007 to 2009.

Jonathan J. Hastings was elected Group President, Performance Materials effective June 2018. He joined the Company in September 2011 as Vice President, Corporate Development, and was appointed Senior Vice President, Corporate Development effective April 2013. Prior to joining the Company, he was Senior Director of Strategy and New Business Development – Coatings, Global at The Dow Chemical Company. Prior to that he held positions of increasing responsibility at Rohm and Haas, including Vice President & General Manager – Packaging and Building Materials – Europe.

Andrew M. Jones was elected Vice President and Managing Director, Energy Services in October 2015. Prior to that, he was Vice President and Managing Director, Eastern Hemisphere, Energy Services since 2014 and Vice President of CETCO Oilfield Services West Africa since 2012. Prior to joining the Company, he was Managing Director of Africa Oilfield Services since 2009.

Douglas W. Mayger was elected Senior Vice President and Director – MTI Supply Chain in November 2015. Prior to that, he was Senior Vice President, Performance Minerals and Supply Chain effective June 2011. Prior to that, he was Vice President and Managing Director, Performance Minerals, effective October 2008. He joined the Company as plant manager in Lucerne Valley in 2002, and subsequently was Business Manager – Western Region and General Manager – Carbonates West, Performance Minerals. Before joining the Company, he served as Vice President of Operations for Aggregate Industries.

Thomas J. Meek was elected Senior Vice President, General Counsel and Secretary, Chief Compliance Officer in October 2012. Mr. Meek joined the Company as Vice President, General Counsel and Secretary effective September 1, 2009. In December 2011, he was given the additional responsibility for Human Resources. Prior to joining the Company, he served as Deputy General Counsel at Alcoa Inc. Before joining Alcoa Inc. in 1999, Mr. Meek worked with Koch Industries, Inc. of Wichita, Kansas, where he held numerous supervisory positions. His last position there was Interim General Counsel. From 1985 to 1990, Mr. Meek was an Associate/Partner in the Wichita, Kansas law firm of McDonald, Tinker, Skaer, Quinn & Herrington, P.A.

D.J. Monagle III was named Group President, Specialty Minerals and Refractories in March 2017. Prior to that, he was Senior Vice President, Chief Operating Officer – Specialty Minerals Inc. and Minteq Group, effective February 2014. Prior to that, he was Senior Vice President and Managing Director, Paper PCC, effective October 2008. In November 2007, he was appointed Vice President and Managing Director – Performance Minerals. He joined the Company in January of 2003 and held positions of increasing responsibility including Vice President, Americas, Paper PCC and Global Marketing Director, Paper PCC. Before joining the Company, Mr. Monagle worked for the Paper Technology Group at Hercules between 1990 and 2003, where he held sales and marketing positions of increasing responsibility. Between 1985 and 1990, he served as an aviation officer in the U.S. Army's 11th Armored Cavalry Regiment, leaving the service as a troop commander with a rank of Captain.

PART II

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

Market Information

The Company's common stock is traded on the New York Stock Exchange under the symbol "MTX".

Holders

On February 4, 2019 there were approximately 173 holders of record of the common stock.

Issuer Purchases of Equity Securities

Period	Total Number of Shares Purchased	Average Price Paid Per Share	Total Number of Shares Purchased as Part of the Publicly Announced Program	Dollar Value of Shares that May Yet be Purchased Under the Program
October 1 - October 28	—	$ —	230,650	$ 133,645,212
October 29 - November 25	—	$ —	230,650	$ 133,645,212
November 26 - December 26	102,534	$ 52.07	333,184	$ 128,306,742
Total	102,534	$ 52.07		

On September 21, 2017, the Company's Board of Directors authorized the Company's management to repurchase, at its discretion, up to $150 million of the Company's shares over a two-year period commencing October 1, 2017 when the previous program expired. As of December 31, 2018, 333,184 shares have been repurchased under this program for

$21.7 million, or an average price of approximately $65.12 per share.

Performance Graph

The graph below compares Minerals Technologies Inc.'s cumulative 5-year total shareholder return on common stock with the cumulative total returns of the S&P 500 index, the Dow Jones US Industrials index, the S&P Midcap 400 index, the Dow Jones US Basic Materials index, and the S&P MidCap 400 Materials Sector. The graph tracks the performance of a $100 investment in our common stock and in each index (with the reinvestment of all dividends) from 12/31/2013 to 12/31/2018.

	2013	2014	2015	2016	2017	2018
Minerals Technologies Inc.	$100.00	$115.99	$76.85	$129.87	$116.07	$86.81
S&P 500	100.00	113.69	115.26	129.05	157.22	150.33
S&P Midcap 400	100.00	109.77	107.38	129.65	150.71	134.01
Dow Jones US Industrials	100.00	170.30	105.49	126.09	157.03	139.35
Dow Jones US Basic Materials	100.00	103.39	90.54	108.90	136.22	114.19
S&P MidCap 400 Materials Sector	100.00	102.28	87.23	120.37	144.08	114.64

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Item 6. Selected Financial Data

(in millions, except per share data)	Year Ended December 31, 2018	2017	2016	2015	2014
Net sales	$1,807.6	$1,675.7	$1,638.0	$1,797.6	$1,725.0
Cost of sales	1,346.2	1,208.5	1,177.6	1,326.6	1,289.6
Production margin	461.4	467.2	460.4	471.0	435.4
Marketing and administrative expenses	178.6	180.7	176.4	184.4	181.2
Research and development expenses	22.7	23.7	23.8	23.6	24.4
Insurance / litigation gain	—	—	—	—	(2.3)
Acquisition related transaction and integration costs	1.7	3.4	8.0	11.8	19.1
Restructuring and other items, net	2.5	15.0	28.3	45.2	43.2
Income from operations	255.9	244.4	223.9	206.0	169.8
Interest expense, net	(45.9)	(43.4)	(54.4)	(60.9)	(41.8)
Debt modification costs and fees	—	(3.9)	—	(4.5)	(5.8)
Non-cash pension settlement costs	(4.4)	—	—	—	—
Other non-operating income (deductions), net	(1.5)	(6.2)	0.8	(8.0)	0.8
Total non-operating deductions, net	(51.8)	(53.5)	(53.6)	(73.4)	(46.8)
Income from continuing operations before tax and equity in earnings	204.1	190.9	170.3	132.6	123.0
Provision (benefit) for taxes on income*	34.4	(6.6)	35.3	22.8	30.8
Equity in earnings of affiliates, net of tax	3.5	1.5	2.1	1.8	1.2
Income from continuing operations, net of tax	173.2	199.0	137.1	111.6	93.4
Income from discontinued operations, net of tax	—	—	—	—	2.1
Consolidated net income	173.2	199.0	137.1	111.6	95.5
Less:					
Net income attributable to non-controlling interests	4.2	3.9	3.7	3.7	3.1
Net income attributable to Minerals Technologies Inc. (MTI)	$169.0	$195.1	$133.4	$107.9	$92.4
Earnings per share attributable to MTI:					
Basic:					
Income from continuing operations	$4.79	$5.54	$3.82	$3.11	$2.62
Income from discontinued operations	—	—	—	—	0.06
Basic earnings per share	$4.79	$5.54	$3.82	$3.11	$2.68
Diluted:					
Income from continuing operations	$4.75	$5.48	$3.79	$3.08	$2.59
Income from discontinued operations	—	—	—	—	0.06
Diluted earnings per share	$4.75	$5.48	$3.79	$3.08	$2.65
Cash dividends declared per common share	$0.20	$0.20	$0.20	$0.20	$0.20
Shares used in computation of earnings per share:					
Basic	35.3	35.2	34.9	34.7	34.5

Diluted	35.6	35.6	35.2	35.0	34.8

* During the fourth quarter of 2017, the Company recorded a provisional $47 million income tax benefit from the U.S. Tax Cuts and Job Acts legislation. This benefit is comprised of an $82 million benefit which related primarily to the remeasurement of the Company's U.S. deferred tax liabilities at a lower U.S. tax rate of 21%, partially offset by tax expense of $35 million for the deemed repatriation of unremitted earnings of foreign subsidiaries. During 2018, the Company recorded a benefit of $4.4 million as a measurement period adjustment to the deemed repatriation of unremitted earnings of foreign subsidiaries.

	Year Ended December 31,				
(in millions)	2018	2017	2016	2015	2014
Working capital	$494.4	$542.2	$455.6	$485.0	$552.0
Total assets	3,087.1	2,970.4	2,863.4	2,980.0	3,157.5
Long-term debt, net of unamortized discount and deferred financing costs	907.8	959.8	1,069.9	1,255.3	1,429.4
Total debt	1,016.3	969.9	1,082.8	1,264.9	1,435.3
Total shareholders' equity	1,385.3	1,279.1	1,030.9	937.7	888.9

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

Cautionary Statement for “Safe Harbor” Purposes under the Private Securities Litigation Reform Act of 1995

The Private Securities Litigation Reform Act of 1995 provides a safe harbor for forward-looking statements made by or on behalf of the Company. This report contains statements that the Company believes may be “forward-looking statements” within the meaning of Section 21E of the Securities Exchange Act of 1934, particularly statements relating to the Company’s objectives, plans or goals, future actions, future performance or results of current and anticipated products, sales efforts, expenditures, and financial results. From time to time, the Company also provides forward-looking statements in other publicly-released materials, both written and oral. Forward-looking statements provide current expectations and forecasts of future events such as new products, revenues and financial performance, and are not limited to describing historical or current facts. They can be identified by the use of words such as “believes,” “expects,” “plans,” “intends,” “anticipates,” and other words and phrases of similar meaning.

Forward-looking statements are necessarily based on assumptions, estimates and limited information available at the time they are made. A broad variety of risks and uncertainties, both known and unknown, as well as the inaccuracy of assumptions and estimates, can affect the realization of the expectations or forecasts in these statements. Many of these risks and uncertainties are difficult to predict or are beyond the Company’s control. Consequently, no forward-looking statements can be guaranteed. Actual future results may vary materially. Significant factors affecting the expectations and forecasts are set forth under “Item 1A — Risk Factors” in this Annual Report on Form 10-K.

The Company undertakes no obligation to update any forward-looking statements to reflect events or circumstances that arise after the date hereof. Investors should refer to the Company's subsequent filings under the Securities Exchange Act of 1934 for further disclosures.

Executive Summary

Worldwide sales increased 8% in 2018 to $1.808 billion as compared with $1.676 billion in 2017. Consolidated income from operations increased 5% to $255.9 million as compared with $244.4 million in the prior year. Included in income from operations for 2018 were restructuring and other items of $2.5 million and included in income from operations in the previous year were restructuring and other costs of $15.0 million. Net income was $169.0 million, as compared to $195.1 million in the prior year. During the fourth quarter of 2017, the Company recorded a provisional $47 million income tax benefit from the U.S. Tax Cuts and Job Acts legislation. This benefit was comprised of an $82 million benefit which related primarily to the re-measurement of the Company’s U.S. deferred tax liabilities at a lower U.S. tax rate of 21%, partially offset by tax expense of $35.1 million for the deemed repatriation of unremitted earnings of foreign subsidiaries. During 2018, the Company recorded a benefit of $4.4 million as a measurement period adjustment for the deemed repatriation of unremitted earnings of foreign subsidiaries. The Company reported diluted earnings of $4.75 per share in 2018 as compared with $5.48 per share in the prior year.

In 2018, the Company continued to execute on its growth strategies of geographic expansion, new product innovation and acquisitions. We continued our expansion and penetration efforts in the Metalcasting and Paper PCC markets in Asia. During 2017 and 2018, the Company signed contracts for over 400,000 tons of additional PCC capacity in Asia, of which 165,000 tons were secured in 2018. In 2018, we commercialized 35 new value-added products and we continue to have a robust pipeline of innovative new products with a focus on increased speed of development. The Company also successfully closed on the acquisition of Sivomatic, a leading European supplier of premium pet litter products.

Long term debt as of December 31, 2018 was $907.8 million. During 2018, we repaid $66 million of our long-term debt. Since the acquisition of AMCOL in 2014, we repaid approximately $647 million of our Term Loan debt. We continue to strengthen our balance sheet. Cash, cash equivalents and short-term investments were $212.6 million as of December 31, 2018. Cash flow from operations for 2018 was $203.6 million. Our intention is to maintain a balanced approach to capital deployment, by using excess cash flow for investments in growth, continued debt reduction and selective share repurchases.

Outlook

The Company will continue to focus on innovation and new product development and other opportunities for sales growth in 2019 from its existing businesses, as follows:

- Develop multiple high-filler technologies under the FulFill® platform of products, to increase the fill rate in freesheet paper and continue to progress with commercial discussions and full-scale paper machine trials.
- Develop products and processes for waste management and recycling opportunities to reduce the environmental impact of the paper mill, reduce energy consumption and improve the sustainability of the papermaking process, including our NewYield® and ENVIROFIL® products.
- Further penetration into the packaging segment of the paper industry.
- Increase our sales of PCC for paper by further penetration of the markets for paper filling at both freesheet and groundwood mills, particularly in emerging markets.
- Expand the Company's PCC coating product line using the satellite model.
- Increase our presence and gain penetration of our bentonite-based foundry customers for the Metalcasting industry in emerging markets, such as China and India.
- Increase our presence and market share in global pet care products, particularly in emerging markets.
- Deploy new products in pet care such as lightweight litter.
- Promote the Company's expertise in crystal engineering, especially in helping papermakers customize PCC morphologies for specific paper applications.
- Expand PCC produced for paper filling applications by working with industry partners to develop new methods to increase the ratio of PCC for fiber substitutions.
- Develop unique calcium carbonate and talc products used in the manufacture of novel biopolymers, a new market opportunity.
- Deploy new talc and GCC products in paint, coating and packaging applications.
- Deploy value-added formulations of refractory materials that not only reduce costs but improve performance.
- Deploy our laser measurement technologies into new applications.
- Expand our refractory maintenance model to other steel makers globally.
- Increase our presence and market share in Asia and in the global powdered detergent market.
- Continue the development of our proprietary Enersol® products for agricultural applications worldwide.
- Pursue opportunities for our products in environmental and building and construction markets in the Middle East, Asia Pacific and South America regions.
- Increase our presence and market share for geosynthetic clay liners within the Environmental Products product line.
- Increase our presence and market penetration in offshore produced water and offshore filtration and well testing within the Energy Services segment.
- Deploy operational excellence principles into all aspects of the organization, including system infrastructure and lean principles.
- Continue to explore selective acquisitions to fit our core competencies in minerals and fine particle technology.

However, there can be no assurance that we will achieve success in implementing any one or more of these opportunities.

Results of Operations

Consolidated Income Statement Review

(millions of dollars)	Year Ended December 31, 2018	2017	2016	2018 vs. 2017	2017 vs. 2016
Net sales	$1,807.6	$1,675.7	$1,638.0	7.9 %	2.3 %
Cost of sales	1,346.2	1,208.5	1,177.6	11.4 %	2.6 %
Production margin	461.4	467.2	460.4	(1.2)%	1.5 %
Production margin %	25.5 %	27.9 %	28.1 %		
Marketing and administrative expenses	178.6	180.7	176.4	(1.2)%	2.4 %
Research and development expenses	22.7	23.7	23.8	(4.2)%	(0.4)%
Acquisition related transaction and integration costs	1.7	3.4	8.0	(50.0)%	(57.5)%
Restructuring and other items, net	2.5	15.0	28.3	(83.3)%	(47.0)%
Income from operations	255.9	244.4	223.9	4.7 %	9.2 %
Operating margin %	14.2 %	14.6 %	13.7 %		
Interest expense, net	(45.9)	(43.4)	(54.4)	5.8 %	(20.2)%
Debt modification costs and fees	—	(3.9)	—	*	*
Non-cash pension settlement costs	(4.4)	—	—	*	*
Other non-operating income (deductions), net	(1.5)	(6.2)	0.8	(75.8)%	*
Total non-operating deductions, net	(51.8)	(53.5)	(53.6)	(3.2)%	(0.2)%
Income from operations before tax and equity in earnings	204.1	190.9	170.3	6.9 %	12.1 %
Provision (benefit) for taxes on income	34.4	(6.6)	35.3	*	(118.7)%
Effective tax rate	16.9 %	(3.5)%	20.7 %		
Equity in earnings of affiliates, net of tax	3.5	1.5	2.1	133.3%	(28.6)%
Income from operations, net of tax	173.2	199.0	137.1	(13.0)%	45.1 %
Less: Net income attributable to non-controlling interests	4.2	3.9	3.7	7.7 %	5.4 %
Net income attributable to Minerals Technologies Inc. (MTI)	$169.0	$195.1	$133.4	(13.4)%	46.3 %

*Not meaningful

Net Sales

(millions of dollars)	Year Ended December 31, 2018	2017	2016	2018 vs. 2017	2017 vs. 2016
U.S.	$961.6	$939.3	$936.2	2.4 %	0.3 %
International	846.0	736.4	701.8	14.9 %	4.9 %
Total sales	$1,807.6	$1,675.7	$1,638.0	7.9 %	2.3 %
Performance Materials Segment	$828.1	$734.8	$686.1	12.7 %	7.1 %

Specialty Minerals Segment	589.3	584.8	591.5	0.8 %	(1.1)%
Refractories Segment	311.9	279.4	274.5	11.6 %	1.8 %
Energy Services Segment	78.3	76.7	85.9	2.1 %	(10.7)%
Total sales	$1,807.6	$1,675.7	$1,638.0	7.9 %	2.3 %

Worldwide net sales in 2018 increased 8% from the previous year to $1,807.6 million. Foreign exchange had a favorable impact on sales of approximately $13.0 million or 1 percentage point. The Company's results include $61.8 million of sales from Sivomatic. Net sales in the United States increased 2.4% to $961.6 million in 2018 and represented 53% of consolidated net sales. International sales increased to 14.9% to $846.0 million from $736.4 million and represented 47% of consolidated net sales.

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Worldwide net sales in 2017 increased 2% from the previous year to $1,675.7 million. Net sales in the United States increased slightly to $939.3 million in 2017 and represented 56% of consolidated net sales. International sales increased to $736.4 million from $701.8 million and represented 44% of consolidated net sales.

Operating Costs and Expenses

Consolidated cost of sales was $1,346.2 million, $1,208.5 million and $1,177.6 million in 2018, 2017 and 2016, respectively. Production margin as a percentage of net sales was 25.5% in 2018, 27.9% in 2017 and 28.1% in 2016. The decrease in production margin was primarily due to higher raw material, logistics and energy costs.

Marketing and administrative costs were $178.6 million, $180.7 million and $176.4 million in 2018, 2017 and 2016, respectively. Marketing and administrative costs as a percentage of net sales were 9.9% in 2018, 10.7% in 2017 and 10.8% in 2016.

Research and development expenses were $22.7 million, $23.7 million and $23.8 million in 2018, 2017 and 2016, respectively. Research and development expenses as a percentage of net sales were 1.3% in 2018, 1.4% in 2017 and 1.4% in 2016.

The Company incurred $1.7 million, $3.4 million and $8.0 million in 2018, 2017 and 2016, respectively for acquisition related transaction and integration costs.

In 2018, the Company recorded a $1.8 million restructuring charge relating to Energy Services businesses we previously exited and a $0.7 million non-cash impairment charge related to the closure of one of our Paper PCC facilities in North America in the first quarter of 2019.

In 2017, the Company recorded $15.0 million in restructuring and non-cash impairment charges from the closure of Paper PCC facilities in North America, as well as the alignment of corporate and Paper PCC staffing levels into higher growth regions.

In 2016, the Company recorded a $28.3 million charge for impairment of assets and other restructuring costs, including lease termination costs relating to its exit of U.S. on-shore service lines, including the Nitrogen and Pipeline product lines in our Energy Services segment.

Income from Operations

During 2018, the Company recorded income from operations of $255.9 million as compared with $244.4 million in the prior year. Income from operations represented 14.2% of sales compared with 14.6% of sales in the prior year. Income from operations in 2018 included acquisition related integration costs of $1.7 million and restructuring and other items of $2.5 million.

During 2017, the Company recorded income from operations of $244.4 million as compared with $223.9 million in the prior year. Income from operations represented 14.6% of sales compared with 13.7% of sales in the prior year. Income from operations in 2017 included acquisition related integration costs of $3.4 million and restructuring and other items of $15.0 million.

Non-Operating Income (Deductions)

The Company recorded non-operating deductions of $51.8 million in 2018 as compared with $53.5 million in the previous year.

Net interest expense was $45.9 million in 2018 as compared to $43.4 million in the prior year, as a result of higher interest rates and incremental borrowings related to our acquisition of Sivomatic. The Company recorded a $4.4 million pension settlement charge associated with our pension plans in the U.S.

Net interest expense was $43.4 million in 2017 as compared to $54.4 million in the prior year, as a result of lower debt balances due to principal repayments and lower interest costs relating to lower interest rates resulting from our debt repricing. The Company recorded $3.9 million in debt modification costs and fees relating to its repricing of the variable tranche of its Term Loan debt in February 2017.

Provision (Benefit) for Taxes on Income

Provision (benefit) for taxes was $34.4 million, $(6.6) million and $35.3 million in 2018, 2017 and 2016, respectively. The effective tax rates were 16.9%, (3.5)% and 20.7% during 2018, 2017 and 2016, respectively. Included in the benefit from taxes in 2017 was a provisional $47.3 million income tax benefit from the U.S. Tax Cuts and Jobs Act ("U.S. Tax Reform") legislation, enacted in December 2017. This benefit is comprised of an $82.4 million gain related primarily to the re-measurement of the Company's U.S. deferred tax liabilities at a lower U.S. tax rate of 21%, partially offset by tax expense of $35.1 million for the deemed repatriation of unremitted earnings of foreign subsidiaries. Included in the provision for taxes for 2018 is a $4.4 million benefit representing an adjustment of the provisional amounts previously recorded for U.S. Tax Reform.

The higher effective tax rate in 2018 as compared to 2017 was primarily due to the benefit of the re-measurement of the Company's U.S. deferred tax liabilities to 21% in 2017. The lower effective tax rate in 2017 as compared to 2016 was primarily due to U.S. Tax Reform. Effective in 2018, U.S. Tax Reform reduces the U.S. statutory tax rate from 35% to 21% and creates new taxes on certain foreign-sourced earnings and certain related-party payments.

The other factors having the most significant impact on our effective tax rates in recent periods are the rate differentials related to foreign earnings indefinitely invested, percentage depletion, and the tax benefits on restructuring and impairment charges at a higher rate. The higher effective tax rate in 2016 was primarily due to a lower benefit from depletion as a percentage of earnings and to the mix of earnings.

Percentage depletion allowances (tax deductions for depletion that may exceed our tax basis in our mineral reserves) are available to us under the income tax laws of the United States for operations conducted in the United States. The tax benefits from percentage depletion were $8.0 million in 2018, $12.9 million in 2017 and $11.3 million in 2016.

The U.S. Tax Reform legislation established a new Global Intangible Low-Tax Income provision ("GILTI") that currently taxes certain income from foreign operations. The Company has elected, as its accounting policy, to treat the taxes due from GILTI as a current period expense when incurred. The net charge to the Company during 2018 for GILTI is $2.1 million.

We operate in various countries around the world that have tax laws, tax incentives and tax rates that are significantly different than those of the United States. These differences combine to move our overall effective tax rate higher or lower than the United States statutory rate depending on the mix of income relative to income earned in the United States. The effects of foreign earnings and the related foreign rate differentials resulted in an increase of $2.3 million and decrease of income tax expense of $10.7 million and $14.7 million in 2018, 2017 and 2016, respectively.

Consolidated Net Income

Consolidated net income was $173.2 million in 2018 and included a $7.0 million charge, net of tax. This charge consisted of acquisition related transaction and integration costs and restructuring and other items, net. Additionally, it includes a $3.7 million benefit from U.S. Tax Reform.

Consolidated net income was $199.0 million in 2017 and included a $15.5 million charge, net of tax. This charge consisted of acquisition related transaction and integration costs and restructuring and other items, net. Additionally, it includes a $47.3 million tax benefit from U.S. Tax Reform.

Segment Review

The following discussions highlight the operating results for each of our four segments.

Performance Materials Segment

	Year Ended December 31,				
(millions of dollars)	2018	2017	2016	2018 vs. 2017	2017 vs. 2016
Net Sales					
Metalcasting	$328.9	$294.3	$258.0	$34.6	$36.3
Household, Personal Care & Specialty Products	248.8	169.6	171.2	79.2	(1.6)
Environmental Products	80.3	67.7	78.9	12.6	(11.2)
Building Materials	70.4	78.2	74.1	(7.8)	4.1

Basic Minerals	99.7	125.0	103.9	(25.3)	21.1
Total net sales	$828.1	$734.8	$686.1	$93.3	$48.7
Income from operations	$116.8	$119.7	$121.1	$(2.9)	$(1.4)
% of net sales	14.1 %	16.3 %	17.7 %		

2018 v 2017

Net sales in the Performance Materials segment were $828.1 million and increased $93.3 million in 2018, or 13 percent. Metalcasting's sales increased $34.6 million or 12 percent, primarily due to higher volumes of greensand bonds in North America and Asia. Household, Personal Care & Specialty Products sales increased 47 percent, primarily driven by higher pet care revenue, including the acquisition of Sivomatic, and increased European fabric care sales. Environmental Products sales rose 19 percent due to several large projects. This growth was partially offset by lower sales in Building Materials resulting from fewer large projects and a decrease in Basic Minerals due to the Company's exit from the bulk chromite business.

Income from operations decreased $2.9 million to $116.8 million in 2018 and represented 14.1% of net sales as compared to $121.1 million and 17.7% of sales in 2017, primarily due to higher raw material, logistics and energy costs, which were partially offset by increased selling prices and higher volume.

2017 v 2016

Net sales in the Performance Materials segment in 2017 of $734.8 million increased $48.7 million from 2016. Metalcasting's sales increased $36.3 million or 14 percent primarily due to higher volumes in Asia and North America. Basic Minerals sales increased $21.1 million or 20 percent primarily due to higher sales of chromite and drilling products. These sales increases were partially offset by lower Environmental Products sales and lower fabric care sales which impacted Household, Personal Care & Specialty Products.

Income from operations decreased $1.4 million to $119.7 million in 2017 and represented 16.3% of net sales compared to $121.1 million and 17.7% of sales in 2016.

Specialty Minerals Segment

	Year Ended December 31,				
(millions of dollars)	2018	2017	2016	2018 vs. 2017	2017 vs. 2016
Net Sales					
Paper PCC	$378.5	$377.7	$387.9	$0.8	$(10.2)
Specialty PCC	66.9	66.0	64.3	0.9	1.7
PCC Products	$445.4	$443.7	$452.2	$1.7	$(8.5)
Ground Calcium Carbonate	$91.0	$87.3	$83.6	$3.7	$3.7
Talc	52.9	53.8	55.7	(0.9)	(1.9)
Processed Minerals Products	$143.9	$141.1	$139.3	$2.8	$1.8
Total net sales	$589.3	$584.8	$591.5	$4.5	$(6.7)
Income from operations	$95.4	$88.9	$102.7	$6.5	$(13.8)
% of net sales	16.2 %	15.2 %	17.4 %		

2018 v 2017

Net sales in the Specialty Minerals segment increased 1 percent to $589.3 million in 2018 from $584.8 million in 2017. Worldwide sales of PCC products were up slightly to $445.4 million as higher sales in Asia were partially offset by reduced sales in North America due to customer paper machine shutdowns in late 2017 and early 2018. Sales of

Processed Minerals products rose 2 percent to $143.9 million. Ground Calcium Carbonate sales grew 4 percent, driven by higher volumes in the construction market, while talc sales decreased 2 percent.

Income from operations increased $6.5 million to $95.4 million in 2018 and represented 16.2% of net sales compared to $88.9 million and 15.2% of sales in the prior year. This increase was primarily due to $12.4 million in restructuring and bad debt costs recorded in the prior year. Excluding the impact of the restructuring and bad debt costs recorded in the prior year, there was a decrease in operating income due to paper machine shutdowns in North America, and higher logistics and energy costs. Included in income from operations for 2018 were restructuring and impairment charges of $0.7 million.

2017 v 2016

Net sales in the Specialty Minerals segment decreased 1 percent to $584.8 million in 2017 from $591.5 million in 2016. Higher sales in our Processed Minerals product line, stemming from increased ground calcium carbonate volumes, were offset by declines in Paper PCC. Worldwide net sales of PCC products, which are primarily used in the manufacturing process of the paper industry, decreased $8.5 million, or 2 percent. The decrease in Paper PCC sales was primarily due to the closure of several paper mills in North America, which offset growth in Asia, Europe and Latin America.

Income from operations decreased $13.8 million to $88.9 million in 2017 and represented 15.2% of net sales compared to $102.7 million and 17.4% of sales in prior year. Included in income from operations were restructuring and impairment charges of $10.3 million and provision for bad debt related to a customer bankruptcy in Malaysia for $2.1 million.

Refractories Segment

	Year Ended December 31,				
(millions of dollars)	2018	2017	2016	2018 vs. 2017	2017 vs. 2016
Net Sales					
Refractory Products	$261.1	$226.9	$219.0	$34.2	$7.9
Metallurgical Products	50.8	52.5	55.5	(1.7)	(3.0)
Total net sales	$311.9	$279.4	$274.5	$32.5	$4.9
Income from operations	$45.4	$39.8	$37.0	$5.6	$2.8
% of net sales	14.6 %	14.2 %	13.5 %		

2018 v 2017

Net sales in the Refractories segment increased 12 percent to $311.9 million in 2018, driven by higher volumes of refractory products and from increased pricing to offset higher raw material costs.

Income from operations increased $5.6 million to $45.4 million and represented 14.6% of net sales in 2018 compared to $39.8 million or 14.2% of sales in 2017.

2017 v 2016

Net sales in the Refractories segment of $279.4 million increased $4.9 million in 2017 or 2 percent. Higher equipment sales were partially offset by lower sales in metallurgical products.

Income from operations increased $2.8 million in 2017 to $39.8 million and represented 14.2% of net sales compared to $37.0 million or 13.5% of sales in 2016. The increase in income from operations relates primarily to higher refractory and equipment sales and lower refractory operating costs.

Energy Services Segment

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016

				2018 vs. 2017	2017 vs. 2016
Net Sales	$78.3	$76.7	$85.9	$1.6	$(9.2)
Income (Loss) from operations	$4.5	$6.1	$(25.9)	$(1.6)	$32.0
% of net sales	5.7 %	8.0 %	*		

*Not meaningful

<u>2018 v 2017</u>

Net sales in the Energy Services segment increased $1.6 million in 2018 or 2 percent, driven by higher filtration activity in the Gulf of Mexico and in the North Sea.

The segment recorded income from operations of $4.5 million in 2018 as compared to $6.1 million in the prior year. Included in income from operations was $1.8 million of additional restructuring charges relating to the exit of certain businesses in 2016.

2017 v 2016

Net sales in the Energy Services segment declined $9.2 million in 2017. The sales decrease was due to continued weak market conditions in the oil and gas sector and the shutdown of U.S. on-shore service lines, including nitrogen and pipeline, in the second quarter of 2016.

The segment recorded income from operations of $6.1 million in 2017. Included in income from operations was $1.7 million of additional restructuring charges relating to the exit of certain businesses in 2016, which was offset by a $1.1 million gain on sale of previously impaired assets.

Liquidity and Capital Resources

Cash provided from continuing operations in 2018 was $203.6 million, compared with $207.6 million in prior year. Cash flows provided from operations in 2018 were principally use to repay debt, fund the Company's pension plans, fund capital expenditures, repurchase shares and to pay the Company's dividend to common shareholders. The Company’s intention is to use excess cash flow for investments in growth, continued debt reduction and selective share repurchases. In 2018, the Company repaid approximately $66 million in principal amount of its long-term debt.

On May 9, 2014, in connection with the acquisition of AMCOL International Corporation (“AMCOL”), the Company entered into a credit agreement providing for the $1.560 billion senior secured term loan facility (the “Term Facility”) and a $200 million senior secured revolving credit facility (the “Revolving Facility” and, together with the Term Facility, the “Facilities”).

On June 23, 2015, the Company entered into an amendment (the “First Amendment”) to the credit agreement to reprice the $1.378 billion then outstanding on the Term Facility. As amended, the Term Facility had a $1.078 billion floating rate tranche and a $300 million fixed rate tranche. On February 14, 2017, the Company entered into an amendment (the “Second Amendment”) to the credit agreement to reprice the $788 million floating rate tranche then outstanding, which extended the maturity and lowered the interest costs by 75 basis points. On April 18, 2018, the Company entered into an amendment (the “Third Amendment”) to the credit agreement to refinance the Revolving Facility. As amended, the Revolving Facility has been increased to $300 million in aggregate commitments. Following the amendments, the loans outstanding under the floating rate tranche of the Term Facility will mature on February 14, 2024, the loans outstanding under the fixed rate tranche of the Term Facility will mature on May 9, 2021 and the loans outstanding (if any) and commitments under the Revolving Facility will mature and terminate, as the case may be, on April 18, 2023. Loans under the floating rate tranche of the Term Facility bear interest at a rate equal to an adjusted LIBOR rate (subject to a floor of 0.75%) plus an applicable margin equal to 2.25% per annum. Loans under the fixed rate tranche of the Term Facility bear interest at a rate of 4.75%. Loans under the Revolving Facility bear interest at a rate equal to an adjusted LIBOR rate plus an applicable margin equal to 1.625% per annum. Such rates are subject to decrease by up to 25 basis points in the event that, and for so long as, the Company’s net leverage ratio (as defined in the credit agreement) is less than certain thresholds. The floating rate tranche of the Term Facility was issued at par and the fixed rate tranche of the Term Facility was issued at a 0.25% discount in connection with the First Amendment. The variable rate tranche of the Term Facility was issued at a 0.25% discount in connection with the Second Amendment. The variable rate tranche has a 1% required amortization per year. The Company will pay certain fees under the credit agreement, including customary annual administration fees. The obligations of the Company under the Facilities are unconditionally guaranteed jointly and severally by, subject to certain exceptions, all material domestic subsidiaries of the Company (the “Guarantors”) and secured, subject to certain exceptions, by a security interest in substantially all of the assets of the Company and the Guarantors.

The credit agreement contains certain customary affirmative and negative covenants that limit or restrict the ability of the Company and its restricted subsidiaries to enter into certain transactions or take certain actions. In addition, the credit agreement contains a financial covenant that requires the Company, if on the last day of any fiscal quarter loans or letters of credit were outstanding under the Revolving Facility (excluding up to $15 million of letters of credit), to maintain a maximum net leverage ratio (as defined in the credit agreement) of, initially, 5.25 to 1.00 for the four fiscal quarter period preceding such day. Such maximum net leverage ratio requirement is subject to decrease during the duration of the facility to a minimum level (when applicable) of 3.50 to 1.00. During 2018, the Company repaid $57 million on its Term Facility. In connection with the Sivomatic acquisition, the Company incurred $113.0 million of short-term debt under the Revolving Facility. As of December 31, 2018, there were $100 million in outstanding loans and $10.5 million in letters of credit outstanding under the Revolving Facility. The Company is in compliance with all the covenants associated with the Revolving Facility as of the end of the period covered by this report.

The Company has committed loan facilities for the funding of new manufacturing facilities in China. In addition, the Company has a committed loan facility in Japan. As of December 31, 2018, on a combined basis, $5.1 million was outstanding under these facilities. Principal will be repaid in accordance with the payment schedules ending in 2021. The Company repaid $3.8 million on these loans in 2018.

As part of the Sivomatic acquisition, the Company assumed $10.7 million in long-term debt, recorded at fair value, consisting of two term loans, one of which matures in 2020 and the other of which matures in 2022. These loans carry an interest rate of Euribor plus 2.0% and have quarterly repayments. During 2018, the Company repaid $5.4 million on these loans.

As of December 31, 2018, the Company had $42.7 million in uncommitted short-term bank credit lines, of which approximately $5.2 million was in use. The credit lines are primarily outside the U.S. and are generally one year in term at competitive market rates at large, well-established institutions. The Company typically uses its available credit lines to fund working capital requirements or local capital spending needs. We anticipate that capital expenditures for 2019 should be between $70 million and $80 million, principally related to the construction of PCC plants and other opportunities that meet our strategic growth objectives. We expect to meet our other long-term financing requirements from internally generated funds, committed and uncommitted bank credit lines and, where appropriate, project financing of certain satellite plants.

On April 5, 2016, the Company entered into a floating to fixed interest rate swap for an initial aggregate notional amount of $300 million to limit exposure to interest rate increases related to a portion of the Company's floating rate indebtedness. This swap agreement hedges a portion of contractual floating rate interest through its expiration in May 2021. As a result of the agreement, the Company's effective fixed interest rate on the notional amount floating rate indebtedness will be 4.25%. The fair value of this instrument at December 31, 2018 was an asset of $2.7 million.

During the second quarter of 2018, the Company entered into a floating to fixed interest rate swap for a notional amount of $150 million. Additionally, the Company entered into a cross currency rate swap with a total notional value of $150 million to exchange monthly fixed-rate interest rate payments in U.S. dollars for monthly fixed-rate interest rate payments in Euros. These swaps mature in May 2023. As a result of these swaps, the Company's effective fixed interest rate on the notional floating rate indebtedness will be 2.5%. The combined fair value of these instruments at December 31, 2018 was an asset of $1.3 million.

On September 21, 2017, the Company's Board of Directors authorized the Company's management to repurchase, at its discretion, up to $150 million of the Company's shares over a two-year period commencing October 1, 2017 after the previous program expired. As of December 31, 2018, 333,184 shares have been repurchased under this program for $21.7 million, or an average price of approximately $65.12 per share.

On January 23, 2019, the Company's Board of Directors declared a regular quarterly dividend on its common stock of $0.05 per share. No dividend will be payable unless declared by the Board and unless funds are legally available for payment thereof.

Contractual Obligations

The Company has committed cash outflow related to long-term debt, interest on debt, pension and post-retirement benefit obligations, operating lease agreements, and other long-term contractual obligations. As of December 31, 2018, minimum payments for these obligations were as follows:

	Payments Due by Period				
(millions of dollars)	Total	2019	2020 – 2021	2022 – 2023	After 2023
Long-term debt	$930.9	$3.3	$269.4	$0.2	$658.0

Interest related to long term debt	200.6	45.6	83.7	65.8	5.5
Estimated pension and post retirement plan funding	20.0	10.0	10.0	—	—
Operating lease obligations	79.8	17.3	22.5	15.2	24.8
Repatriation tax liability	16.4	—	—	—	16.4
Other long term liabilities	23.4	0.4	—	—	23.0
Total contractual obligations	$1,271.1	$76.6	$385.6	$81.2	$727.7

Debt amounts in the preceding table represent the principal amounts of all outstanding long-term debt, including current portion. As of December 31, 2018, maturities for long-term debt extended to 2024. The above table does not include borrowings under our Revolving Facility as such amounts can be borrowed and repaid as required. Any remaining outstanding loans under the Revolving Facility will mature in April 2023.

Interest related to long-term debt is based on interest rates in effect as of December 31, 2018 and is calculated on debt with maturities that, on December 31, 2018 extended to 2024. As the contractual interest rate for a portion of our debt is variable, actual cash payments may differ from the estimates provided in the preceding table.

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Estimated minimum required pension funding and post-retirement benefits are based on actuarial estimates using current assumptions for discount rates, long-term rate of return on plan assets, rate of compensation increases, and health care cost trend rates. The Company has determined that it is not practicable to present expected pension funding and other postretirement benefit payments beyond 2020 and, accordingly, no amounts have been included in the table beyond such dates.

The Company has several non-cancelable operating leases, primarily for office space and equipment. Operating lease obligations includes future minimum rental commitments under non-cancelable leases.

The Company recorded a tax liability for the one-time transition tax on accumulated foreign subsidiary earnings under U.S. Tax Reform of $35.1 million, payable in eight annual interest-free installments beginning in 2018. The Company paid its first installment in 2018 and was required to apply certain overpayments to the outstanding liability. The remaining liability is payable in 2023 and after.

Other long-term liabilities include asset retirement obligations relating to the retirement of certain tangible long-lived assets and land restoration obligations at its PCC satellite facilities and mining operations. See Note 20 to the Consolidated Financial Statements.

The total amount of contingent obligations associated with gross unrecognized tax benefits for uncertain tax positions, including positions impacting only the timing of tax benefits was $16.6 million at December 31, 2018. Payment of these obligations would result from settlements with taxing authorities. Due to the difficulty in determining the timing of settlements, these obligations are not included in the table above. We do not expect to make a tax payment related to these obligations within the next year that would significantly impact liquidity.

Critical Accounting Policies and Estimates

Our discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosure of contingent assets and liabilities.

On an ongoing basis, we evaluate our estimates and assumptions, including those related to revenue recognition, valuation of long-lived assets, goodwill and other intangible assets, income taxes, including valuation allowances and pension plan assumptions. We base our estimates on historical experience and on other assumptions that we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that cannot readily be determined from other sources. There can be no assurance that actual results will not differ from those estimates.

We believe the following critical accounting policies require us to make significant judgments and estimates in the preparation of our consolidated financial statements.

Revenue Recognition

Revenue is recognized at the point in time when the customer obtains control of the promised goods or services in an amount that reflects the consideration we expect to receive in exchange for those goods or services. The Company's revenues are primarily derived from the sale of products. Our primary performance obligation is satisfied upon shipment or delivery to our customer based on written sales terms, which is also when control is transferred. Revenues from sales of equipment are recorded upon completion of installation and transfer of control to the customer. Revenues from services are recorded when the services are performed.

In most of our PCC contracts, the price per ton is based upon the total number of tons sold to the customer during the year. Under those contracts, the price billed to the customer for shipments during the year is based on periodic estimates of the total annual volume that will be sold to the customer. Revenues are adjusted at the end of each year to reflect the actual volume sold. There were no significant revenue adjustments in the fourth quarter of 2018 and 2017, respectively. We have consignment arrangements with certain customers in our Refractories segment. Revenues for these transactions are recorded when the consigned products are consumed by the customer.

Revenues within our Energy Services segment are service based. Certain contracts within this segment are long-term contracts. Revenue where our performance obligations are satisfied in phases is recognized over time using certain input measures based on the measurement of the value transferred to the customer, including milestones achieved.

Valuation of Long-lived Assets, Goodwill and Other Intangible Assets

We assess the possible impairment of long-lived assets and identifiable amortizable intangibles whenever events or changes in circumstances indicate that the carrying value may not be recoverable.

Goodwill is evaluated for impairment at least annually. Factors we consider important that could trigger an impairment review include the following:

Significant under-performance relative to historical or projected future operating results;
Significant changes in the manner of use of the acquired assets or the strategy for the overall business;
Significant negative industry or economic trends;
Market capitalization below invested capital.

Annually, the Company performs a qualitative assessment for each of its reporting units to determine if the two-step process for impairment testing is required. If the Company determines that it is more likely than not that the fair value of a reporting unit is less than its carrying amount, the Company then evaluates the recoverability of goodwill using a two-step impairment test approach at the reporting unit level. Step one involves a) developing the fair value of total invested capital of each reporting unit in which goodwill is assigned; and b) comparing the fair value of total invested capital for each reporting unit to its carrying amount, to determine if there is goodwill impairment. Should the carrying amount for a reporting unit exceed its fair value, then the step one test is failed, and the magnitude of any goodwill impairment is determined under step two. The amount of impairment loss is determined in step two by comparing the implied fair value of reporting unit goodwill with the carrying amount of goodwill.

The Company has five reporting units; Performance Materials, PCC, Processed Minerals, Refractories and Energy Services. We identify our reporting units by assessing whether the components of our operating segments constitute businesses for which discrete financial information is available and management regularly reviews the operating results of those components. In the fourth quarter of 2018, the Company performed a qualitative assessment of each of its reporting units and determined it was not more likely than not that the fair value of any of its reporting units was less than their carrying values.

Property, plant and equipment are depreciated over their useful lives. Useful lives are based on management's estimates of the period that the assets can generate revenue, which does not necessarily coincide with the remaining term of a customer's contractual obligation to purchase products made using those assets. Our sales of PCC are predominately pursuant to long-term evergreen contracts, initially ten years in length, with paper mills at which we operate satellite PCC plants. The terms of many of these agreements have been extended, often in connection with an expansion of the satellite PCC plant. Failure of a PCC customer to renew an agreement or continue to purchase PCC from our facility could result in an impairment of assets or accelerated depreciation at such facility.

We evaluate the recoverability of our property, plant and equipment whenever events or change in circumstances indicate that the carrying value of the assets may not be recoverable. For testing the recoverability, we primarily use discounted cash flow models or cost approach to estimate the fair value of these assets. Critical assumptions used in conducting these tests included expectations of our business performance and financial results, useful lives of assets, discount rates and comparable market data.

When we acquire a company, we determine fair value on the acquisition date of assets acquired and liabilities assumed. We use the income, market or cost approach (or a combination thereof) for the valuation and use valuation inputs and analyses that are based on market participant assumptions. Goodwill is calculated as the excess of the consideration transferred over the assets acquired and represents the estimated future economic benefits arising from other assets acquired that could not be individually identified and separately recognized.

Income Taxes

As part of the process of preparing our consolidated financial statements, we are required to estimate our income taxes in each of the jurisdictions in which we operate. This process involves estimating current tax expense together with assessing temporary differences resulting from differing treatments of items for tax and accounting purposes. These differences result in deferred tax assets and liabilities, which are included in the consolidated balance sheet. We must then assess the likelihood that our deferred tax assets will be recovered from future taxable income, and to the extent we believe that recovery is not likely, we must establish a valuation allowance. To the extent we establish a valuation allowance or change this allowance in a period, we must include an expense within the tax provision in the Consolidated Statements of Income.

Deferred tax liabilities represent the amount of income taxes payable in future periods. Such liabilities arise because of temporary differences between the financial reporting and tax bases of assets and liabilities. Deferred income tax assets represent amounts available to reduce income taxes payable on taxable income in future years. Such assets arise because of temporary differences between the financial reporting and tax bases of assets and liabilities, as well as from net operating losses. We evaluate the recoverability of these future tax deductions by assessing the adequacy of future expected taxable income from all sources, including reversal of taxable temporary differences and forecasted operating earnings. These sources of income inherently rely heavily on estimates. We use our historical experience and business forecasts to provide insight. The amount recorded for the net deferred tax liability was $170.5 million and $133.8 million at December 31, 2018 and 2017, respectively.

U.S. Tax Reform was enacted on December 22, 2017 and introduces significant changes to U.S. income tax law. Effective in 2018, the legislation reduced the U.S. statutory tax rate from 35% to 21%, created new taxes on certain foreign-sourced earnings and certain related-party payments. In addition, in 2017, the Company was subject to a one-time transition tax on accumulated foreign subsidiary earnings not previously subject to U.S. income tax. Accounting for the income tax effects of this legislation requires significant judgments and estimates in the interpretation and calculations of its provisions.

Due to the timing of the enactment and the complexity involved in applying the provisions of the U.S. Tax Reform, the Company made reasonable estimates of the effects and recorded provisional amounts in our consolidated financial statements for the year ended December 31, 2017. In 2018, the Company reviewed additional guidance issued by the U.S. Treasury Department, IRS and other standard-setting bodies, collected and prepared the necessary data, and made adjustments to the provisional amount, which resulted in a $4.4 million benefit recorded for the year ended December 31, 2018.

The application of income tax law is inherently complex. Laws and regulations in this area are voluminous and are often ambiguous. As such, we are required to make many subjective assumptions and judgments regarding our income tax exposures. Interpretations of and guidance surrounding income tax laws and regulations change over time. As such, changes in our subjective assumptions and judgments can materially affect amounts recognized in the consolidated balance sheets and statements of operations. See Note 7 to the Consolidated Financial Statements for additional detail on our uncertain tax positions.

Pension Benefits

We sponsor pension and other retirement plans in various forms covering the majority of employees who meet eligibility requirements. Several statistical and actuarial models which attempt to estimate future events are used in calculating the expense and liability related to the plans. These models include assumptions about the discount rate, expected return on plan assets and rate of future compensation increases as determined by us, within certain guidelines. Our assumptions reflect our historical experience and management's best judgment regarding future expectations. In addition, our actuarial consultants also use subjective factors such as withdrawal and mortality rates to estimate these assumptions. The actuarial assumptions used by us may differ materially from actual results due to changing market and economic conditions, higher or lower withdrawal rates or longer or shorter life spans of participants, among other things. Differences from these assumptions may result in a significant impact to the amount of pension expense/liability recorded by us follows:

A one percentage point change in our major assumptions would have the following effects:

Effect on Expense

(millions of dollars)	Discount Rate	Salary Scale	Return on Asset
1% increase	$ (3.8)	$ 0.8	$ (2.0)

1% decrease	$ 6.6	$ (0.7)	$ 2.7

Effect on Projected Benefit Obligation

(millions of dollars)	Discount Rate	Salary Scale
1% increase	$ (31.4)	$ 4.0
1% decrease	$ 54.0	$ (3.5)

The investment strategy for pension plan assets is to maintain a broadly diversified portfolio designed to both preserve and grow plan assets to meet future plan obligations. The Company's average rate of return on assets from inception through December 31, 2018 was approximately 9%. The Company's assets are strategically allocated among equity, debt and other investments to achieve a diversification level that dampens fluctuations in investment returns. The Company's long-term investment strategy is an investment portfolio mix of approximately 55%-65% in equity securities, 30%-35% in fixed income securities and 0%-15% in other securities. As of December 31, 2018, the Company had approximately 55% of its pension assets in equity securities, 38% in fixed income securities and 7% in other securities.

The Company recognized pension expense of $16.0 million in 2018 as compared to $12.6 million in 2017. Accounting guidance on retirement benefits requires companies to discount future benefit obligations back to today's dollars using a discount rate that is based on high-quality fixed-income investments. A decrease in the discount rate increases the pension benefit obligation, while an increase in the discount rate decreases the pension benefit obligation. This increase or decrease in the pension benefit obligation is recognized in Accumulated other comprehensive income and subsequently amortized into earnings as an actuarial gain or loss. The guidance also requires companies to use an expected long-term rate of return on plan assets for computing current year pension expense. Differences between the actual and expected returns are also recognized in Accumulated other comprehensive income (loss) and subsequently amortized into earnings as actuarial gains and losses. At the end of 2018, total actuarial losses recognized in Accumulated other comprehensive income (loss) for pension plans were ($73.6 million), as compared to ($91.3 million) in 2017. The majority of the actuarial losses were due to decreases in the discount rate in 2012 and lower actual rates of return on assets than expected during the financial crisis of 2008.

In 2018, included in other comprehensive income, is a net loss of $21.6 million ($16.9 million after-tax) primarily due to a change in discount rates. In 2017, a net loss of $10.0 million ($8.5 million after-tax) was recorded in other comprehensive income, primarily due to a change in discount rates. In 2016, a net loss of $4.6 million ($3.2 million after-tax) was recorded in other comprehensive income, primarily due to a change in discount rates and updated mortality tables.

Actuarial losses for pensions will be impacted in future periods by actual asset returns, discount rate changes, actual demographic experience and other factors that impact these expenses. These losses, reported in Accumulated other comprehensive income (loss), will generally be amortized as a component of net periodic benefit cost on a straight-line basis over the average remaining service period of active employees expected to receive benefits under the benefit plans. At the end of 2018, the average remaining service period of active employees or life expectancy for fully eligible employees was 10 years. We expect our 2019 amortization of net actuarial losses to be approximately $9.6 million.

For a detailed discussion on the application of these and other accounting policies, see "Summary of Significant Accounting Policies" in Note 1 to the Consolidated Financial Statements. This discussion and analysis should be read in conjunction with the consolidated financial statements and related notes included elsewhere in this report.

Inflation

While inflation historically has not had a material impact on the Company, our financial performance could be adversely affected by increases in energy and commodity prices. Our production processes consume a significant amount of energy, primarily electricity, diesel fuel, natural gas and coal. We use diesel fuel to operate our mining and processing equipment and our freight costs are heavily dependent upon fuel prices and surcharges. Energy costs also affect the cost of raw materials. On a combined basis, these factors represent a large exposure to petrochemical and energy products which may be subject to significant price fluctuations. The contracts pursuant to which we construct and operate our satellite PCC plants generally adjust pricing to reflect the pass-through of increases in costs resulting from inflation, including lime and energy prices. However, there is a time lag before such price adjustments can be implemented. The Company and its customers will typically negotiate reasonable price adjustments in order to recover a portion of these escalating costs, but there can be no assurance that we will be able to recover increasing costs through such negotiations.

Cyclical Nature of Customers' Businesses

The bulk of our sales within Specialty Minerals, Performance Materials and Refractories segments are to customers in the paper manufacturing, metalcasting, steel manufacturing and construction industries, which have historically been cyclical. The pricing structure of some of our long-term PCC contracts makes our PCC business less sensitive to declines in the quantity of product purchased. In addition, our customers' demand for our Energy Services segment's products and services are affected by oil and natural gas production activities, which are heavily influenced by the benchmark price of these commodities. Oil and natural gas prices decreased significantly between 2014 through 2017, which had caused exploration companies to reduce their capital expenditures and production and exploration activities. This has had the effect of decreasing the demand and increasing competition for the services we provide. We cannot predict the economic outlook in the countries in which we do business, nor in the key industries we serve.

Recently Issued Accounting Standards

Changes to accounting principles generally accepted in the United States of America (U.S. GAAP) are established by the Financial Accounting Standards Board (FASB) in the form of accounting standards updates (ASUs) to the FASB's Accounting Standards Codification. The Company considers the applicability and impact of all ASUs. ASUs not listed below were assessed and determined to be either not applicable or are expected to have minimal impact on our consolidated financial position and results of operations.

Leases

In February 2016, the FASB issued ASU 2016-02, “Leases”, which requires lessees to recognize most leases on their balance sheets as lease liabilities with corresponding right-of-use ("ROU") assets. Lessor accounting remains substantially similar to current U.S. GAAP. ASU 2016-02 is effective for public business entities for annual and interim periods in fiscal years beginning after December 15, 2018 with early adoption permitted. ASU 2016-02 mandates a modified retrospective transition method for all entities, applying the new lease standard to all leases existing at the date of initial application. The Company has adopted this new standard effective January 1, 2019 using the effective date as our date of initial application. As such, financial information and required disclosures will not be provided for dates prior to January 1, 2019. The new standard provides a number of optional practical expedients in transition. We have elected the ‘package of practical expedients’, which permits us not to reassess under the new standard our prior conclusions about lease identification, lease classification and initial direct costs. The new standard also provides practical expedients for an entity’s ongoing accounting. We have elected the short-term lease recognition exemption for all leases that qualify. On adoption, we expect to recognize additional operating liabilities of between $60 million to $65 million with corresponding ROU assets ranging from $50 million to $55 million based on the present value of the remaining lease payments under existing operating leases. The adoption of this standard will not have a material impact on the Company's financial statements.

Intangibles – Goodwill and Other

In January 2017, the FASB issued ASU 2017-04, "Intangibles-Goodwill and Other: Simplifying the Test for Goodwill Impairment", which no longer requires an entity to perform a hypothetical purchase price allocation to measure goodwill impairment. Instead, goodwill will be measured using the difference between the carrying amount and the fair value of the reporting unit. The standard is effective for the interim and annual periods beginning on or after December 15, 2019, with early adoption permitted. The Company will adopt this standard January 1, 2020. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income

In February 2018, the FASB issued ASU 2018-02, "Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income", which allows a reclassification from accumulated other comprehensive income to retained earnings for stranded tax effects resulting from the U.S. Tax Cuts and Jobs Act. The standard is effective for the interim and annual periods beginning after December 15, 2018, with early adoption permitted. We have adopted this standard effective January 1, 2019. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Retirement Benefits

In August 2018, the FASB issued ASU 2018-14, "Compensation – Retirement Benefits – Defined Benefit Plans – General: Disclosure Framework – Changes to the Disclosure Requirements for Defined Benefit Plans," which removes disclosures that no longer are considered cost beneficial, clarifies the specific requirements of certain disclosures and adds disclosure requirements identified as relevant. The standard is effective for annual periods beginning after December 15, 2020, with early adoption permitted. The Company will adopt this standard January 1, 2021. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Fair Value Measurement

In August 2018, the FASB issued ASU 2018-13, "Fair Value Measurement: Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement," which eliminates, amends and adds disclosure requirements for fair value measurement. The standard is effective for the interim and annual periods beginning after December 15, 2019, with early adoption permitted. The Company will adopt this standard January 1, 2020. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Adoption of ASU 2014-09 Revenue from Contracts with Customers

On January 1, 2018, the Company adopted the provisions of ASU No. 2014-09, “Revenue from Contracts with Customers”. The underlying principle is that an entity will recognize revenue to depict the transfer of goods or services to customers at an amount that the entity expects to be entitled to in exchange for those goods or services. The standard provides a five-step analysis of transactions to determine when and how revenue is recognized. The standard also requires enhanced disclosures regarding the nature, amount, timing and uncertainty of revenue and cash flows arising from an entity’s contracts with customers. The Company has elected to use the cumulative effect transition method and there has not been a change to our previously reported financial results.

Under accounting standards codification (ASC 606) revenue is recognized when a customer obtains control of promised goods or services in an amount that reflects the consideration we expect to receive in exchange for those goods or services. We measure revenue based on the consideration specified in the customer arrangement and revenue is recognized when the performance obligations in the customer arrangement are satisfied. A performance obligation is a promise in a contract to transfer a distinct good or service to the customer. The transaction price of a contract is allocated to each distinct performance obligation and recognized as revenue when or as, the customer receives the benefit of the performance obligation. Customers typically receive the benefit as goods are delivered and services are performed.

We utilized a comprehensive approach to assess the impact of the standard on our contract portfolio by reviewing our current accounting policies and practices to identify potential differences that would result from applying the new requirements to our revenue contracts, including evaluation of our performance obligations, principal versus agent considerations and variable consideration. We completed our contract and business process reviews and implemented changes to our controls to support recognition and disclosures under the new standard. We recognize revenue when our performance obligation is satisfied. See Note 2 to the Consolidated Financial Statements.

Adoption of ASU 2017-07 Compensation - Retirement Benefits: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost

On January 1, 2018, the Company adopted the provisions of ASU 2017-07, “Compensation – Retirement Benefits: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost”, which requires companies to present the service cost component of the net benefit cost in the same line items in which they report compensation cost. All other components of net periodic benefit cost will be presented outside operating income. The provisions have been applied retrospectively for the income statement presentation requirements. Prior to the adoption of the standard, the Company classified all net periodic benefit costs within operating costs, primarily within “Marketing and administrative expenses” on the Consolidated Statements of Income. The line item classification changes required by the standard did not impact the Company’s pre-tax earnings or net income; however, “Income from operations” and “Other non-operating income (deductions), net” changed by immaterial offsetting amounts. As a result of the accounting change, the Company reclassified approximately $1.7 million and $3.0 million from marketing and administrative expenses to other non-operating deductions for the years ended December 31, 2017 and 2016, respectively, to conform to the current year presentation.

Adoption of ASU 2017-12 Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities

On January 1, 2018, the Company early adopted the provisions of ASU 2017-12, “Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities,” which improves and simplifies existing standard to allow companies to better reflect their risk management activities in the financial statements. The standard expands the ability to hedge nonfinancial and financial risk components, eliminates the requirement to separately measure and recognize hedge ineffectiveness and eases requirements of an entity’s assessment of hedge effectiveness. The adoption of this standard did not have an impact on the Company’s financial statements.

Adoption of ASU 2017-01 Business Combinations

On January 1, 2018, the Company adopted the provisions of ASU 2017-01, “Business Combinations,” which clarifies the definition of a business with the objective of adding guidance to assist entities with evaluating whether transactions should be accounted for as acquisitions (or disposals) of assets or businesses. The definition of a business affects many areas of accounting including acquisitions, disposals, goodwill, and consolidation. The adoption of this new standard did not have an impact on the Company’s financial statements.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk

We are exposed to market risk from fluctuations in foreign currency exchange rates, interest rates and credit risk. We use a variety of practices to manage these market risks, including derivative financial instruments when appropriate. Our treasury and risk management policies prohibit us from using derivative instruments for trading or speculative purposes. We also do not use leveraged derivative instruments or derivatives with complex features.

Exchange Rate Sensitivity

As we operate in over 30 countries with many international subsidiaries, we are exposed to currency fluctuations related to manufacturing and selling our products and services. This foreign currency risk is diversified and involves assets, liabilities and cash flows denominated in currencies other than the U.S. Dollar (USD).

We manage our foreign currency exchange risk in part through operational means, including managing same currency revenues versus same currency costs, as well as, same currency assets versus same currency liabilities. We also have subsidiaries with the same currency exposures which may offset each other, providing a natural hedge against one another's currency risk. When appropriate, we enter into derivative financial instruments, such as forward exchange contracts and cross currency interest rate swaps, to mitigate the impact of foreign exchange rate movements on our operating results. The counterparties are major financial institutions. Such forward exchange contracts would not subject us to additional risk from exchange rate because gains and losses on these contracts would offset losses and gains on the assets, liabilities, and transactions being hedged. In the second quarter of 2018, the Company entered into a cross currency swap with a total notional value of $150 million. The swap matures in May 2023. The fair value of this swap at December 31, 2018, was an asset of $3.7 million.

Assets and liabilities of our international subsidiaries are translated to their parent company's reporting currency at current exchange rates during consolidation; gains and losses stemming from these translations are included as a component of Other Comprehensive Income and reported within Accumulated Comprehensive Income within our Consolidated Balance Sheets. Income and expenses of our international subsidiaries are translated at average exchange rates for the period and, when included within retained earnings in the balance sheet at current exchange rates, the differences to those average exchange rates are included within Other Comprehensive Income and reported within Accumulated Comprehensive Income. When our subsidiaries transact business in currencies other than their functional currency, those transactions are revalued in their functional currency and differences resulting from such revaluations are included within other non-operating income (deduction), net within our Consolidated Statement of Income.

We do not anticipate that near-term changes in exchange rates will have a material impact on our future earnings or cash flows. However, there can be no assurance that a sudden and significant change in the value of foreign currencies would not have a material adverse effect on our financial condition and results of operations.

Interest Rate Sensitivity

A portion of our long-term bank debt bears interest at variable rates (see Note 14 to the Consolidated Financial Statements) and our results of operations would be affected by interest rate changes to such bank debt outstanding. The Company utilizes interest rate swaps to limit exposure to market fluctuations on floating-rate debt. During the second quarter of 2016, the Company entered into a floating to fixed interest rate swap for an initial aggregate notional amount of $300 million. In the second quarter of 2018, the Company entered into an additional floating to fixed interest rate swap for an initial aggregate notional amount of $150 million. An immediate 10% increase in the interest rates would not have a material effect on our results of operations over the next fiscal year. A one percentage point change in interest rates would cost $4.0 million in incremental interest charges on an annual basis.

Credit Risk

We are exposed to credit risk on certain assets, primarily accounts receivable. We provide credit to customers in the ordinary course of business and perform ongoing credit evaluations. Concentrations of credit risk with respect to trade receivables are limited due to the large number of customers comprising our customer base. We currently believe our allowance for doubtful accounts is sufficient to cover customer credit risks. Our accounts receivable financial instruments are carried at amounts that approximate fair value.

Sovereign Debt Risk

We do not have any material credit risk with sovereign governments currently facing this situation as we do not sell our products to them. We do, however, sell to customers in these countries, but we believe our risk associated with these customers is not material.

Item 8. Financial Statements and Supplementary Data

The financial information required by Item 8 is contained in Item 15 of Part IV of this report.

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

None.

Item 9A. Controls and Procedures

Disclosure Controls and Procedures

As of the end of the period covered by this report, and under the supervision and with participation of the Company's management, including the Chief Executive Officer and the Chief Financial Officer, the Company carried out an evaluation of the effectiveness of the design and operation of the Company's disclosure controls and procedures, pursuant to Exchange Act Rule 13a-15(b). Based upon that evaluation, the Chief Executive Officer and Chief Financial Officer concluded that the Company's disclosure controls and procedures were effective as of December 31, 2018.

Pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, we have included a report of management's assessment of the design and operating effectiveness of our internal controls as part of this report. Management's report is included in our consolidated financial statements beginning on page F-1 of this report under the caption entitled "Management's Report on Internal Control Over Financial Reporting."

Changes in Internal Control Over Financial Reporting

During 2018, we closed on the acquisition of Sivomatic and we excluded Sivomatic from the scope of management's report on internal control over financial reporting for the year ended December 31, 2018. We are in the process of integrating Sivomatic to our overall internal control over financial reporting and will include them in scope for the year ending December 31, 2019. This process may result in additions or changes to our internal control over financial reporting.

There were no other changes in our internal control over financial reporting during the fourth fiscal quarter of 2018 identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information

None

PART III

Item 10. Directors, Executive Officers and Corporate Governance

The information concerning the Company's Board of Directors required by this item is incorporated herein by reference to the Company's Proxy Statement, under the captions "Corporate Governance", "Committees of the Board of Directors" and "Item 1- Election of Directors."

The information regarding compliance with Section 16(a) of the Securities Exchange Act of 1934 required by this Item is incorporated herein by reference to the Company's Proxy Statement, under the caption "Section 16(a) Beneficial Ownership Reporting Compliance."

The Board has established a code of ethics for the Chief Executive Officer, the Chief Financial Officer, and the Chief Accounting Officer entitled "Code of Ethics for the Senior Financial Officers," which is available on our website, www.mineralstech.com, by clicking the links entitled Our Company, then Governance, then Corporate Responsibility and then Policies and Charters.

See "Executive Officers of the Company" in Part I of this report for information regarding executive officers of the Company.

Item 11. Executive Compensation

The information appearing in the Company's Proxy Statement under the captions “Compensation Discussion and Analysis,” “Report of the Compensation Committee” and “Compensation of Executive Officers and Directors" is incorporated herein by reference.

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

The information appearing in the Company's Proxy Statement under the caption "Security Ownership of Certain Beneficial Owners and Management" is incorporated herein by reference.

Equity Compensation Plan Information

The following table summarizes information about our equity compensation plans as of December 31, 2018. All outstanding awards relate to our common stock.

Plan Category	Number of Securities to be Issued Upon Exercise of Outstanding Options	Weighted Average Exercise Price of Outstanding Options	Number of Securities Remaining Available for Future Issuance
Equity compensation plans approved by security holders	1,054,259	$ 54.04	866,023
Total	1,054,259	$ 54.04	866,023

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

The information appearing in the Company's Proxy Statement under the caption "Certain Relationships and Related Transactions" is incorporated herein by reference.

The Board has established Corporate Governance principles which include guidelines for determining Director independence, which is available on our website, www.mineralstech.com, by clicking the links entitled Our Company, then Governance, then Corporate Responsibility and then Policies and Charters. The information appearing in the Company's Proxy Statement under the caption "Corporate Governance – Director Independence" is incorporated herein by reference.

Item 14. Principal Accountant Fees and Services

The information appearing in the Company's Proxy Statement under the caption "Principal Accountant Fees and Services" is incorporated herein by reference.

PART IV

Item 15. Exhibits and Financial Statement Schedules

(a) The following documents are filed as part of this report:

1. Financial Statements. The following Consolidated Financial Statements of Mineral Technologies Inc. and subsidiary companies and Reports of Independent Registered Public Accounting Firm are set forth on pages F-2 to F-38.

Consolidated Balance Sheets as of December 31, 2018 and 2017
Consolidated Statements of Income for the years ended December 31, 2018, 2017 and 2016
Consolidated Statements of Comprehensive Income for the years ended December 31, 2018, 2017 and 2016
Consolidated Statements of Cash Flows for the years ended December 31, 2018, 2017 and 2016

2. Financial Statement Schedule. The following financial statement schedule is filed as part of this report:

All other schedules for which provision is made in the applicable accounting regulations of the SEC are not required under the related instructions or are inapplicable and, therefore, have been omitted.

3. Exhibits. The following exhibits are filed as part of, or incorporated by reference into, this report.

Exhibit No.	Exhibit Title
3.1	Restated Certificate of Incorporation of the Company (Incorporated by reference to exhibit 3.1 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2003)
3.2	By-Laws of the Company as amended and restated effective March 13, 2018 (Incorporated by reference to exhibit 3.1 filed with the Company's Current Report on Form 8-K (file no. 001-11430) filed on March 19, 2018)
4.1	Specimen Certificate of Common Stock (Incorporated by reference to exhibit 4.1 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2003)
10.1	Asset Purchase Agreement, dated as of September 28, 1992, by and between Specialty Refractories Inc. and Quigley Company Inc. (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-51292), originally filed on August 25, 1992)
10.1(a)	Agreement dated October 22, 1992 between Specialty Refractories Inc. and Quigley Company Inc., amending Exhibit 10.1 (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-59510), originally filed on March 15, 1993)
10.1(b)	Letter Agreement dated October 29, 1992 between Specialty Refractories Inc. and Quigley Company Inc., amending Exhibit 10.1 (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-59510), originally filed on March 15, 1993)
10.2	Reorganization Agreement, dated as of September 28, 1992, by and between the Company and Pfizer Inc. (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-51292), originally filed on August 25, 1992)
10.3	Asset Contribution Agreement, dated as of September 28, 1992, by and between Pfizer Inc. and Specialty Minerals Inc. (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-51292), originally filed on August 25, 1992)
10.4	Asset Contribution Agreement, dated as of September 28, 1992, by and between Pfizer Inc. and Barretts Minerals Inc. (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-51292), originally filed on August 25, 1992)
10.4(a)	Agreement dated October 22, 1992 between Pfizer Inc, Barretts Minerals Inc. and Specialty Minerals Inc., amending Exhibits 10.3 and 10.4 (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-59510), originally filed on March 15, 1993)
10.5	Employment Agreement, dated December 13, 2016, between the Company and Douglas T. Dietrich (Incorporated by reference to exhibit 10.1 filed with the Company's Current Report on Form 8-K (file no. 001-11430) filed on December 16, 2016) (+)
10.6	Form of Employment Agreement between the Company and each of Brett Argirakis, Michael A. Cipolla, Matthew E. Garth, Jonathan J., Hastings, Andrew Jones, Douglas W. Mayger, Thomas J. Meek, and D.J. Monagle, III (Incorporated by reference to exhibit 10.6 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2016) (+)
10.7	Severance Agreement between the Company and Douglas T. Dietrich (Incorporated by reference to the exhibit 10.2 filed with the Company’s Current Report on form 8-K (file no. 001-11430) filed on December 16, 2016) (+)
10.8	Form of Severance Agreement between the Company and each of Brett Argirakis, Michael A. Cipolla, Matthew E. Garth, Jonathan J. Hastings, Andrew Jones, Douglas W. Mayger, Thomas J. Meek, and D.J. Monagle, III (Incorporated by reference to exhibit 10.8 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2016) (+)
10.9	

	Form of Indemnification Agreement between the Company and each of Brett Argirakis, Michael A. Cipolla, Douglas T. Dietrich, Matthew E. Garth, Jonathan J. Hastings, Andrew Jones, Douglas W. Mayger, Thomas J. Meek, D.J. Monagle III and each of the Company’s non-employee directors (Incorporated by reference to exhibit 10.1 filed with the Company's Current Report on Form 8-K (file no. 001-11430) filed on May 8, 2009) (+)
10.10	Company Employee Protection Plan, as amended August 27, 1999 (Incorporated by reference to exhibit 10.7 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2004) (+)
10.11	Company Nonfunded Deferred Compensation and Unit Award Plan for Non-Employee Directors, as amended and restated effective January 1, 2008 (Incorporated by reference to exhibit 10.8 filed with the Company's Quarterly Report on Form 10-Q (file no. 001-11430) for the quarter ended March 30, 2008) (+)
10.11(a)	First Amendment to the Company Nonfunded Deferred Compensation and Unit Award Plan for Non-Employee Directors, dated January 18, 2012 (Incorporated by reference to exhibit 10.11(a) filed with the Company’s Annual Report on Form 10-K (file no. 001-11430)for the year ended December 31, 2011) (+)
10.12	2015 Stock Award and Incentive Plan of the Company (Incorporated by reference to Appendix B to the Company’s 2015 Proxy Statement (file no. 001-11430) filed on April 2, 2015) (+)
10.13	Company Retirement Plan, as amended and restated, dated December 21, 2012 (Incorporated by reference to exhibit 10.12 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2012) (+)

10.13(a)	Second Amendment to Company Retirement Plan, as amended and restated, dated December 22, 2014 (Incorporated by reference to exhibit 10.13(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.13(b)	Third Amendment to Company Retirement Plan, as amended and restated, dated June 12, 2015 (Incorporated by reference to exhibit 10.2 filed with the Company's Quarterly Report on Form 10-Q (file no. 001-11430) for the quarter ended June 28, 2015)(+)
10.13(c)	Fourth Amendment to Company Retirement Plan, as amended and restated, dated December 16, 2016 (Incorporated by reference to exhibit 10.13(c) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2016)(+)
10.13(d)	Fifth Amendment to Company Retirement Plan, as amended and restated, dated December 6, 2017 (Incorporated by reference to exhibit 10.13(d) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2017)(+)
10.14	Company Supplemental Retirement Plan, amended and restated effective December 31, 2009 (Incorporated by reference to exhibit 10.13 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2009) (+)
10.14(a)	First Amendment to Company Supplemental Retirement Plan, as amended and restated, dated December 22, 2014 (Incorporated by reference to exhibit 10.14(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.15	Company Savings and Investment Plan, as amended and restated, dated December 21, 2012 (Incorporated by reference to exhibit 10.14 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2012) (+)
10.15(a)	Amendment to the Company Savings and Investment Plan, as amended and restated, dated December 5, 2013 (Incorporated by reference to exhibit 10.15(a) filed with the Company’s Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2013) (+)
10.15(b)	Amendment to the Company Savings and Investment Plan, as amended and restated, dated December 5, 2013 (Incorporated by reference to exhibit 10.15(b) filed with the Company’s Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2013) (+)
10.15(c)	Third Amendment to the Company Savings and Investment Plan, as amended and restated, dated December 22, 2014 (Incorporated by reference to exhibit 10.15(c) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.15(d)	Amendment to the Company Savings and Investment Plan, as amended and restated, dated December 31, 2015 (Incorporated by reference to exhibit 10.15(d) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2015)(+)
10.16	Company Supplemental Savings Plan, amended and restated effective December 31, 2009 (Incorporated by reference to exhibit 10.15 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2009) (+)
10.16(a)	Amendment to the Company Supplemental Savings Plan, dated December 28, 2011 (Incorporated by reference to exhibit 10.16(a) filed with the Company’s Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2011)(+)
10.16(b)	First Amendment to the Company Supplemental Savings Plan, dated December 22, 2014 (Incorporated by reference to exhibit 10.16(b) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.16(c)	Second Amendment to the Company Supplemental Savings Plan, dated December 22, 2014 (Incorporated by reference to exhibit 10.16(c) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.16(d)	Third Amendment to the Company Supplemental Savings Plan, dated December 16, 2016 (Incorporated by reference to exhibit 10.16(d) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2016)(+)
10.17	Company Health and Welfare Plan, effective as of April 1, 2003 and amended and restated as of January 1, 2006 (Incorporated by reference to exhibit 10.14 filed with the Company's Annual Report on Form 10-K

	(file no. 001-11430) for the year ended December 31, 2006)(+)
10.17(a)	Amendment to the Company Health and Welfare Plan, dated May 19, 2009 (Incorporated by reference to exhibit 10.16(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2009) (+)
10.17(b)	First Amendment to Company Health and Welfare Plan, dated December 22, 2014 (Incorporated by reference to exhibit 10.17(b) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.18	Company Retiree Medical Plan, effective as of January 1, 2011 (Incorporated by reference to exhibit 10.17 filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2010)(+)

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10.18(a)	First Amendment to Company Retiree Medical Plan, dated December 22, 2014 (Incorporated by reference to exhibit 10.18(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.19	Amended and Restated Grantor Trust Agreement, dated as of April 1, 2010, by and between the Company and the Wilmington Trust Company (Incorporated by reference to exhibit 10.1 filed with the Company's Quarterly Report on Form 10-Q (file no. 001-11430) for the period ended April 4, 2010)(+)
10.19(a)	Agreement and Amendment No. 1, dated October 1, 2017, to the Amended and Restated Grantor Trust Agreement, dated as of April 1, 2010, by and between the Company and the Wilmington Trust Company (Incorporated by reference to exhibit 10.19(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2017)(+)
10.20	AMCOL International Corporation Nonqualified Deferred Compensation Plan, as amended (Incorporated by reference to exhibit 10.1 filed with the Annual Report on Form 10-K for the year ended December 31, 2008 of AMCOL International Corporation (file no. 0-15661)) (+)
10.20(a)	First Amendment to AMCOL International Corporation Nonqualified Deferred Compensation Plan, as amended, dated December 22, 2014 (Incorporated by reference to exhibit 10.20(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.20(b)	Third Amendment to the AMCOL International Corporation Nonqualified Deferred Compensation Plan, as amended, dated August 21, 2015 (Incorporated by reference to exhibit 10.1 filed with the Company's Quarterly Report on Form 10-Q (file no. 001-11430) for the quarter ended September 27, 2015)(+)
10.21	AMCOL International Corporation Amended and Restated Supplementary Pension Plan for Employees (Incorporated by reference to the exhibit 10.6 filed with the Annual Report on Form 10-K for the year ended December 31, 2008 of AMCOL International Corporation (file no. 0-15661)) (+)
10.21(a)	First Amendment to AMCOL International Corporation Amended and Restated Supplementary Pension Plan for Employees, dated December 22, 2014 (Incorporated by reference to exhibit 10.21(a) filed with the Company's Annual Report on Form 10-K (file no. 001-11430) for the year ended December 31, 2014)(+)
10.21(b)	Second Amendment to Amended and Restated Supplementary Pension Plan for Employees of AMCOL International Corporation, dated August 21, 2015 (Incorporated by reference to exhibit 10.2 filed with the Company's Quarterly Report on Form 10-Q (file no. 001-11430) for the quarter ended September 27, 2015)(+)
10.22	Third Amendment, dated as of April 18, 2018, to the Credit Agreement, dated as of May 9, 2014, among Minerals Technologies Inc., the subsidiary borrowers party thereto, the lenders party thereto, JPMorgan Chase Bank, N.A., as administrative agent and collateral agent , and the other agents party thereto, JPMorgan Chase Bank, N.A., as administrative agent and collateral agent, and the other agents party thereto (Incorporated by reference to the exhibit 10.1 filed with the Company's Current Report on Form 8-K (file no. 001-11430) filed on April 20, 2018)
10.23	Indenture, dated July 22, 1963, between the Cork Harbour Commissioners and Roofchrome Limited (Incorporated by reference to the exhibit so designated filed with the Company's Registration Statement on Form S-1 (Registration No. 33-51292), originally filed on August 25, 1992)
21.1	Subsidiaries of the Company (*)
23.1	Consent of Independent Registered Public Accounting Firm (*)
24	Power of Attorney (*)
31.1	Rule 13a-14(a)/15d-14(a) Certification executed by the Company's principal executive officer (*)
31.2	Rule 13a-14(a)/15d-14(a) Certification executed by the Company's principal financial officer (*)
32	Section 1350 Certification (*)
95	Information Concerning Mine Safety Violations (*)

(*) Filed herewith.

(+) Management contract or compensatory plan or arrangement required to be filed pursuant to Item 601 of Regulation S-K.

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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.

By:/s/ Douglas T. Dietrich
Douglas T. Dietrich
Chief Executive Officer

February 15, 2019

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 in the capacities and on the dates indicated:

SIGNATURE	TITLE	DATE
/s/ Douglas T. Dietrich Douglas T. Dietrich	Chief Executive Officer (Principal Executive Officer)	February 15, 2019
/s/ Matthew E. Garth Matthew E. Garth	Senior Vice President – Finance and Treasury, Chief Financial Officer (Principal Financial Officer)	February 15, 2019
/s/ Michael A. Cipolla Michael A. Cipolla	Vice President – Controller and Chief Accounting Officer (Principal Accounting Officer)	February 15, 2019
* Joseph C. Breunig	Director	February 15, 2019
* John J. Carmola	Director	February 15, 2019
* Robert L. Clark	Director	February 15, 2019
/s/ Douglas T. Dietrich Douglas T. Dietrich	Director	February 15, 2019
* Duane R. Dunham	Chairman and Director	February 15, 2019
* Franklin L. Feder	Director	February 15, 2019
* Carolyn K. Pittman	Director	February 15, 2019
* Marc E. Robinson	Director	February 15, 2019
*	Director	February 15, 2019

Donald C. Winter

*By: /s/ Thomas J. Meek
Thomas J. Meek
Attorney-in-Fact

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
CONSOLIDATED BALANCE SHEETS

	December 31,	
(millions of dollars, except share and per share amounts)	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	$208.8	$212.2
Short-term investments, at cost which approximates market	3.8	2.7
Accounts receivable, less allowance for doubtful accounts – $3.2 in 2018; $4.2 in 2017	387.3	383.0
Inventories	239.2	219.3
Prepaid expenses	32.0	30.1
Other current assets	5.2	4.9
Total current assets	876.3	852.2
Property, plant and equipment, less accumulated depreciation and depletion	1,102.9	1,061.3
Goodwill	812.4	779.3
Intangible assets	214.1	196.5
Deferred income taxes	26.3	25.6
Other assets and deferred charges	55.1	55.5
Total assets	$3,087.1	$2,970.4
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current liabilities:		
Short-term debt	$105.2	$6.3
Current maturities of long-term debt	3.3	3.8
Accounts payable	169.1	179.0
Income tax payable	1.6	8.4
Accrued compensation and related items	48.1	55.4
Other current liabilities	54.6	57.1
Total current liabilities	381.9	310.0
Long-term debt, net of unamortized discount and deferred financing costs	907.8	959.8
Deferred income taxes	196.8	159.4
Accrued pension and postretirement benefits	124.2	155.0
Other non-current liabilities	91.1	107.1
Total liabilities	1,701.8	1,691.3
Shareholders' equity:		
Preferred stock, without par value; 1,000,000 shares authorized; none issued	—	—
Common stock, par value at $0.10 per share; 100,000,000 shares authorized; Issued 48,793,918 shares in 2018 and 48,644,736 shares in 2017	4.9	4.9
Additional paid-in capital	431.9	422.7
Retained earnings	1,769.1	1,607.2
Accumulated other comprehensive loss	(233.7)	(186.1)
Less common stock held in treasury, at cost; 13,603,575 shares in 2018 and 13,270,391 shares in 2017	(618.7)	(597.0)

Total Minerals Technologies Inc. shareholders' equity	1,353.5	1,251.7
Non-controlling interests	31.8	27.4
Total shareholders' equity	1,385.3	1,279.1
Total liabilities and shareholders' equity	$3,087.1	$2,970.4

See Notes to Consolidated Financial Statements, which are an integral part of these statements.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
CONSOLIDATED STATEMENTS OF INCOME

	Year Ended December 31,		
(millions of dollars, except per share data)	2018	2017	2016
Product sales	$1,729.3	$1,599.0	$1,552.1
Service revenue	78.3	76.7	85.9
Total net sales	1,807.6	1,675.7	1,638.0
Cost of goods sold	1,293.3	1,158.5	1,117.7
Cost of service revenue	52.9	50.0	59.9
Total cost of sales	1,346.2	1,208.5	1,177.6
Production margin	461.4	467.2	460.4
Marketing and administrative expenses	178.6	180.7	176.4
Research and development expenses	22.7	23.7	23.8
Acquisition related transaction and integration costs	1.7	3.4	8.0
Restructuring and other items, net	2.5	15.0	28.3
Income from operations	255.9	244.4	223.9
Interest expense, net	(45.9)	(43.4)	(54.4)
Debt modification costs and fees	—	(3.9)	—
Non-cash pension settlement costs	(4.4)	—	—
Other non-operating income (deductions), net	(1.5)	(6.2)	0.8
Total non-operating deductions, net	(51.8)	(53.5)	(53.6)
Income from operations before tax and equity in earnings	204.1	190.9	170.3
Provision (benefit) for taxes on income	34.4	(6.6)	35.3
Equity in earnings of affiliates, net of tax	3.5	1.5	2.1
Consolidated net income	173.2	199.0	137.1
Less:			
Net income attributable to non-controlling interests	4.2	3.9	3.7
Net income attributable to Minerals Technologies Inc.	$169.0	$195.1	$133.4
Earnings per share:			
Basic:			
Income from operations attributable to Minerals Technologies Inc.	$4.79	$5.54	$3.82
Diluted:			
Income from operations attributable to Minerals Technologies Inc.	$4.75	$5.48	$3.79
Cash dividends declared per common share	$0.20	$0.20	$0.20
Shares used in computation of earnings per share:			
Basic	35.3	35.2	34.9
Diluted	35.6	35.6	35.2

See Notes to Consolidated Financial Statements, which are an integral part of these statements.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Consolidated net income	$173.2	$199.0	$137.1
Other comprehensive income (loss), net of tax:			
Foreign currency translation adjustments	(67.9)	44.7	(40.2)
Pension and postretirement plan adjustments	16.9	(8.5)	(3.2)
Unrealized gains on cash flow hedges	1.6	0.3	1.6
Total other comprehensive income (loss), net of tax	(49.4)	36.5	(41.8)
Total comprehensive income including non-controlling interests	123.8	235.5	95.3
Less: Net income attributable to non-controlling interests	4.2	3.9	3.7
Less: Foreign currency translation adjustments attributable to non-controlling interests	(1.8)	1.5	(1.6)
Comprehensive income attributable to non-controlling interests	2.4	5.4	2.1
Comprehensive income attributable to Minerals Technologies Inc.	$121.4	$230.1	$93.2

See Notes to Consolidated Financial Statements, which are an integral part of these statements.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Operating Activities:			
Consolidated net income	$173.2	$199.0	$137.1
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation, depletion and amortization	94.3	91.0	91.9
Loss on disposal of property, plant and equipment	2.8	1.8	1.9
Deferred income taxes	15.4	(76.1)	(10.9)
Pension amortization and settlement loss	13.4	7.4	7.9
Provision for bad debts	3.2	3.8	6.2
Stock-based compensation	6.2	8.1	6.3
Asset impairment charge	0.7	5.3	18.5
Non-cash debt modification costs	—	1.8	—
Other non-cash items	(3.5)	(1.7)	(3.1)
Changes in operating assets and liabilities			
Accounts receivable	(3.0)	(27.3)	(4.9)
Inventories	(14.7)	(25.2)	3.1
Pension plan funding	(24.2)	(10.8)	(10.5)
Accounts payable	(11.2)	28.0	(4.8)
Restructuring liabilities	(4.9)	4.5	(4.3)
Income taxes payable	(7.4)	(12.6)	5.4
Prepaid expenses and other	(36.7)	10.6	(14.7)
Net cash provided by operating activities	203.6	207.6	225.1
Investing Activities:			
Purchases of property, plant and equipment	(75.9)	(76.7)	(62.4)
Acquisition of business, net of cash acquired	(122.5)	—	—
Proceeds from sale of assets	0.9	1.4	1.4
Purchases of short-term investments	(7.7)	(4.5)	(6.7)
Proceeds from sale of short-term investments	6.1	3.8	8.0
Other investing activities	(0.9)	(1.5)	(1.9)
Net cash used in investing activities	(200.0)	(77.5)	(61.6)
Financing Activities:			
Debt issuance costs	(1.5)	—	—
Proceeds from issuance of long-term debt	—	—	7.2
Repayment of long-term debt	(66.3)	(118.9)	(193.2)
Proceeds from issuance of short-term debt	113.0	—	—
Repayment of short-term debt	(14.0)	(0.2)	(0.1)
Purchase of common shares for treasury	(21.7)	(0.7)	(2.6)
Proceeds from issuance of stock under option plan	3.0	14.6	5.5
Excess tax benefits related to stock incentive programs	(3.1)	(3.6)	0.3

Dividends paid to non-controlling interests	(1.8)	(2.4)	(4.9)
Capital contribution by non-controlling interests	3.7	—	—
Cash dividends paid	(7.1)	(7.0)	(7.0)
Net cash used in financing activities	4.2	(118.2)	(194.8)
Effect of exchange rate changes on cash and cash equivalents	(11.2)	11.8	(9.6)
Net increase (decrease) in cash and cash equivalents	(3.4)	23.7	(40.9)
Cash and cash equivalents at beginning of period	212.2	188.5	229.4
Cash and cash equivalents at end of period	$208.8	$212.2	$188.5
Supplemental disclosure of cash flow information:			
Non-cash financing activities			
Treasury stock purchases settled after period end	$0.3	$—	$—

See Notes to Consolidated Financial Statements, which are an integral part of these statements.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

	Equity Attributable to MTI						
(millions of dollars)	Common Stock	Additional Paid-in Capital	Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Treasury Stock	Non-controlling Interests	Total
Balance as of December 31, 2015	$4.8	$ 387.6	$1,292.7	$ (180.9)	$(593.7)	$ 27.2	$937.7
Net income	—	—	133.4	—	—	3.7	137.1
Other comprehensive income (loss)	—	—	—	(40.2)	—	(1.6)	(41.8)
Dividends declared	—	—	(7.0)	—	—	—	(7.0)
Dividends to non-controlling interests	—	—	—	—	—	(4.9)	(4.9)
Issuance of shares pursuant to employee stock compensation plans	—	5.5	—	—	—	—	5.5
Income tax benefit arising from employee stock compensation plans	—	0.6	—	—	—	—	0.6
Purchase of common stock for treasury	—	—	—	—	(2.6)	—	(2.6)
Stock-based compensation	—	6.3	—	—	—	—	6.3
Balance as of December 31, 2016	$4.8	$ 400.0	$1,419.1	$ (221.1)	$(596.3)	$ 24.4	$1,030.9
Net income	—	—	195.1	—	—	3.9	199.0
Other comprehensive income (loss)	—	—	—	35.0	—	1.5	36.5
Dividends declared	—	—	(7.0)	—	—	—	(7.0)
Dividends to non-controlling interests	—	—	—	—	—	(2.4)	(2.4)
Issuance of shares pursuant to employee stock compensation plans	0.1	14.6	—	—	—	—	14.7
Purchase of common stock for treasury	—	—	—	—	(0.7)	—	(0.7)
Stock-based compensation	—	8.1	—	—	—	—	8.1
Balance as of December 31, 2017	$4.9	$ 422.7	$1,607.2	$ (186.1)	$(597.0)	$ 27.4	$1,279.1
Net income	—	—	169.0	—	—	4.2	173.2
Other comprehensive income (loss)	—	—	—	(47.6)	—	(1.8)	(49.4)
Dividends declared	—	—	(7.1)	—	—	—	(7.1)
Dividends to non-controlling interests	—	—	—	—	—	(1.8)	(1.8)
Acquisition of non-controlling interests	—	—	—	—	—	0.1	0.1
Capital contribution from non-controlling interests	—	—	—	—	—	3.7	3.7
Issuance of shares pursuant to employee stock compensation plans	—	3.0	—	—	—	—	3.0
Purchase of common stock for treasury	—	—	—	—	(21.7)	—	(21.7)
Stock-based compensation	—	6.2	—	—	—	—	6.2
Balance as of December 31, 2018	$4.9	$ 431.9	$1,769.1	$ (233.7)	$(618.7)	$ 31.8	$1,385.3

See Notes to Consolidated Financial Statements, which are an integral part of these statements.

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MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Note 1. Summary of Significant Accounting Policies

Business

The Company is a resource- and technology-based company that develops, produces and markets on a worldwide basis a broad range of specialty mineral, mineral-based and synthetic mineral products and supporting systems and services.

Basis of Presentation

The accompanying consolidated financial statements include the accounts of Minerals Technologies Inc. (the "Company"), its wholly and majority-owned subsidiaries, as well as variable interest entities for which the Company is the primary beneficiary. All intercompany balances and transactions have been eliminated in consolidation.

Use of Estimates

The Company employs accounting policies that are in accordance with U.S. generally accepted accounting principles and require management to make estimates and assumptions relating to the reporting of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenue and expenses during the reported period. Significant estimates include those related to revenue recognition, valuation of long-lived assets, goodwill and other intangible assets, pension plan assumptions, income tax, and litigation and environmental liabilities. Actual results could differ from those estimates.

Cash Equivalents and Short-term Investments

The Company considers all highly liquid investments with original maturities of three months or less to be cash equivalents. Short-term investments consist of financial instruments, mainly bank deposits, with original maturities beyond three months, but less than twelve months. Short-term investments amounted to $3.8 million and $2.7 million at December 31, 2018 and 2017, respectively. There were no unrealized holding gains and losses on the short-term bank investments held at December 31, 2018.

Trade Accounts Receivable

Trade accounts receivables are recorded at the invoiced amount and do not bear interest. The allowance for doubtful accounts is the Company's best estimate of the amount of probable credit losses in the Company's existing accounts receivable. The Company determines the allowance based on historical write-off experience and specific allowances for bankrupt customers. The Company also analyzes the collection history and financial condition of its other customers, considering current industry conditions and determines whether an allowance needs to be established. The Company reviews its allowance for doubtful accounts monthly. Past due balances over 90 days based on payment terms are reviewed individually for collectability. Account balances are charged off against the allowance after all means of collection have been exhausted and the potential for recovery is considered remote. The Company does not have any off-balance-sheet credit exposure related to its customers.

Inventories

Inventories are valued at the lower of cost or market. Cost is determined by the first-in, first-out (FIFO) method.

Additionally, items such as idle facility expense, excessive spoilage, freight handling costs, and re-handling costs are recognized as current period charges. The allocation of fixed production overheads to the costs of conversion are based upon the normal capacity of the production facility. Fixed overhead costs associated with idle capacity are expensed as incurred.

Property, Plant and Equipment

Property, plant and equipment are recorded at cost. Significant improvements are capitalized, while maintenance and repair expenditures are charged to operations as incurred. The Company capitalizes interest cost as a component of construction in progress. The straight-line method of depreciation is used for substantially all of the assets for financial reporting purposes, except for mining related equipment which uses units-of-production method. The annual rates of depreciation are 3% - 6.67% for buildings, 6.67% - 12.5% for machinery and equipment, 8% - 12.5% for furniture and fixtures and 12.5% - 25% for computer equipment and software-related assets. The estimated useful lives of our PCC production facilities and machinery and equipment pertaining to our natural stone mining and processing plants and our chemical plants are 15 years.

Property, plant and equipment are depreciated over their useful lives. Useful lives are based on management's estimates of the period that the assets can generate revenue, which does not necessarily coincide with the remaining term of a customer's contractual obligation to purchase products made using those assets. The Company's sales of PCC are predominantly pursuant to long-term evergreen contracts, initially ten years in length, with paper mills at which the Company operates satellite PCC plants. The terms of many of these agreements have been extended, often in connection with an expansion of the satellite PCC plant. Failure of a PCC customer to renew an agreement or continue to purchase PCC from a Company facility could result in an impairment of assets charge or accelerated depreciation at such facility.

Depletion of mineral reserves is determined on a unit-of-extraction basis for financial reporting purposes, based upon proven and probable reserves, and generally on a percentage depletion basis for tax purposes.

Stripping Costs Incurred During Production

Stripping costs are those costs incurred for the removal of waste materials for the purpose of accessing ore body that will be produced commercially. Stripping costs incurred during the production phase of a mine are variable costs that are included in the costs of inventory produced during the period that the stripping costs are incurred.

Accounting for the Impairment of Long-Lived Assets

Long-lived assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. If events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable, the Company estimates the undiscounted future cash flows (excluding interest), resulting from the use of the asset and its ultimate disposition. If the sum of the undiscounted cash flows (excluding interest) is less than the carrying value, the Company recognizes an impairment loss, measured as the amount by which the carrying value exceeds the fair value of the asset, determined principally using discounted cash flows.

Goodwill and Other Intangible Assets

Goodwill represents the excess of purchase price and related costs over the value assigned to the net tangible and identifiable intangible assets of businesses acquired. Goodwill is not amortized, but instead assessed for impairment. Intangible assets with estimable useful lives are amortized on a straight-line basis over their respective estimated lives to the estimated residual values, and reviewed for impairment.

The Company performs a qualitative assessment for each of its reporting units to determine if the two step process for impairment testing is required. If the Company determines that it is more likely than not that the fair value of a reporting unit is less than its carrying amount, the Company would then evaluate the recoverability of goodwill using a two-step impairment test approach at the reporting unit level. In the first step, the fair value for the reporting unit is compared to its book value including goodwill. In the case that the fair value of the reporting unit is less than book value, a second step is performed which compares the fair value of the reporting unit's goodwill to the book value of the goodwill. The fair value for the goodwill is determined based on the difference between the fair values of the reporting unit and the net fair values of the identifiable assets and liabilities of such reporting unit. If the fair value of the goodwill is less than the book value, the difference is recognized as impairment.

Investment in Joint Ventures

The Company uses the equity method of accounting to incorporate the results of its investments in companies in which it has significant influence but does not control; and cost method of accounting in companies in which it cannot exercise significant control. The Company records the equity in earnings of its investments in joint ventures on a one-month lag. At December 31, 2018, the book value of the Company's equity method investments was $17.8 million.

Accounting for Asset Retirement Obligations

The Company provides for obligations associated with the retirement of long-lived assets and the associated asset retirement costs. The fair value of a liability for an asset retirement obligation is recognized in the period in which it is incurred if a reasonable estimate of fair value can be made. The associated asset retirement costs are capitalized as part of the carrying amount of the long-lived asset. The Company also provides for legal obligations to perform asset retirement activities where timing or methods of settlement are conditional on future events.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

The Company also records liabilities related to land reclamation as a part of the asset retirement obligations. The Company mines land for various minerals using a surface-mining process that requires the removal of overburden. In many instances, the Company is obligated to restore the land upon completion of the mining activity. As the overburden is removed, the Company recognizes this liability for land reclamation based on the estimated fair value of the obligation. The obligation is adjusted to reflect the passage of time and changes in estimated future cash outflows.

Fair Value of Financial Instruments

The recorded amounts of cash and cash equivalents, receivables, short-term borrowings, accounts payable, accrued interest, and variable-rate long-term debt approximate fair value because of the short maturity of those instruments or the variable nature of underlying interest rates. Short-term investments are recorded at cost, which approximates fair market value.

Derivative Financial Instruments

The Company records derivative financial instruments which are used to hedge certain foreign exchange risk at fair value on the balance sheet. See Note 11 for a full description of the Company's hedging activities and related accounting policies.

Revenue Recognition

Revenue is recognized at the point in time when the customer obtains control of the promised goods or services in an amount that reflects the consideration we expect to receive in exchange for those goods or services. The Company's revenues are primarily derived from the sale of products. Our primary performance obligation is satisfied upon shipment or delivery to our customer based on written sales terms, which is also when control is transferred. Revenues from sales of equipment are recorded upon completion of installation and transfer of control to the customer. Revenues from services are recorded when the services are performed.

In most of our PCC contracts, the price per ton is based upon the total number of tons sold to the customer during the year. Under those contracts, the price billed to the customer for shipments during the year is based on periodic estimates of the total annual volume that will be sold to the customer. Revenues are adjusted at the end of each year to reflect the actual volume sold. There were no significant revenue adjustments in the fourth quarter of 2018 and 2017, respectively. We have consignment arrangements with certain customers in our Refractories segment. Revenues for these transactions are recorded when the consigned products are consumed by the customer.

Revenues within our Energy Services segment is service based. Certain contracts within this segment are long-term contracts. Revenue where our performance obligations are satisfied in phases is recognized over time using certain input measures based on the measurement of the value transferred to the customer, including milestones achieved.

Foreign Currency

The assets and liabilities of the Company's international subsidiaries are translated into U.S. dollars using exchange rates at the respective balance sheet date. The resulting translation adjustments are recorded in accumulated other comprehensive income (loss) in shareholders' equity. Income statement items are generally translated at monthly average exchange rates prevailing during the period. International subsidiaries operating in highly inflationary economies translate non-monetary assets at historical rates, while net monetary assets are translated at current rates, with the resulting translation adjustments included in net income. At December 31, 2018, the Company had no international subsidiaries operating in highly inflationary economies.

Income Taxes

Deferred tax assets and liabilities are recognized for the estimated future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates in effect for the year in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

The Company operates in multiple taxing jurisdictions, both within the U.S. and outside the U.S. In certain situations, a taxing authority may challenge positions that the Company has adopted in its income tax filings. The Company regularly assesses its tax position for such transactions and includes reserves for those differences in position. The reserves are utilized or reversed once the statute of limitations has expired or the matter is otherwise resolved.

The application of income tax law is inherently complex. Laws and regulations in this area are voluminous and are often ambiguous. As such, we are required to make many subjective assumptions and judgments regarding our income tax exposures. Interpretations of and guidance surrounding income tax laws and regulations change over time. As such, changes in our subjective assumptions and judgments can materially affect amounts recognized in the consolidated balance sheets and statements of operations. The Company's accounting policy is to recognize interest and penalties as part of its provision for income taxes. See Note 7 for additional detail on our uncertain tax positions.

The accompanying financial statements do not include a provision for foreign withholding taxes on international subsidiaries' unremitted earnings, which are expected to be permanently reinvested overseas.

Research and Development

Research and development costs are expensed as incurred.

Accounting for Stock-Based Compensation

The Company recognizes compensation expense for share-based awards based upon the grant date fair value over the vesting period.

Pension and Post-retirement Benefits

The Company has defined benefit pension plans covering the majority of its employees. The benefits are generally based on years of service and an employee's modified career earnings.

The Company also provides post-retirement healthcare benefits for the majority of its retirees and employees in the United States. The Company measures the costs of its obligation based on its best estimate. The net periodic costs are recognized as employees render the services necessary to earn the post-retirement benefits.

Environmental

Expenditures that relate to current operations are expensed or capitalized as appropriate. Expenditures that relate to an existing condition caused by past operations and which do not contribute to current or future revenue generation are expensed. Liabilities are recorded when it is probable the Company will be obligated to pay amounts for environmental site evaluation, remediation or related costs, and such amounts can be reasonably estimated.

Earnings Per Share

Basic earnings per share have been computed based upon the weighted average number of common shares outstanding during the period.

Diluted earnings per share have been computed based upon the weighted average number of common shares outstanding during the period assuming the issuance of common shares for all potentially dilutive common shares outstanding.

Subsequent Events

The Company has evaluated for subsequent events through the date of issuance of its financial statements.

Recently Issued Accounting Standards

Changes to accounting principles generally accepted in the United States of America (U.S. GAAP) are established by the Financial Accounting Standards Board (FASB) in the form of accounting standards updates (ASUs) to the FASB's Accounting Standards Codification. The Company considers the applicability and impact of all ASUs. ASUs not listed below were assessed and determined to be either not applicable or are expected to have minimal impact on our consolidated financial position and results of operations.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Leases

In February 2016, the FASB issued ASU 2016-02, “Leases”, which requires lessees to recognize most leases on their balance sheets as lease liabilities with corresponding right-of-use ("ROU") assets. Lessor accounting remains substantially similar to current U.S. GAAP. ASU 2016-02 is effective for public business entities for annual and interim periods in fiscal years beginning after December 15, 2018 with early adoption permitted. ASU 2016-02 mandates a modified retrospective transition method for all entities, applying the new lease standard to all leases existing at the date of initial application. The Company has adopted this new standard effective January 1, 2019 using the effective date as our date of initial application. As such, financial information and required disclosures will not be provided for dates prior to January 1, 2019. The new standard provides a number of optional practical expedients in transition. We have elected the ‘package of practical expedients’, which permits us not to reassess under the new standard our prior conclusions about lease identification, lease classification and initial direct costs. The new standard also provides practical expedients for an entity’s ongoing accounting. We have elected the short-term lease recognition exemption for all leases that qualify. On adoption, we currently expect to recognize additional operating liabilities between $60 million to $65 million with corresponding ROU assets ranging from $50 million to $55 million based on the present value of the remaining lease payments under existing operating leases. The adoption of this standard will not have a material impact on the Company's financial statements.

Intangibles – Goodwill and Other

In January 2017, the FASB issued ASU 2017-04, "Intangibles-Goodwill and Other: Simplifying the Test for Goodwill Impairment", which no longer requires an entity to perform a hypothetical purchase price allocation to measure goodwill impairment. Instead, goodwill will be measured using the difference between the carrying amount and the fair value of the reporting unit. The standard is effective for the interim and annual periods beginning on or after December 15, 2019, with early adoption permitted. The Company will adopt this standard on January 1, 2020. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income

In February 2018, the FASB issued ASU 2018-02, "Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income", which allows a reclassification from accumulated other comprehensive income to retained earnings for stranded tax effects resulting from the U.S. Tax Cuts and Jobs Act. The standard is effective for the interim and annual periods beginning after December 15, 2018, with early adoption permitted. We have adopted this standard effective January 1, 2019. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Retirement Benefits

In August 2018, the FASB issued ASU 2018-14, "Compensation – Retirement Benefits – Defined Benefit Plans – General: Disclosure Framework – Changes to the Disclosure Requirements for Defined Benefit Plans," which removes disclosures that no longer are considered cost beneficial, clarifies the specific requirements of certain disclosures and adds disclosure requirements identified as relevant. The standard is effective for annual periods beginning after December 15, 2020, with early adoption permitted. The Company will adopt this standard on January 1, 2021. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Fair Value Measurement

In August 2018, the FASB issued ASU 2018-13, "Fair Value Measurement: Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement," which eliminates, amends and adds disclosure requirements for fair value measurement. The standard is effective for the interim and annual periods beginning after December 15, 2019, with early adoption permitted. The Company will adopt this standard on January 1, 2020. The adoption of this standard is not expected to have a material impact on the Company's financial statements.

Adoption of ASU 2014-09 Revenue from Contracts with Customers

On January 1, 2018, the Company adopted the provisions of ASU No. 2014-09, “Revenue from Contracts with Customers”. The underlying principle is that an entity will recognize revenue to depict the transfer of goods or services to customers at an amount that the entity expects to be entitled to in exchange for those goods or services. The standard provides a five-step analysis of transactions to determine when and how revenue is recognized. The standard also requires enhanced disclosures regarding the nature, amount, timing and uncertainty of revenue and cash flows arising from an entity’s contracts with customers. The Company has elected to use the cumulative effect transition method and there has not been a change to our previously reported financial results.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Under accounting standards codification (ASC 606), revenue is recognized when a customer obtains control of promised goods or services in an amount that reflects the consideration we expect to receive in exchange for those goods or services. We measure revenue based on the consideration specified in the customer arrangement and revenue is recognized when the performance obligations in the customer arrangement are satisfied. A performance obligation is a promise in a contract to transfer a distinct good or service to the customer. The transaction price of a contract is allocated to each distinct performance obligation and recognized as revenue when or as, the customer receives the benefit of the performance obligation. Customers typically receive the benefit as goods are delivered and services are performed.

We utilized a comprehensive approach to assess the impact of the standard on our contract portfolio by reviewing our current accounting policies and practices to identify potential differences that would result from applying the new requirements to our revenue contracts, including evaluation of our performance obligations, principal versus agent considerations and variable consideration. We recognize revenue when our performance obligation is satisfied. See Note 2 to the Consolidated Financial Statements.

Adoption of ASU 2017-07 Compensation - Retirement Benefits: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost

On January 1, 2018, the Company adopted the provisions of ASU 2017-07, “Compensation – Retirement Benefits: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost”, which requires companies to present the service cost component of the net benefit cost in the same line items in which they report compensation cost. All other components of net periodic benefit cost will be presented outside operating income. The provisions have been applied retrospectively for the income statement presentation requirements. Prior to the adoption of the standard, the Company classified all net periodic benefit costs within operating costs, primarily within “Marketing and administrative expenses” on the Consolidated Statements of Income. The line item classification changes required by the standard did not impact the Company’s pre-tax earnings or net income; however, “Income from operations” and “Other non-operating income (deductions), net” changed by immaterial offsetting amounts. As a result of the accounting change, the Company reclassified approximately $1.7 million and $3.0 million from marketing and administrative expenses to other non-operating deductions for the years ended December 31, 2017 and 2016, respectively, to conform to the current year presentation.

Adoption of ASU 2017-12 Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities

On January 1, 2018, the Company early adopted the provisions of ASU 2017-12, “Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities,” which improves and simplifies existing standard to allow companies to better reflect their risk management activities in the financial statements. The standard expands the ability to hedge nonfinancial and financial risk components, eliminates the requirement to separately measure and recognize hedge ineffectiveness and eases requirements of an entity’s assessment of hedge effectiveness. The adoption of this standard did not have an impact on the Company’s financial statements.

Adoption of ASU 2017-01 Business Combinations

On January 1, 2018, the Company adopted the provisions of ASU 2017-01, “Business Combinations,” which clarifies the definition of a business with the objective of adding guidance to assist entities with evaluating whether transactions should be accounted for as acquisitions (or disposals) of assets or businesses. The definition of a business affects many areas of accounting including acquisitions, disposals, goodwill, and consolidation. The adoption of this new standard did not have an impact on the Company’s financial statements.

Note 2. Revenue from Contracts with Customers

The Company's revenues are primarily derived from the sale of products in product lines within our Performance Materials, Specialty Minerals, Refractories and Energy Services businesses. Our primary performance obligation (the sale of products) is satisfied upon shipment or delivery to our customers based on written sales terms, which is also when control is transferred. In most of our contracts in our Paper PCC product line, which is in our Specialty Minerals segment, the price per ton is based upon the total number of tons sold to the customer during the year. Under these contracts, the price billed to the customer for shipments during the year is based on periodic estimates of the total annual volume that will be sold to such customer. Revenues are adjusted at the end of each year to reflect the actual volume sold. The Company also has consignment arrangements with certain customers in our Refractories segment. Revenues for these transactions are recorded when the consigned products are consumed by the customer and control is transferred to the customer.

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Revenue from sales of equipment, primarily in our Refractory products product line within our Refractories segment, is recorded upon completion of installation and control is transferred to the customer. Revenue from services is recorded when the services have been performed. Included within our Refractory products product line are certain consignment arrangements with certain customers in our Refractories segment. Revenues for these transactions are recorded when the consigned products are consumed by the customer and control is transferred.

Revenue from long-term construction, primarily in our Energy Services segment, where our performance obligations are satisfied in phases, is recognized over time using certain input measures based on the measurement of the value transferred to the customer, including milestones achieved.

The following table disaggregates our revenue by major source (product line) for the years ended December 31, 2018, 2017 and 2016:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Net Sales			
Metalcasting	$328.9	$294.3	$258.0
Household, Personal Care and Specialty Products	248.8	169.6	171.2
Environmental Products	80.3	67.7	78.9
Building Materials	70.4	78.2	74.1
Basic Minerals	99.7	125.0	103.9
Performance Materials	828.1	734.8	686.1
Paper PCC	378.5	377.7	387.9
Specialty PCC	66.9	66.0	64.3
Ground Calcium Carbonate	91.0	87.3	83.6
Talc	52.9	53.8	55.7
Specialty Minerals	589.3	584.8	591.5
Refractory Products	261.1	226.9	219.0
Metallurgical Products	50.8	52.5	55.5
Refractories	311.9	279.4	274.5
Energy Services	78.3	76.7	85.9
Total	$1,807.6	$1,675.7	$1,638.0

Note 3. Business Combination

On April 30, 2018, the Company completed the acquisition of Sivomatic Holding B.V. (“Sivomatic”), a leading European supplier of premium pet litter products. Sivomatic is a vertically integrated manufacturer, with production facilities in the Netherlands, Austria and Turkey. With a leading position in premier clumping products, Sivomatic’s product portfolio spans the range of pet litter derived from bentonite, sourced predominantly from wholly-owned mines in Turkey. The results of Sivomatic are included in our Performance Materials segment. Sivomatic sales of $61.8 million are included in the Company's consolidated results for the year ended December 31, 2018. The acquisition was financed through a combination of cash on hand and borrowings under the Company’s credit facilities. The fair value of the total consideration transferred, net of cash acquired, was $122.5 million.

The acquisition has been accounted for using the acquisition method of accounting, which requires, among other things, that we recognize the assets acquired and liabilities assumed at their respective fair values as of the acquisition date. As of December 31, 2018, the purchase price allocation remains preliminary as the Company completes its assessment of property, mineral rights, certain reserves including environmental, legal and tax matters, obligations, intangible assets, taxes payable, impact of foreign exchange and deferred taxes, as well as complete our review of Sivomatic's existing accounting policies.

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The following table summarizes the Company’s preliminary purchase price allocation for the Sivomatic acquisition as of December 31, 2018, as compared with the allocation previously reported on the Company's Form 10-Q for the quarter ended July 1, 2018:

(millions of dollars)	Preliminary Allocation Previously Reported on Form 10-Q as of July 1, 2018	Increase/ (Decrease)	Allocation as of December 31, 2018
Accounts receivable	$ 24.4	$ —	$ 24.4
Inventories	15.6	—	15.6
Other current assets	0.6	—	0.6
Mineral rights	35.0	4.7	39.7
Plant, property and equipment	38.0	(9.7)	28.3
Goodwill	32.4	2.6	35.0
Intangible assets	20.0	6.4	26.4
Total assets acquired	166.0	4.0	170.0
Current maturity of long-term debt	5.7	—	5.7
Accounts payable	9.0	—	9.0
Accrued expenses	5.8	(0.2)	5.6
Long-term debt	5.1	0.2	5.3
Non-current deferred tax liability	16.2	3.5	19.7
Other non-current liabilities	0.1	2.1	2.2
Total liabilities assumed	41.9	5.6	47.5
Net assets acquired	$ 124.1	$ (1.6)	$ 122.5

The Company used the income, market, or cost approach (or a combination thereof) for the preliminary valuation and used valuation inputs and analyses that were based on market participant assumptions. Market participants are considered to be buyers and sellers unrelated to the Company in the principal or most advantageous market for the asset or liability. For certain items, the carrying value was determined to be a reasonable approximation of fair value based on the information available.

Goodwill was calculated as the excess of the consideration transferred over the assets acquired and represents the estimated future economic benefits arising from other assets acquired that could not be individually identified and separately recognized. The allocation is expected to be completed during the second quarter of 2019. Goodwill recognized as a result of this acquisition is not deductible for tax purposes.

In connection with the acquisition, the Company recorded an additional deferred tax liability of $18.8 million with a corresponding increase to goodwill. The increase in deferred tax liability represents the tax effect of the difference between the estimated assigned fair value of the tangible and intangible assets and the tax basis of such assets.

Mineral rights were valued using discounted cash flow method. Plant, property and equipment were valued using the cost method adjusted for age and deterioration.

Intangible assets acquired mainly include tradenames and customer relationships. Tradenames have an estimated useful life of approximately 20 years. Customer relationships have an estimated useful life of approximately 20 years.

The Company incurred $1.7 million of acquisition-related costs during the year ended December 31, 2018, which are reflected within the Acquisition related transaction and integration costs line of the Consolidated Statements of Income. We did not present pro forma and other financial information for the Sivomatic acquisition, as this is not considered to be a material business combination.

Note 4. Restructuring and Other Items, net

In 2016, the Company recognized restructuring charges for lease termination costs, inventory write-offs and impairment of assets relating to its exit from the Nitrogen and Pipeline product lines and restructuring of other onshore services within the Energy Services segment as a result of the significant reduction in oil prices and overcapacity in the onshore oil service market. In addition, the Company recognized a $2.9 million gain on previously impaired assets in the Refractories and Energy Services Segments.

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In 2017, the Company recognized $15.0 million in restructuring and non-cash impairment charges from the closure of paper mills in North America, as well as the alignment of corporate and Paper PCC staffing levels into higher growth regions. The restructuring is expected to result in approximately $6 million (unaudited) in savings on an annualized basis.

In 2018, the Company recorded impairment of assets charges relating to the shut-down of one of its Paper PCC facilities in the U.S. in the first quarter of 2019 and additional restructuring costs relating to our exited Energy Services businesses.

The following table outlines the amount of restructuring charges recorded within the Consolidated Statements of Income, and the segments they relate to:

Restructuring and Other Items, net (millions of dollars)	Year Ended December 31, 2018	2017	2016
Impairment of assets			
Specialty Minerals	$0.7	$5.3	$—
Energy Services	—	—	18.5
Corporate	—	—	—
Total impairment of assets charges	$0.7	$5.3	$18.5
Severance and other employee costs			
Specialty Minerals	$—	$5.0	$—
Energy Services	1.8	1.7	12.7
Corporate	—	4.1	—
Total severance and other employee costs	$1.8	$10.8	$12.7
Other			
Refractories	$—	$—	$(2.0)
Energy Services	—	(1.1)	(0.9)
Total restructuring and other items, net	$2.5	$15.0	$28.3

At December 31, 2018 and 2017, the Company had $2.5 million and $8.1 million, respectively, included within other current liabilities within our Consolidated Balance Sheets for cash expenditures needed to satisfy remaining obligations under these reorganization initiatives. The Company expects to pay these amounts by the end of 2019.

The following table is a reconciliation of our restructuring liability balance:

(millions of dollars)	
Restructuring liability, December 31, 2017	$8.1
Additional provisions	1.7
Cash payments	(6.6)
Other	(0.7)
Restructuring liability, December 31, 2018	$2.5

Note 5. Stock-Based Compensation

At the Company's 2015 Annual Meeting of Stockholders, the Company's stockholders ratified the adoption of the Company's 2015 Stock Award and Incentive Plan (the "2015 Plan"), which provides for grants of incentive and non-qualified stock options, restricted stock, stock appreciation rights, stock awards or performance unit awards. The 2015 Plan is substantially similar to the Company's 2001 Stock Award and Incentive Plan (as amended and restated as of March 18, 2009, the "2001 Plan" and collectively with the 2015 Plan, the "Plans"). The Company established the 2015 Plan to increase the total number of shares of common stock reserved and available for issuance by 880,000 shares from the number of shares remaining under the 2001 Plan. With the ratification of the 2015 Plan by the Company's stockholders, the 2001 Plan was discontinued as to new grants (however, all awards previously granted under the 2001 Plan remained unchanged). The Plans are administered by the Compensation Committee of the Board of Directors. Stock options granted under the Plans generally have a ten year term. The exercise price for stock options are at prices at or above the fair market value of the common stock on the date of the grant, and each award of stock options will vest ratably over a specified period, generally three years.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
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Stock-based compensation expense is recognized in the consolidated financial statements for stock options based on the grant date fair value.

Net income for years ended 2018, 2017 and 2016 include $4.2 million, $4.1 million and $3.5 million pre-tax compensation costs, respectively, related to stock option expense as a component of marketing and administrative expenses. All stock option expense is recognized in the consolidated statements of operations. The related tax benefit included in the statement of income on the non-qualified stock options was $1.1 million, $1.1 million and $1.4 million for 2018, 2017 and 2016, respectively.

Stock Options

The fair value of options granted is estimated on the date of grant using the Black-Scholes valuation model. Compensation expense is recognized only for those options expected to vest, with forfeitures estimated at the date of grant based on the Company's historical experience and future expectations. The forfeiture rate assumption used for the periods ended December 31, 2018, 2017 and 2016 was 8.20%, 8.71% and 7.38%, respectively.

The weighted average grant date fair value for stock options granted during the years ended December 31, 2018, 2017 and 2016 was $25.79, $30.28 and $14.34, respectively. The weighted average grant date fair value for stock options vested during 2018, 2017 and 2016 was $21.33, $18.45 and $20.94, respectively. The total intrinsic value of stock options exercised during the years ended December 31, 2018, 2017 and 2016 was $3.3 million, $11.7 million and $4.9 million, respectively.

The fair value for stock awards was estimated at the date of grant using the Black-Scholes option valuation model with the following weighted average assumptions for the years ended December 31, 2018, 2017 and 2016:

	Year Ended December 31,		
	2018	2017	2016
Expected life (in years)	6.2	6.4	6.5
Interest rate	2.50%	2.04%	1.72%
Volatility	30.33%	36.61%	36.75%
Expected dividend yield	0.26%	0.26%	0.54%

The expected term of the options represents the estimated period of time until exercise and is based on historical experience of similar awards, based upon contractual terms, vesting schedules, and expectations of future employee behavior. The expected stock-price volatility is based upon the historical and implied volatility of the Company's stock. The interest rate is based upon the implied yield on U.S. Treasury bills with an equivalent remaining term. Estimated dividend yield is based upon historical dividends paid by the Company.

The following table summarizes stock option activity for the year ended December 31, 2018:

	Awards	Weighted Average Exercise Price per Share	Weighted Average Remaining Contractual Life (Years)	Aggregate Intrinsic Value (Millions)
Awards outstanding at December 31, 2017	996,839	$ 48.21		
Granted	191,147	76.09		
Exercised	(98,945)	33.83		
Canceled	(34,782)	65.74		

Awards outstanding at December 31, 2018	1,054,259	$ 54.04	6.10	$ 7.8
Awards exercisable at December 31, 2018	688,652	$ 46.17	4.90	$ 6.9

The aggregate intrinsic value above is calculated before applicable income taxes, based on the Company's closing stock price of $51.34 as of the last business day of the period ended December 31, 2018 had all options been exercised on that date. The weighted average intrinsic value of the options exercised during 2018, 2017 and 2016 was $33.10, $32.95 and $32.34 per share, respectively. As of December 31, 2018, total unrecognized stock-based compensation expense related to non-vested stock options was approximately $4.5 million, which is expected to be recognized over a weighted average period of approximately three years.

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The Company issues new shares of common stock upon the exercise of stock options

Non-vested stock option activity for the year ended December 31, 2018 is as follows:

	Awards	Weighted Average Grant Date Fair Value per Share
Nonvested awards outstanding at December 31, 2017	400,393	$ 58.94
Granted	191,147	76.09
Vested	(195,055)	56.17
Canceled	(30,878)	65.13
Nonvested awards outstanding at December 31, 2018	365,607	$ 68.86

Restricted Stock

The Company has granted key employees rights to receive shares of the Company's common stock pursuant to the Plan. The rights will be deferred for a specified number of years of service, subject to restrictions on transfer and other conditions. Compensation expense for these shares is recognized over the vesting period. The Company granted 69,361 shares, 69,539 shares and 155,165 shares for the periods ended December 31, 2018, 2017 and 2016, respectively. The fair value was determined based on the market value of unrestricted shares. As of December 31, 2018, there was unrecognized stock-based compensation related to restricted stock of $5.1 million, which will be recognized over approximately the next three years. The compensation expense amortized with respect to all units was approximately $4.4 million, $5.9 million and $5.8 million for the periods ended December 31, 2018, 2017 and 2016, respectively. In addition, the Company recorded reversals of $2.4 million, $2.4 million and $3.8 million for periods ended December 31, 2018, 2017 and 2016, respectively, related to restricted stock forfeitures. Such costs and reversals are included in marketing and administrative expenses.

The following table summarizes the restricted stock activity for the Plan:

	Awards	Weighted Average Grant Date Fair Value per Share
Unvested balance at December 31, 2017	180,110	$ 58.57
Granted	69,361	76.26
Vested	(59,649)	56.44
Canceled	(55,244)	58.57
Unvested balance at December 31, 2018	134,578	$ 68.64

Note 6. Earnings Per Share (EPS)

	Year Ended December 31,		
(in millions, except per share data)	2018	2017	2016

Net income attributable to MTI	$169.0	$195.1	$133.4
Weighted average shares outstanding	35.3	35.2	34.9
Dilutive effect of stock options and stock units	0.3	0.4	0.3
Weighted average shares outstanding, adjusted	35.6	35.6	35.2
Basic earnings per share attributable to MTI	$4.79	$5.54	$3.82
Diluted earnings per share attributable to MTI	$4.75	$5.48	$3.79

Options to purchase 568,284 shares, 181,003 shares and 784 shares of common stock for the years ended December 31, 2018, 2017 and 2016, respectively, were not included in the computation of diluted earnings per share because they were anti-dilutive, as the exercise prices of the options were greater than the average market price of the common shares.

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Note 7. Income Taxes

The U.S. Tax Cuts and Jobs Act (“U.S. Tax Reform”), enacted in December 2017, significantly changes U.S. corporate income tax laws by, among other things, reducing the U.S. corporate income tax rate to 21% starting in 2018 and creating a territorial tax system with a one-time mandatory tax on previously deferred foreign earnings of U.S. subsidiaries. Under U.S. GAAP (specifically, ASC Topic 740), the effects of changes in tax rates and laws on deferred tax balances are recognized in the period in which the new legislation is enacted.

During 2018, we recorded a benefit of $4.4 million as a measurement period adjustment to the one-time mandatory tax on previously deferred earnings of non-U.S. subsidiaries. The accounting for income tax effects of U.S. Tax Reform is complete based on additional tax regulations available as of December 31, 2018. Amounts recorded during 2018 and 2017, respectively, are reflected within the provision for income taxes in the Consolidated Statement of Income.

Additionally, U.S. tax reform subjects a U.S. shareholder to current tax on global intangible low-taxed income ("GILTI") earned by certain foreign subsidiaries. We have elected to not recognize deferred taxes for temporary differences until such differences reverse as GILTI in future years.

Income from operations before provision for taxes by domestic and foreign source is as follows:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Income from continuing operations before income taxes and income from affiliates and joint ventures:			
Domestic	$93.1	$96.7	$72.9
Foreign	111.0	94.2	97.4
	$204.1	$190.9	$170.3

The provision (benefit) for taxes on income consists of the following:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Domestic			
Taxes currently payable			
Federal	$(3.7)	$46.0	$18.7
State and local	1.4	2.4	4.4
Deferred income taxes	11.1	(78.1)	(8.8)
Domestic tax provision (benefit)	8.8	(29.7)	14.3
Foreign			
Taxes currently payable	21.3	21.1	23.2
Deferred income taxes	4.3	2.0	(2.2)
Foreign tax provision	25.6	23.1	21.0
Total tax provision (benefit)	$34.4	$(6.6)	$35.3

The provision (benefit) for taxes on income shown in the previous table is classified based on the location of the taxing authority, regardless of the location in which the taxable income is generated.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
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The major elements contributing to the difference between the U.S. federal statutory tax rate and the consolidated effective tax rate are as follows:

	Year Ended December 31,		
	2018	2017	2016
U.S. statutory rate	21.0%	35.0%	35.0%
Depletion	(3.9)%	(6.7)%	(6.6)%
Difference between tax provided on foreign earnings and the U.S. statutory rate	1.1%	(3.8)%	(6.4)%
Global Intangible Low-Tax Income (GILTI)	0.8%	0.0%	0.0%
Foreign Derived Intangible Income	(0.7)%	0.0%	0.0%
State and local taxes, net of federal tax benefit	1.9%	1.1%	1.1%
Tax credits and foreign dividends	(0.3)%	0.3%	0.6%
Change in valuation allowance	—	(1.9)%	(1.1)%
Impact of uncertain tax positions	0.5%	0.4%	0.4%
Impact of officer's non-deductible compensation	0.8%	0.8%	0.1%
Manufacturing deduction	—	(1.6)%	(2.0)%
Impact of U.S. Tax Reform	(2.2)%	(24.8)%	0.0%
Other	(2.1)%	(2.3)%	(0.4)%
Consolidated effective tax rate	16.9%	(3.5)%	20.7%

The Company believes that its accrued liabilities are sufficient to cover its U.S. and foreign tax contingencies. The tax effects of temporary differences that give rise to significant portions of the deferred tax assets and deferred tax liabilities are presented below:

	December 31,	
(millions of dollars)	2018	2017
Deferred tax assets attributable to:		
Accrued liabilities	$22.2	$28.6
Net operating loss carry forwards	34.4	33.2
Pension and post-retirement benefits costs	33.8	40.4
Other	28.6	22.0
Valuation allowance	(22.0)	(21.4)
Total deferred tax assets	97.0	102.8
Deferred tax liabilities attributable to:		
Plant and equipment, principally due to differences in depreciation	182.8	161.6
Intangible assets	69.5	63.4
Other	15.2	11.6
Total deferred tax liabilities	267.5	236.6
Net deferred tax asset (liability)	$(170.5)	$(133.8)

Net deferred tax assets and net deferred tax liabilities are as follows:

	December 31,	
(millions of dollars)	2018	2017
Net deferred tax asset, long-term	$26.3	$25.6
Net deferred tax liability, long-term	196.8	159.4
Net deferred tax asset (liability), long-term	$(170.5)	$(133.8)

The Company has $34.4 million of deferred tax assets arising from tax loss carry forwards which will be realized through future operations. Carry forwards of approximately $17.1 million expire over the next 20 years, and $17.3 million can be utilized over an indefinite period.

On December 31, 2018, the Company had $16.6 million of total unrecognized tax benefits. Included in this amount were a total of $13.2 million of unrecognized income tax benefits that, if recognized, would affect the Company's effective tax rate. While it is expected that the amount of unrecognized tax benefits will change in the next 12 months, we do not expect the change to have a significant impact on the results of operations or the financial position of the Company.

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The following table summarizes the activity related to our unrecognized tax benefits:

(millions of dollars)	2018	2017
Balance at beginning of the year	$14.7	$13.7
Increases related to current year tax positions	0.6	1.2
Increases related to new judgements	1.3	1.2
Decreases related to audit settlements and statue expirations	—	(1.4)
Balance at the end of the year	$16.6	$14.7

The Company's accounting policy is to recognize interest and penalties accrued, relating to unrecognized income tax benefits as part of its provision for income taxes. The Company had recorded a $0.9 million benefit in interest and penalties during 2018 and had a total accrued balance on December 31, 2018 of $2.5 million.

The Company operates in multiple taxing jurisdictions, both within and outside the U.S. In certain situations, a taxing authority may challenge positions that the Company has adopted in its income tax filings. The Company, with a few exceptions (none of which are material), is no longer subject to U.S. federal, state, local, and international income tax examinations by tax authorities for years prior to 2010.

Net cash paid for income taxes were $43.8 million, $47.7 million and $30.6 million for the years ended December 31, 2018, 2017 and 2016, respectively.

The Company had approximately $507.8 million of foreign subsidiaries' undistributed earnings as of December 31, 2018. We intend to continue to permanently reinvest these earnings overseas for the foreseeable future and while U.S. federal tax expense as been recognized as a result of U.S. Tax Reform, no deferred tax liabilities with respect to foreign withholding taxes or state taxes have been recognized.

Note 8. Inventories

The following is a summary of inventories by major category:

	December 31,	
(millions of dollars)	2018	2017
Raw materials	$93.4	$82.5
Work-in-process	11.2	7.9
Finished goods	92.2	92.3
Packaging and supplies	42.4	36.6
Total inventories	$239.2	$219.3

Note 9. Property, Plant and Equipment

The major categories of property, plant and equipment and accumulated depreciation and depletion are presented below:

	December 31,	
(millions of dollars)	2018	2017
Mineral rights and reserves	$582.8	$545.9
Land	47.3	44.5
Buildings	219.3	199.6

Machinery and equipment	1,235.6	1,247.5
Furniture and fixtures and other	134.8	132.3
Construction in progress	36.1	49.8
	2,256.0	2,219.6
Less: accumulated depreciation and depletion	(1,153.1)	(1,158.3)
Property, plant and equipment, net	$1,102.9	$1,061.3

Depreciation and depletion expense for the years ended December 31, 2018, 2017 and 2016 was $80.7 million, $75.6 million and $75.4 million, respectively.

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Note 10. Goodwill and Other Intangible Assets

Goodwill and other intangible assets with indefinite lives are not amortized, but instead are assessed for impairment, at least annually. The carrying amount of goodwill was $812.4 million and $779.3 million as of December 31, 2018 and December 31, 2017, respectively. The net change in goodwill since December 31, 2017 was primarily attributable to the Sivomatic acquisition (see Note 3).

The balance of goodwill by segment and the activity occurring in the past two fiscal years is as follows:

(millions of dollars)	Performance Materials	Specialty Minerals	Refractories	Consolidated
Balance at December 31, 2016	$ 720.9	$ 12.1	$ 45.7	$ 778.7
Change in goodwill relating to:				
Foreign exchange translation	—	0.6	—	0.6
Total Changes	$ —	$ 0.6	$ —	$ 0.6
Balance at December 31, 2017	$ 720.9	$ 12.7	$ 45.7	$ 779.3
Change in goodwill relating to:				
Acquisition of Sivomatic	35.0	—	—	35.0
Foreign exchange translation	—	(0.4)	(1.5)	(1.9)
Total Changes	$ 35.0	$ (0.4)	$ (1.5)	$ 33.1
Balance at December 31, 2018	$ 755.9	$ 12.3	$ 44.2	$ 812.4

Acquired intangible assets subject to amortization as of December 31, 2018 and December 31, 2017 were as follows:

		December 31, 2018		December 31, 2017	
	Weighted Average Useful Life (Years)	Gross Carrying Amount	Accumulated Amortization	Gross Carrying Amount	Accumulated Amortization
Tradenames	35	$204.2	$ 26.6	$199.8	$ 20.7
Technology	13	18.8	6.4	18.8	4.8
Patents	19	6.4	5.6	6.4	5.3
Customer relationships	22	26.5	3.2	4.5	2.2
	32	$255.9	$ 41.8	$229.5	$ 33.0

The weighted average amortization period of the acquired intangible assets subject to amortization is approximately 32 years. Amortization expense was approximately $8.8 million, $8.0 million and $8.2 million for the years ended December 31, 2018, 2017 and 2016, respectively and is recorded within the Marketing and administrative expenses line within the Consolidated Statements of Income. The estimated amortization expense is as follows: 2019 - $9.3 million; 2020 -$9.3; 2021 - $9.3; 2022 -$9.1 million; 2023 - $9.0 million and $168.1 million thereafter.

Note 11. Derivative Financial Instruments and Hedging Activities

As a multinational corporation with operations throughout the world, the Company is exposed to certain market risks. The Company uses a variety of practices to manage these market risks, including, when considered appropriate, derivative financial instruments. The Company's objective is to offset gains and losses resulting from interest rates and foreign currency exposures with gains and losses on the derivative contracts used to hedge them. The Company uses derivative financial instruments only for risk management and not for trading or speculative purposes.

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By using derivative financial instruments to hedge exposures to changes in interest rates and foreign currencies, the Company exposes itself to credit risk and market risk. Credit risk is the risk that the counterparty will fail to perform under the terms of the derivative contract. When the fair value of a derivative contract is positive, the counterparty owes the Company, which creates credit risk for the Company. When the fair value of a derivative contract is negative, the Company owes the counterparty, and therefore, it does not face any credit risk. The Company minimizes the credit risk in derivative instruments by entering into transactions with major financial institutions.

Market risk is the adverse effect on the value of a financial instrument that results from a change in interest rates, currency exchange rates, or commodity prices. The market risk associated with interest rate and forward exchange contracts is managed by establishing and monitoring parameters that limit the types and degree of market risk that may be undertaken.

Cash Flow Hedges

For derivative instruments that are designated and qualify as cash flow hedges, the Company records the effective portion of the gain or loss in accumulated other comprehensive income (loss) as a separate component of shareholders' equity. The Company subsequently reclassifies the effective portion of gain or loss into earnings in the period during which the hedged transaction is recognized in earnings.

The Company utilizes interest rate swaps to limit exposure to market fluctuations on floating-rate debt. In the second quarter of 2018, the Company entered into a floating to fixed interest rate swap for a notional amount of $150 million. The fair value of this swap is a liability of $2.4 million at December 31, 2018 and is recorded in other non-current liabilities on the Consolidated Balance Sheet. In addition, in the second quarter of 2016, the Company entered into a floating to fixed interest rate swap for an initial aggregate notional amount of $300 million. The notional amount at December 31, 2018 was $143 million. The fair value of this swap is an asset of $2.7 million at December 31, 2018 and is recorded in other assets and deferred charges on the Consolidated Balance Sheet. These interest rate swaps are designated as cash flow hedges. The gains and losses associated with these interest rate swaps are recorded in accumulated other comprehensive income (loss).

Net Investment Hedges

To protect the value of our investments in our foreign operations against adverse changes in foreign currency exchange rates, the Company from time to time hedges a portion of our net investment in one or more of our foreign subsidiaries. During the second quarter of 2018, the Company entered into a cross currency rate swap with a total notional value of $150 million to exchange monthly fixed-rate interest payments in U.S. dollars for monthly fixed-rate interest rate payments in Euros. This contract matures in May 2023 and requires the exchange of Euros and U.S. dollar principal payments upon maturity. The fair value of this swap is an asset of $3.7 million at December 31, 2018 and is recorded in other assets and deferred charges on the Consolidated Balance Sheet. Changes in the fair value of this instrument are recognized in accumulated other comprehensive income (loss) to offset the change in the carrying amount of the net investment being hedged. Amounts are reclassified out of accumulated other comprehensive income (loss) into earnings when the hedged net investment is either sold or substantially liquidated.

Other

The Company is exposed to potential gains or losses from foreign currency fluctuations affecting net investments and earning denominated in foreign currencies. The Company is particularly sensitive to currency exchange rate fluctuations for the following currencies: British pound sterling (GBP), Chinese renminbi (CYN), Euro, Malaysian ringgit (MYR), Polish zloty (PLN), South African Rand (ZAR), Thai baht (THB) and Turkish lira (TRY). When considered appropriate, the Company enters into foreign exchange derivative contracts to mitigate the risk of fluctuations on these exposures. The Company does not designate these contracts for hedge accounting treatment and the changes in fair value of these contracts are recorded in earnings. The Company recorded (gains) losses of $(0.7) million and $(1.2) million in other non-operating income (deductions), net within the Consolidated Statements of Income for the years ended 2018 and 2017, respectively. There were no open contracts at December 31, 2018 and December 31, 2017.

Note 12. Fair Value of Financial Instruments

Fair value is an exchange price that would be received for an asset or paid to transfer a liability (exit price) in an orderly transaction between market participants at the measurement date. The Company utilizes market data or assumptions that market participants would use in pricing the asset or liability. The Company follows a three-tier fair value hierarchy, which prioritizes the inputs used in measuring fair value. These tiers include: Level 1, defined as observable inputs such as quoted prices in active markets; Level 2, defined as inputs other than quoted prices in active markets that are either directly or indirectly observable; and Level 3, defined as unobservable inputs about which little or no market data exists, therefore requiring an entity to develop its own assumptions.

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Assets and liabilities measured at fair value are based on one or more of three valuation techniques. The three valuation techniques are as follows:

Market approach – prices and other relevant information generated by market transactions involving identical or comparable assets or liabilities.
Cost approach – amount that would be required to replace the service capacity of an asset or replacement cost.
Income approach – techniques to convert future amounts to a single present amount based on market expectations, including present value techniques, option-pricing and other models.

The Company primarily applies the income approach for foreign exchange derivatives for recurring fair value measurements and attempts to utilize valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs.

The following table sets forth by level within the fair value hierarchy the Company's financial assets and liabilities accounted for at fair value on a recurring basis at the end of each of the past two years. Assets and liabilities are classified in their entirety based on the lowest level of input that is significant to the fair value measurement. The Company's assessment of the significance of a particular input to the fair value measurement requires judgment and may affect the valuation of fair value assets and liabilities and their placement within the fair value hierarchy levels.

(millions of dollars)		Fair Value Measurements Using		
Description	Asset / (Liability) Balance at December 31, 2018	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Deferred compensation plan assets	$ 12.6	$ —	$ 12.6	$ —
Supplementary pension plan assets	10.8	—	10.8	—
Cross currency rate swap	3.7	—	3.7	—
Interest rate swaps	0.3	—	0.3	—

		Fair Value Measurements Using		
Description	Asset / (Liability) Balance at December 31, 2017	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)

Deferred compensation plan assets	$ 12.9	$—	$ 12.9	$ —
Supplementary pension plan assets	11.6	—	11.6	—
Interest rate swap	2.9	—	2.9	—
Money market funds	0.7	0.7	—	—

The fair value of investment in the money market funds is determined by quoted prices in active markets and is categorized as Level 1.

The fair value of foreign exchange contracts is determined based on inputs that are readily available in public markets or can be derived from information available in publicly quoted markets and are categorized as Level 2. Deferred compensation and supplementary pension plan assets related to the acquisition of AMCOL businesses and are valued using quoted prices for similar assets in active markets.

The Company does not have any financial assets or liabilities measured at fair value on a recurring basis categorized as Level 3, except for pension assets discussed in Note 15, and there were no transfers in or out of Level 3 during the year ended December 31, 2018 and 2017. There were also no changes to the Company's valuation techniques used to measure asset and liability fair values on a recurring basis.

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Note 13. Financial Instruments and Concentrations of Credit Risk

The following methods and assumptions were used to estimate the fair value of each class of financial instrument:

Cash and cash equivalents, short-term investments, accounts receivable and payable: The carrying amounts approximate fair value because of the short maturities of these instruments.

Short-term debt and other liabilities: The carrying amounts of short-term debt and other liabilities approximate fair value because of the short maturities of these instruments.

Long-term debt: The fair value of the long-term debt of the Company is estimated based on the quoted market prices for that debt or similar debt and approximates the carrying amount.

Forward exchange contracts: The fair value of forward exchange contracts (used for hedging purposes) is based on information derived from active markets. If appropriate, the Company would enter into forward exchange contracts to mitigate the impact of foreign exchange rate movements on the Company's operating results. It does not engage in speculation. Such foreign exchange contracts would offset losses and gains on the assets, liabilities and transactions being hedged.

Credit risk: The Company provides credit to customers in the ordinary course of business. The Company’s customer base is diverse and includes customers located throughout the world. Credit risk results from the possibility that a loss may occur from the failure of another party to perform according to the terms of the contracts. The Company regularly monitors its credit risk exposures and takes steps to mitigate the likelihood of these exposures resulting in an actual loss. The Company's extension of credit is based on an evaluation of the customer's financial condition and collateral is generally not required.

The Company's bad debt expense for the years ended December 31, 2018, 2017 and 2016 was $3.2 million, $3.8 million and $6.2 million, respectively.

Note 14. Long-Term Debt and Commitments

The following is a summary of long-term debt:

	December 31,	
(millions of dollars)	2018	2017
Term Loan Facility- Variable Tranche due February 14, 2024, net of unamortized discount and deferred financing costs of $19.4 million and $22.7 million	$638.6	$655.3
Term Loan Facility- Fixed Tranche due May 9, 2021, net of unamortized discount and deferred financing costs of $0.3 million and $0.5 million	$262.6	$299.5
Netherlands Term Loan due 2020	3.4	—
Netherlands Term Loan due 2022	1.4	—
Japan Loan Facilities	5.1	5.6
China Loan Facilities	—	3.2
Total	$911.1	$963.6
Less: Current maturities	3.3	3.8
Long-term debt	$907.8	$959.8

On May 9, 2014, in connection with the acquisition of AMCOL International Corporation (“AMCOL”), the Company entered into a credit agreement providing for a $1,560 million senior secured term loan facility (the “Term Facility”) and a $200 million senior secured revolving credit facility (the “Revolving Facility” and, together with the Term Facility, the “Facilities”).

On June 23, 2015, the Company entered into an amendment (the “First Amendment”) to the credit agreement to reprice the $1.378 billion then outstanding on the Term Facility. As amended, the Term Facility had a $1.078 billion floating rate tranche and a $300 million fixed rate tranche. On February 14, 2017, the Company entered into an amendment (the “Second Amendment”) to the credit agreement to reprice the $788 million floating rate tranche then outstanding, which extended the maturity and lowered the interest costs by 75 basis points. On April 18, 2018, the Company entered into an amendment (the “Third Amendment”) to the credit agreement to refinance the Revolving Facility. As amended, the Revolving Facility has been increased to $300 million in aggregate commitments. Following the amendments, the loans outstanding under the floating rate tranche of the Term Facility will mature on February 14, 2024, the loans outstanding under the fixed rate tranche of the Term Facility will mature on May 9, 2021 and the loans outstanding (if any) and commitments under the Revolving Facility will mature and terminate, as the case may be, on April 18, 2023. Loans under the floating rate tranche of the Term Facility bear interest at a rate equal to an adjusted LIBOR rate (subject to a floor of 0.75%) plus an applicable margin equal to 2.25% per annum. Loans under the fixed rate tranche of the Term Facility bear interest at a rate of 4.75%. Loans under the Revolving Facility bear interest at a rate equal to an adjusted LIBOR rate plus an applicable margin equal to 1.625% per annum. Such rates are subject to decrease by up to 25 basis points in the event that, and for so long as, the Company’s net leverage ratio (as defined in the credit agreement) is less than certain thresholds. The floating rate tranche of the Term Facility was issued at par and the fixed rate tranche of the Term Facility was issued at a 0.25% discount in connection with the First Amendment. The variable rate tranche of the Term Facility was issued at a 0.25% discount in connection with the Second Amendment. The variable rate tranche has a 1% required amortization per year. The Company will pay certain fees under the credit agreement, including customary annual administration fees. The obligations of the Company under the Facilities are unconditionally guaranteed jointly and severally by, subject to certain exceptions, all material domestic subsidiaries of the Company (the “Guarantors”) and secured, subject to certain exceptions, by a security interest in substantially all of the assets of the Company and the Guarantors.

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The credit agreement contains certain customary affirmative and negative covenants that limit or restrict the ability of the Company and its restricted subsidiaries to enter into certain transactions or take certain actions. In addition, the credit agreement contains a financial covenant that requires the Company, if on the last day of any fiscal quarter loans or letters of credit were outstanding under the Revolving Facility (excluding up to $15 million of letters of credit), to maintain a maximum net leverage ratio (as defined in the credit agreement) of, initially, 5.25 to 1.00 for the four fiscal quarter period preceding such day. Such maximum net leverage ratio requirement is subject to decrease during the duration of the facility to a minimum level (when applicable) of 3.50 to 1.00. In connection with the Sivomatic acquisition, the Company incurred $113.0 million of short-term debt under the Revolving Facility. As of December 31, 2018, there were $100 million in outstanding loans and $10.5 million in letters of credit outstanding under the Revolving Facility. The Company is in compliance with all the covenants associated with the Revolving Facility as of the end of the period covered by this report.

During 2018, the Company repaid $57 million on its Term Facility and $13 million on its Revolving Facility.

As part of the Sivomatic acquisition, the Company assumed $10.7 million in long-term debt, recorded at fair value, consisting of two term loans, one of which matures in 2020 and the other of which matures in 2022. These loans carry an interest rate of Euribor plus 2.0% and have quarterly repayments. During 2018, the Company repaid $5.4 million on these loans.

The Company has committed loan facilities for the funding of new manufacturing facilities in China. In addition, the Company has a committed loan facility in Japan. As of December 31, 2018, on a combined basis, $5.1 million was outstanding. Principal will be repaid in accordance with the payment schedules ending in 2022. The Company repaid $3.8 million on these loans in 2018.

As of December 31, 2018, the Company had $42.7 million in uncommitted short-term bank credit lines, of which approximately $5.2 million was in use.

Short-term borrowings as of December 31, 2018 and 2017 were $105.2 million and $6.3 million, respectively. The weighted average interest rate on short-term borrowings outstanding as of December 31, 2018 and December 31, 2017 was 4.0% and 3.9%, respectively.

The aggregate maturities of long-term debt are as follows: $3.3 million in 2019; $2.2 million in 2020; $267.2 million in 2021, $0.2 million in 2022; $0.0 million in 2023 and $658.0 million thereafter.

During 2018, 2017 and 2016, respectively, the Company incurred interest costs of $48.6 million, $45.4 million and $56.5 million, including $0.5 million, $0.2 million and $0.1 million, respectively, which were capitalized. Interest paid approximated the incurred interest cost.

Note 15. Benefit Plans

Pension Plans and Other Postretirement Benefit Plans

The Company and its subsidiaries have pension plans covering the majority of eligible employees on a contributory or non-contributory basis. Benefits under defined benefit plans are generally based on years of service and an employee's career earnings. Employees generally become fully vested after five years.

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The Company also provides postretirement health care and life insurance benefits for the majority of its U.S. retired employees. Employees are generally eligible for benefits upon retirement and completion of a specified number of years of creditable service. The Company does not pre-fund these benefits and has the right to modify or terminate the plan in the future.

The Company’s disclosures for the U.S. plans have been combined with those outside of the U.S. as the international plans do not have significantly different assumptions, and together represent less than 25% of our total benefit obligation.

The following table set forth Company's pension obligation and funded status at December 31:

	Pension Benefits		Post-Retirement Benefits	
(millions of dollars)	2018	2017	2018	2017
Change in benefit obligations:				
Beginning projected benefit obligation	$469.5	$427.9	$ 6.9	$ 9.3
Service cost	8.1	7.9	0.2	0.3
Interest cost	13.0	12.6	0.2	0.3
Actuarial (gain)/loss	(40.5)	31.5	(1.5)	(3.0)
Benefits paid	(12.2)	(20.4)	(0.1)	(0.1)
Settlements	(17.1)	—	—	—
Foreign exchange impact	(5.1)	9.6	—	0.1
Other	0.6	0.4	—	—
Ending projected benefit obligation	416.3	469.5	5.7	6.9
Change in plan assets:				
Beginning fair value	320.2	289.3	—	—
Actual return on plan assets	(13.6)	33.8	—	—
Employer contributions	24.2	10.7	0.1	0.1
Plan participants' contributions	0.4	0.4	—	—
Benefits paid	(12.2)	(20.4)	(0.1)	(0.1)
Settlements	(18.2)	(0.8)	—	—
Foreign exchange impact	(4.1)	7.2	—	—
Ending fair value	296.7	320.2	—	—
Funded status of the plan	$(119.6)	$(149.3)	$ (5.7)	$ (6.9)

Amounts recognized in the consolidated balance sheet consist of:

	Pension Benefits		Post-Retirement Benefits	
(millions of dollars)	2018	2017	2018	2017
Current liability	$(0.8)	$(0.8)	$ (0.3)	$ (0.5)
Non-current liability	(118.8)	(148.5)	(5.4)	(6.4)
Recognized liability	$(119.6)	$(149.3)	$ (5.7)	$ (6.9)

The current portion of pension liabilities is included in accrued compensation and related items.

Amounts recognized in accumulated other comprehensive income, net of related tax effects, consist of:

	Pension Benefits		Post-Retirement Benefits	
(millions of dollars)	2018	2017	2018	2017
Net actuarial (gain) loss	$73.5	$91.4	$ (4.1)	$ (4.1)
Prior service cost	0.1	(0.1)	—	(0.7)
Amount recognized end of year	$73.6	$91.3	$ (4.1)	$ (4.8)

The accumulated benefit obligation for all defined benefit pension plans was $389.9 million and $435.4 million at December 31, 2018 and 2017, respectively.

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Changes in the Plan assets and benefit obligations recognized in other comprehensive income:

	Pension Benefits		Post-Retirement Benefits	
(millions of dollars)	2018	2017	2018	2017
Current year actuarial gain (loss)	$6.8	$(15.8)	$ 1.0	$ 2.6
Amortization of actuarial (gain) loss	10.4	7.2	(0.6)	(0.2)
Amortization of prior service credit (gain) loss	—	—	(0.7)	(2.3)
Total recognized in other comprehensive income	$17.2	$(8.6)	$ (0.3)	$ 0.1

The components of net periodic benefit costs are as follows:

	Pension Benefits			Post-Retirement Benefits		
(millions of dollars)	2018	2017	2016	2018	2017	2016
Service cost	$8.1	$7.9	$8.2	$0.2	$0.3	$0.3
Interest cost	13.0	12.6	13.0	0.2	0.3	0.3
Expected return on plan assets	(20.2)	(18.7)	(18.6)	—	—	—
Amortization of prior service cost	—	—	0.6	(0.9)	(3.1)	(3.1)
Recognized net actuarial (gain) loss	10.7	10.8	10.7	(0.8)	(0.3)	(0.2)
Settlement/curtailment loss	4.4	—	0.3	—	—	—
Net periodic benefit cost	$16.0	$12.6	$14.2	$(1.3)	$(2.8)	$(2.7)

Unrecognized prior service cost is amortized over the average remaining service period of each active employee.

The Company's funding policy for U.S. plans generally is to contribute annually into trust funds at a rate that provides for future plan benefits and maintains appropriate funded percentages. Annual contributions to the U.S. qualified plans are at least sufficient to satisfy regulatory funding standards and are not more than the maximum amount deductible for income tax purposes. The funding policies for the international plans conform to local governmental and tax requirements. The plans' assets are invested primarily in stocks and bonds.

The 2019 estimated amortization of amounts in other accumulated comprehensive income are as follows:

(millions of dollars)	Pension Benefits	Post-Retirement Benefits
Amortization of net (gain) loss	$ 9.6	$ (0.8)
Total cost to be recognized	$ 9.6	$ (0.8)

Additional Information

The weighted average assumptions used to determine net periodic benefit cost in the accounting for the pension benefit plans and other benefit plans for the years ended December 31,2018, 2017 and 2016 are as follows:

	Year Ended December 31,		
	2018	2017	2016
Discount rate	3.16%	3.56%	3.88%
Expected return on plan assets	6.40%	6.61%	6.89%
Rate of compensation increase	3.01%	3.01%	3.03%

The weighted average assumptions used to determine benefit obligations for the pension benefit plans and other benefit plans at December 31,2018, 2017 and 2016 are as follows:

	Year Ended December 31,		
	2018	2017	2016
Discount rate	3.75%	3.16%	3.60%
Rate of compensation increase	3.01%	3.01%	2.96%

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For 2018, 2017 and 2016, the discount rate was based on a Citigroup yield curve of high quality corporate bonds with cash flows matching our plans' expected benefit payments. The expected return on plan assets is based on our asset allocation mix and our historical return, taking into account current and expected market conditions. The actual return/(loss) on pension assets was approximately (5)% in 2018, 11% in 2017 and 8% in 2016.

The Company maintains a self-funded health insurance plan for its retirees. This plan provided that the maximum health care cost trend rate would be 5%. Effective June 2010, the Company amended its plan to change the eligibility requirement for retirees and revised its plan so that increases in expected health care costs would be borne by the retiree.

Plan Assets

The Company's pension plan weighted average asset allocation percentages at December 31, 2018 and 2017 by asset category are as follows:

	December 31,	
	2018	2017
Asset Category		
Equity securities	54.9%	56.0%
Fixed income securities	38.3%	36.2%
Real estate	0.8%	0.8%
Other	6.0%	7.0%
Total	100.0%	100.0%

The Company's pension plan fair values at December 31, 2018 and 2017 by asset category are as follows:

	December 31,	
(millions of dollars)	2018	2017
Asset Category		
Equity securities	$162.8	$179.2
Fixed income securities	113.6	116.0
Real estate	2.3	2.4
Other	18.0	22.6
Total	$296.7	$320.2

The following table presents domestic and foreign pension plan assets information at December 31, 2018, 2017 and 2016 (the measurement date of pension plan assets):

	U.S. Plans			International Plans		
(millions of dollars)	2018	2017	2016	2018	2017	2016
Fair value of plan assets	$227.1	$241.9	$221.9	$69.6	$78.3	$67.4

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The following table summarizes our defined benefit pension plan assets measured at fair value as of December 31, 2018:

(millions of dollars)	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	Total
Pension Assets Fair Value as of December 31, 2018				
Equity securities				
US equities	$ 135.4	$ —	$ —	$ 135.4
Non-US equities	27.4	—	—	27.4
Fixed income securities				
Corporate debt instruments	80.9	32.7	—	113.6
Real estate and other				
Real estate	—	—	2.3	2.3
Other	0.3	—	17.7	18.0
Total assets	$ 244.0	$ 32.7	$ 20.0	$ 296.7

The following table summarizes our defined benefit pension plan assets measured at fair value as of December 31, 2017:

(millions of dollars)	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	Total
Pension Assets Fair Value as of December 31, 2017				
Equity securities				
US equities	$ 156.1	$ —	$ —	$ 156.1
Non-US equities	23.1	—	—	23.1
Fixed income securities				
Corporate debt instruments	82.0	34.0	—	116.0
Real estate and other				
Real estate	—	—	2.4	2.4
Other	0.2	—	22.4	22.6

Total assets	$ 261.4	$ 34.0	$ 24.8	$ 320.2

U.S. equities – This class included actively and passively managed common equity securities comprised primarily of large-capitalization stocks with value, core and growth strategies.

Non-U.S. equities – This class included actively managed common equity securities comprised primarily of international large-capitalization stocks.

Fixed income – This class included debt instruments issued by the US Treasury, and corporate debt instruments.

Real Estate and other – This class includes assets related to real estate and other assets such as insurance contracts.

Asset classified as Level 1 are valued using quoted prices on major stock exchange on which individual assets are traded. Our Level 2 assets are valued using net asset value. The net asset value is quoted on a private market that is not active; however, the unit price is based on the underlying investments that are traded on an active market. Our Level 3 assets are estimated at fair value based on the most recent financial information available for the underlying securities, which are not traded on active market, and represents significant unobservable input.

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The following is a reconciliation of changes in fair value measurement of plan assets using significant unobservable inputs (Level 3):

(millions of dollars)	
Beginning balance at December 31, 2016	$20.3
Purchases, sales, settlements	—
Actual return on plan assets still held at reporting date	3.9
Foreign exchange impact	0.5
Ending balance at December 31, 2017	$24.7
Purchases, sales, settlements	—
Actual return on plan assets still held at reporting date	(4.4)
Foreign exchange impact	(0.3)
Ending balance at December 31, 2018	$$ 20.0

There were no transfers in or out of Level 3 during the year ended December 31, 2018 and 2017.

Contributions

The Company expects to contribute $9.7 million to its pension plans and $0.3 million to its other post-retirement benefit plan in 2019.

Estimated Future Benefit Payments

The following benefit payments, which reflect expected future service, as appropriate, are expected to be paid:

(millions of dollars)	Pension Benefits	Other Benefits
2019	$ 21.6	$ 0.4
2020	$ 22.2	$ 0.4
2021	$ 22.9	$ 0.4
2022	$ 24.4	$ 0.5
2023	$ 24.7	$ 0.5
2024-2028	$ 128.0	$ 2.5

Investment Strategies

The investment strategy for pension plan assets is to maintain a broadly diversified portfolio designed to both preserve and grow plan assets to meet future plan obligations. The Company's average rate of return on assets from inception through December 31, 2018 was approximately 9%. The Company’s assets are strategically allocated among equity, debt and other investments to achieve a diversification level that dampens fluctuations in investment returns. The Company’s long-term investment strategy is an investment portfolio mix of approximately 55%-65% in equity securities, 30%-35% in fixed income securities and 0%-15% in other securities.

Savings and Investment Plans

The Company maintains a voluntary Savings and Investment Plan (a 401(k) plan) for most non-union employees in the U.S. Within prescribed limits, the Company bases its contribution to the Savings and Investment Plan on employee contributions. The Company's contributions amounted to $5.4 million, $5.2 million and $5.1 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Note 16. Leases

The Company has several non-cancelable operating leases, primarily for office space and equipment. Rent expense amounted to approximately $19.5 million, $19.3 million and $16.2 million for the years ended December 31, 2018, 2017 and 2016, respectively. Total future minimum rental commitments under all non-cancelable leases for each of the years 2019 through 2023 and in aggregate thereafter are approximately $17.3 million, $13.0 million, $9.5 million, $8.2 million, $7.0 million, respectively, and $24.8 million thereafter. Total future minimum payments to be received under non-cancelable leases for each of the years 2019 through 2023 and the aggregate thereafter are approximately: $1.6 million, $1.2 million, $1.2 million, $1.1 million, $1.0 million and $0 million thereafter.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Note 17. Litigation

The Company is party to a number of lawsuits arising in the normal course of our business.

Certain of the Company's subsidiaries are among numerous defendants in a number of cases seeking damages for exposure to silica or to asbestos containing materials. The Company currently has three pending silica cases and thirty four pending asbestos cases. To date, 1,493 silica cases and 57 asbestos cases have been dismissed, not including any lawsuits against AMCOL or American Colloid Company dismissed prior to our acquisition of AMCOL. Fourteen new asbestos cases were filed in 2018 and four additional cases were filed subsequent to the end of 2018. Four asbestos cases were dismissed during 2018 and no silica cases were dismissed during 2018. Most of these claims do not provide adequate information to assess their merits, the likelihood that the Company will be found liable, or the magnitude of such liability, if any. Additional claims of this nature may be made against the Company or its subsidiaries. At this time management anticipates that the amount of the Company's liability, if any, and the cost of defending such claims, will not have a material effect on its financial position or results of operations.

The Company has settled only one silica lawsuit, for a nominal amount, and no asbestos lawsuits to date (not including any that may have been settled by AMCOL prior to completion of the acquisition). We are unable to state an amount or range of amounts claimed in any of the lawsuits because state court pleading practices do not require identifying the amount of the claimed damage. The aggregate cost to the Company for the legal defense of these cases since inception continues to be insignificant. The majority of the costs of defense for these cases, excluding cases against AMCOL or American Colloid, are reimbursed by Pfizer Inc. pursuant to the terms of certain agreements entered into in connection with the Company's initial public offering in 1992. The Company is entitled to indemnification, pursuant to agreement, for sales prior to the initial public offering. Of the 34 pending asbestos cases, 25 of the non-AMCOL cases are subject to indemnification, in whole or in part, because the plaintiffs claim liability based on sales of products that occurred either entirely before the initial public offering, or both before and after the initial public offering. In five of the six remaining non-AMCOL cases, the plaintiffs have not alleged dates of exposure, and in the sixth remaining non-AMCOL case, exposure is alleged to have been after the Company's initial public offering in 1992. The remaining three cases involve AMCOL only, so no Pfizer indemnity is available. Our experience has been that the Company is not liable to plaintiffs in any of these lawsuits and the Company does not expect to pay any settlements or jury verdicts in these lawsuits.

Environmental Matters

On April 9, 2003, the Connecticut Department of Environmental Protection issued an administrative consent order relating to our Canaan, Connecticut, plant where both our Refractories segment and Specialty Minerals segment have operations. We agreed to the order, which includes provisions requiring investigation and remediation of contamination associated with historic use of polychlorinated biphenyls ("PCBs") and mercury at a portion of the site. We have completed the required investigations and submitted several reports characterizing the contamination and assessing site-specific risks. We are awaiting regulators’ approval of the risk assessment report, which will form the basis for a proposal by the Company concerning eventual remediation.

We believe that the most likely form of overall site remediation will be to leave the existing contamination in place (with some limited soil removal), encapsulate it, and monitor the effectiveness of the encapsulation. We anticipate that a substantial portion of the remediation cost will be borne by the United States based on its involvement at the site from 1942 – 1964, as historic documentation indicates that PCBs and mercury were first used at the facility at a time of U.S. government ownership for production of materials needed by the military. Pursuant to a Consent Decree entered on October 24, 2014, the United States paid the Company $2.3 million in the 4th quarter of 2014 to resolve the Company’s claim for response costs for investigation and initial remediation activities at this facility through October 24, 2014. Contribution by the United States to any future costs of investigation or additional remediation has, by agreement, been left unresolved. Though the cost of the likely remediation remains uncertain pending completion of the phased remediation decision process, we have estimated that the Company’s share of the cost of the encapsulation and limited soil removal described above would approximate $0.4 million, which has been accrued as of December 31, 2018.

The Company is evaluating options for upgrading the wastewater treatment facilities at its Adams, Massachusetts plant. This work has been undertaken pursuant to an administrative Consent Order originally issued by the Massachusetts Department of Environmental Protection (“DEP”) on June 18, 2002. This order was amended on June 1, 2009 and on June 2, 2010. The amended Order includes the investigation by January 1, 2022 of options for ensuring that the facility's wastewater treatment ponds will not result in unpermitted discharge to groundwater. Additional requirements of the amendment include the submittal by July 1, 2022 of a plan for closure of a historic lime solids disposal area. Preliminary engineering reviews completed in 2005 indicate that the estimated cost of wastewater treatment upgrades to operate this facility beyond 2024 may be between $6 million and $8 million. The Company estimates that the remaining remediation costs would approximate $0.4 million, which has been accrued as of December 31, 2018.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
The Company and its subsidiaries are not party to any other material pending legal proceedings, other than routine litigation incidental to their businesses.

Note 18. Stockholders' Equity

Capital Stock

The Company's authorized capital stock consists of 100 million shares of common stock, par value $0.10 per share, of which 35,190,343 shares and 35,374,345 shares were outstanding at December 31, 2018 and 2017, respectively, and 1,000,000 shares of preferred stock, none of which were issued and outstanding.

Cash Dividends

Cash dividends of $7.1 million or $0.20 per common share were paid during 2018. In January 2019, a cash dividend of approximately $1.7 million or $0.05 per share, was declared, payable in the first quarter of 2019.

Stock Award and Incentive Plan

At the Company’s 2015 Annual Meeting of Stockholders, the Company’s stockholders ratified the adoption of the Company’s 2015 Stock Award and Incentive Plan (the “2015 Plan”), which provides for grants of incentive and non-qualified stock options, restricted stock, stock appreciation rights, stock awards or performance unit awards. The 2015 Plan is substantially similar to the Company’s 2001 Stock Award and Incentive Plan (as amended and restated as of March 18, 2009, the “2001 Plan” and collectively with the 2015 Plan, the “Plans”). The Company established the 2015 Plan to increase the total number of shares of common stock reserved and available for issuance by 880,000 shares from the number of shares remaining under the 2001 Plan. With the ratification of the 2015 Plan by the Company’s stockholders, the 2001 Plan was discontinued as to new grants (however, all awards previously granted under the 2001 Plan remained unchanged). The Plans are administered by the Compensation Committee of the Board of Directors. Stock options granted under the Plan have a term not in excess of ten years. The exercise price for stock options will not be less than the fair market value of the common stock on the date of the grant, and each award of stock options will vest ratably over a specified period, generally three years.

The following table summarizes stock option and restricted stock activity for the Plans:

		Stock Options		Restricted Shares	
	Shares Available for Grant	Shares	Weighted Average Exercise Price per Share ($)	Shares	Weighted Average Exercise Price per Share ($)
Balance January 1, 2016	1,491,965	1,091,844	$ 42.29	284,245	$ 58.63
Granted	(538,787)	383,622	38.59	155,165	38.37
Exercised/vested	—	(150,944)	36.66	(88,746)	57.38
Canceled	249,248	(125,797)	43.78	(123,451)	50.72
Balance December 31, 2016	1,202,426	1,198,725	41.66	227,213	49.57
Granted	(257,072)	187,533	77.99	69,539	78.00
Exercised/vested	—	(353,636)	41.56	(61,274)	52.51
Canceled	91,151	(35,783)	50.47	(55,368)	52.74
Balance December 31, 2017	1,036,505	996,839	48.21	180,110	58.57

Granted	(260,508)	191,147	76.09	69,361	76.26
Exercised/vested	—	(98,945)	33.83	(59,649)	56.44
Canceled	90,026	(34,782)	65.74	(55,244)	58.57
Balance December 31, 2018	866,023	1,054,259	54.04	134,578	68.64

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Note 19. Accumulated Other Comprehensive Income (Loss)

Accumulated other comprehensive income (loss) at December 31 comprised of the following components:

	December 31,	
(millions of dollars)	2018	2017
Cumulative foreign currency translation	$(170.1)	$(104.1)
Unrecognized pension costs (net of tax benefit of $25.5 in 2018 and $30.7 in 2017)	(69.7)	(86.5)
Unrealized gain (loss) on cash flow hedges (net of tax expense of $0.3 in 2018 and $0.7 in 2017)	6.1	4.5
	$(233.7)	$(186.1)

The following table summarizes the changes in other comprehensive income (loss) by component:

	Year Ended December 31,								
	2018			2017			2016		
(millions of dollars)	Pre-Tax Amount	Tax (Expense) Benefit	Net-of-Tax Amount	Pre-Tax Amount	Tax (Expense) Benefit	Net-of-Tax Amount	Pre-Tax Amount	Tax (Expense) Benefit	Net-of-Tax Amount
Foreign currency translation adjustment	$(67.9)	$ —	$(67.9)	$44.7	$ —	$44.7	$(40.2)	$ —	$(40.2)
Pension plans:									
Net actuarial gains (losses) and prior service costs arising during the period	9.6	(1.8)	7.8	(17.6)	4.4	(13.2)	(12.5)	4.1	(8.4)
Amortization of net actuarial (gains) losses and prior service costs	12.1	(3.0)	9.1	7.6	(2.9)	4.7	8.0	(2.8)	5.2
Unrealized gains (losses) on cash flow hedges	1.5	0.1	1.6	0.2	0.1	0.3	2.4	(0.8)	1.6
Total other comprehensive income (loss)	$(44.7)	$ (4.7)	$(49.4)	$34.9	$ 1.6	$36.5	$(42.3)	$ 0.5	$(41.8)

The pre-tax amortization amounts of pension plans in the table above are included within the components of net periodic pension benefit costs (see Note 15) and the related tax amounts are included within provision (benefit) for taxes on income line within Consolidated Statements of Income.

Note 20. Accounting for Asset Retirement Obligations

The Company records asset retirement obligations in which the Company will be required to retire tangible long-lived assets. These are primarily related to its PCC satellite facilities and mining operations. The Company has also recorded the provisions related to conditional asset retirement obligations at its facilities. The Company has recorded asset retirement obligations at all of its facilities except where there are no contractual or legal obligations. The associated asset retirement costs are capitalized as part of the carrying amount of the long-lived asset.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
The following is a reconciliation of asset retirement obligations as of December 31, 2018 and 2017:

	December 31,	
(millions of dollars)	2018	2017
Asset retirement liability, beginning of period	$22.1	$21.5
Accretion expense	1.0	3.3
Other	2.1	—
Payments	(1.3)	(3.2)
Foreign currency translation	(0.5)	0.5
Asset retirement liability, end of period	$23.4	$22.1

The Company mines various minerals using a surface mining process that requires the removal of overburden. In certain areas and under various governmental regulations, the Company is obligated to restore the land comprising each mining site to its original condition at the completion of the mining activity. This liability will be adjusted to reflect the passage of time, mining activities, and changes in estimated future cash outflows

The current portion of the liability of approximately $0.4 million is included in other current liabilities and the long-term portion of the liability of approximately $23.0 million is included in other non-current liabilities in the Consolidated Balance Sheet as of December 31, 2018.

Accretion expense is included in cost of goods sold in the Company's Consolidated Statements of Income.

Note 21. Segment and Related Information

The Company determines its operating segments based on the discrete financial information that is regularly evaluated by its chief operating decision maker, our Chief Executive Officer, in deciding how to allocate resources and in assessing performance. The Company's operating segments are strategic business units that offer different products and serve different markets. They are managed separately and require different technology and marketing strategies.

The Company has four reportable segments: Performance Materials, Specialty Minerals, Refractories and Energy Services.

The Performance Materials segment is a leading global supplier of bentonite and bentonite-related products, chromite and leonardite. This segment also provides products for non-residential construction, environmental and infrastructure projects worldwide, serving customers engaged in a broad range of construction projects.

The Specialty Minerals segment produces and sells the synthetic mineral product precipitated calcium carbonate ("PCC") and processed mineral product quicklime ("lime"), and mines mineral ores then processes and sells natural mineral products, primarily limestone and talc.

The Refractories segment produces and markets monolithic and shaped refractory materials and specialty products, services and application and measurement equipment, and calcium metal and metallurgical wire products.

The Energy Services segment provides services to improve the production, costs, compliance, and environmental impact of activities performed in oil and gas industry. This segment offers a range of services for off-shore filtration and well testing to the worldwide oil and gas industry.

The accounting policies of the segments are the same as those described in the summary of significant accounting policies. The Company evaluates performance based on the operating income of the respective business units. The costs deducted to arrive at operating profit do not include several items, such as net interest or income tax expense. Depreciation expense related to corporate assets is allocated to the business segments and is included in their income from operations. However, such corporate depreciable assets are not included in the segment assets. Intersegment sales and transfers are not significant.

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Segment information for the years ended December 31, 2018, 2017 and 2016 was as follows:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Net Sales			
Performance Materials	$828.1	$734.8	$686.1
Specialty Minerals	589.3	584.8	591.5
Refractories	311.9	279.4	274.5
Energy Services	78.3	76.7	85.9
Total	1,807.6	1,675.7	1,638.0
Income from Operations			
Performance Materials	116.8	119.7	121.1
Specialty Minerals	95.4	88.9	102.7
Refractories	45.4	39.8	37.0
Energy Services	4.5	6.1	(25.9)
Total	262.1	254.5	234.9
Depreciation, Depletion and Amortization			
Performance Materials	41.1	40.5	38.9
Specialty Minerals	38.2	35.5	34.9
Refractories	6.6	6.8	6.9
Energy Services	8.4	8.2	11.2
Total	94.3	91.0	91.9
Segment Assets			
Performance Materials	2,119.7	1,989.6	1,942.1
Specialty Minerals	511.9	519.4	491.7
Refractories	296.6	307.4	283.4
Energy Services	110.4	110.6	104.7
Total	3,038.6	2,927.0	2,821.9
Capital Expenditures			
Performance Materials	22.4	33.1	12.8
Specialty Minerals	42.4	32.6	40.4
Refractories	5.0	5.9	5.9
Energy Services	4.9	4.5	1.4
Total	74.7	76.1	60.5

A reconciliation of the totals reported for the operating segments to the applicable line items in the consolidated financial statements is as follows:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Income from Operations before Provision (Benefit) for Taxes on Income			
Income from operations for reportable segments	$262.1	$254.5	$234.9
Acquisition related transaction and integration costs	(1.7)	(3.4)	(8.0)
Unallocated corporate expenses	(4.5)	(6.7)	(3.0)

Consolidated income from operations	255.9	244.4	223.9
Non-operating deductions, net	(51.8)	(53.5)	(53.6)
Income from operations before provision (benefit) for taxes on income	204.1	190.9	170.3

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Total Assets			
Total segment assets	3,038.6	2,927.0	2,821.9
Corporate assets	48.5	43.4	41.5
Consolidated total assets	3,087.1	2,970.4	2,863.4
Capital Expenditures			
Total segment capital expenditures	74.7	76.1	60.5
Corporate capital expenditures	1.2	0.6	1.9
Consolidated capital expenditures	75.9	76.7	62.4

Financial information relating to the Company's operations by geographic area was as follows:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Net Sales			
United States	$961.6	$939.3	$936.2
Canada/Latin America	83.7	81.6	82.6
Europe/Africa	443.4	349.0	338.8
Asia	318.9	305.8	280.4
Total International	846.0	736.4	701.8
Consolidated net sales	1,807.6	1,675.7	1,638.0
Long-Lived Assets			
United States	$1,767.7	$1,774.4	$1,794.5
Canada/Latin America	13.7	14.8	14.8
Europe/Africa	225.0	115.9	98.2
Asia	123.0	132.0	127.3
Total International	361.7	262.7	240.3
Consolidated long-lived assets	2,129.4	2,037.1	2,034.8

Net sales and long-lived assets are attributed to countries and geographic areas based on the location of the legal entity. No individual foreign country represents more than 10% of consolidated net sales or consolidated long-lived asset.

The Company's sales by product category are as follows:

	Year Ended December 31,		
(millions of dollars)	2018	2017	2016
Metalcasting	$328.9	$294.3	$258.0
Household, Personal Care & Specialty Products	248.8	169.6	171.2
Environmental Products	80.3	67.7	78.9
Building Materials	70.4	78.2	74.1
Basic Minerals	99.7	125.0	103.9
Paper PCC	378.5	377.7	387.9
Specialty PCC	66.9	66.0	64.3

Ground Calcium Carbonate	91.0	87.3	83.6
Talc	52.9	53.8	55.7
Refractory Products	261.1	226.9	219.0
Metallurgical Products	50.8	52.5	55.5
Energy Services	78.3	76.7	85.9
Total	$1,807.6	$1,675.7	$1,638.0

MINERALS TECHNOLOGIES INC. AND SUBSIDIARY COMPANIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Note 22. Quarterly Financial Data (unaudited)

	2018 Quarters			
(millions of dollars, except per share data)	First	Second	Third	Fourth
Net sales by segment				
Performance Materials segment	$187.3	$214.5	$219.5	$206.8
Specialty Minerals segment	149.6	150.9	146.3	142.5
Refractories segment	75.3	79.6	79.1	77.9
Energy Services segment	19.1	19.7	19.2	20.3
Net sales	431.3	464.7	464.1	447.5
Gross profit	113.5	115.9	119.2	112.8
Income from operations	62.6	62.8	68.2	62.3
Consolidated net income	41.1	45.2	42.9	44.0
Net income attributable to Minerals Technologies Inc. (MTI)	39.9	44.1	41.9	43.1
Basic earnings per share attributable to MTI shareholders	$1.13	$1.25	$1.19	$1.22
Diluted earnings per share attributable to MTI shareholders	$1.12	$1.24	$1.18	$1.22
Market price range per share of common stock:				
High	$76.95	$76.40	$77.75	$$ 67.65
Low	$66.10	$65.10	$65.75	$$ 47.89
Close	$66.95	$75.35	$67.60	$$ 51.34
Dividends paid per common share	$0.05	$0.05	$0.05	$0.05

	2017 Quarters			
(millions of dollars, except per share data)	First	Second	Third	Fourth
Net sales by segment				
Performance Materials segment	$169.9	$180.3	$188.8	$195.8
Specialty Minerals segment	146.2	147.0	147.7	143.9
Refractories segment	70.2	68.9	69.0	71.3
Energy Services segment	18.7	17.9	19.0	21.1
Net sales	405.0	414.1	424.5	432.1
Gross profit	113.7	119.7	119.3	114.5
Income from operations	62.1	69.0	67.2	46.1
Consolidated net income	35.6	43.8	42.8	76.7
Net income attributable to MTI	34.6	43.0	41.7	75.8
Basic earnings per share attributable to MTI shareholders	$0.99	$1.23	$1.18	$2.14

Diluted earnings per share attributable to MTI shareholders	$0.97	$1.21	$1.17	$2.12
Market price range per share of common stock:				
High	$83.70	$80.20	$75.60	$73.55
Low	$72.20	$70.50	$62.95	$66.40
Close	$76.60	$73.20	$70.65	$68.85
Dividends paid per common share	$0.05	$0.05	$0.05	$0.05

Report of Independent Registered Public Accounting Firm

To the Shareholders and Board of Directors
Minerals Technologies Inc.:

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Minerals Technologies Inc. and subsidiaries (the Company) as of December 31, 2018 and 2017, the related consolidated statements of income, comprehensive income, shareholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and the related notes and financial statement schedule (collectively, the consolidated financial statements). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2018, 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 (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission, and our report dated February 15, 2019 expressed an unqualified opinion on the effectiveness of the Company's internal control over financial reporting.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these consolidated 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 consolidated 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 consolidated 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 consolidated 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 consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ KPMG LLP

We have served as the Company's auditor since 1992.

New York, New York
February 15, 2019

Report of Independent Registered Public Accounting Firm

To the Shareholders and Board of Directors
Minerals Technologies Inc.:

Opinion on Internal Control Over Financial Reporting

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

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, and the related consolidated statements of income, comprehensive income, shareholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and related notes and financial statement schedule (collectively, the consolidated financial statements), and our report dated February 15, 2019 expressed an unqualified opinion on those consolidated financial statements.

The Company acquired Sivomatic Holdings, B.V. during 2018, and management excluded from its assessment of the effectiveness of the Company's internal control over financial reporting as of December 31, 2018, Sivomatic Holdings, BV's internal control over financial reporting associated with approximately 2% of total consolidated assets, excluding goodwill, mineral rights and intangibles which are included within the scope of the assessment, and approximately 3% of total consolidated revenues of the Company as of and for the year ended December 31, 2018. Our audit of internal control over financial reporting of the Company also excluded an evaluation of the internal control over financial reporting of Sivomatic Holdings, B.V.

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 of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audit also included 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/ KPMG LLP

New York, New York
February 15, 2019

Management's Report On Internal Control Over Financial Reporting

Management of Minerals Technologies Inc. is responsible for the preparation, integrity and fair presentation of its published consolidated financial statements. The financial statements have been prepared in accordance with U.S. generally accepted accounting principles and, as such, include amounts based on judgments and estimates made by management. The Company also prepared the other information included in the annual report and is responsible for its accuracy and consistency with the consolidated financial statements.

Management is also responsible for establishing and maintaining effective internal control over financial reporting. The Company's internal control over financial reporting includes those policies and procedures that pertain to the Company's ability to record, process, summarize and report reliable financial data. The Company maintains a system of internal control over financial reporting, which is designed to provide reasonable assurance to the Company's management and board of directors regarding the preparation of reliable published financial statements and safeguarding of the Company's assets. The system includes a documented organizational structure and division of responsibility, established policies and procedures, including a code of conduct to foster a strong ethical climate, which are communicated throughout the Company, and the careful selection, training and development of our people.

The Board of Directors, acting through its Audit Committee, is responsible for the oversight of the Company's accounting policies, financial reporting and internal control. The Audit Committee of the Board of Directors is comprised entirely of outside directors who are independent of management. The Audit Committee is responsible for the appointment and compensation of the independent registered public accounting firm. It meets periodically with management, the independent registered public accounting firm and the internal auditors to ensure that they are carrying out their responsibilities. The Audit Committee is also responsible for performing an oversight role by reviewing and monitoring the financial, accounting and auditing procedures of the Company in addition to reviewing the Company's financial reports. The independent registered public accounting firm and the internal auditors have full and unlimited access to the Audit Committee, with or without management, to discuss the adequacy of internal control over financial reporting, and any other matters which they believe should be brought to the attention of the Audit Committee.

Management recognizes that there are inherent limitations in the effectiveness of any system of internal control over financial reporting, including the possibility of human error and the circumvention or overriding of internal control. Accordingly, even effective internal control over financial reporting can provide only reasonable assurance with respect to financial statement preparation and may not prevent or detect misstatements. Further, because of changes in conditions, the effectiveness of internal control over financial reporting may vary over time.

The Company acquired Sivomatic Holdings, B.V. during 2018, which represented approximately 2% of total consolidated assets, excluding goodwill, mineral rights and intangibles which are included within the scope of the assessment, and approximately 3% of total consolidated revenues of the Company as of and for the year ended December 31, 2018. Sivomatic was excluded from the Company's assessment of the effectiveness of the Company’s internal control over financial reporting as of December 31, 2018.
The Company assessed its internal control system as of December 31, 2018 in relation to criteria for effective internal control over financial reporting described in "Internal Control – Integrated Framework (2013)" issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on its assessment, the Company has determined that, as of December 31, 2018, its system of internal control over financial reporting was effective.

The consolidated financial statements have been audited by the independent registered public accounting firm, which was given unrestricted access to all financial records and related data, including minutes of all meetings of stockholders, the Board of Directors and committees of the Board. Reports of the independent registered public accounting firm, which includes the independent registered public accounting firm's attestation of the effectiveness of the Company's internal control over financial reporting are also presented within this document.

/s/ Douglas T. Dietrich
Chief Executive Officer

/s/ Matthew E. Garth
Senior Vice President, Finance and Treasury, Chief Financial Officer

/s/ Michael A. Cipolla
Vice President, Corporate Controller and Chief Accounting Officer

February 15, 2019

MINERALS TECHNOLOGIES INC. & SUBSIDIARY COMPANIES
SCHEDULE II – VALUATION AND QUALIFYING ACCOUNTS
(millions of dollars)

Description	Balance at Beginning of Period	Additions Charged to Costs, Provisions and Expenses	Deductions (a)	Balance at End of Period
Year Ended December 31, 2018				
Valuation and qualifying accounts deducted from assets to which they apply:				
Allowance for doubtful accounts	$ 4.2	3.2	(4.2)	$ 3.2
Year Ended December 31, 2017				
Valuation and qualifying accounts deducted from assets to which they apply:				
Allowance for doubtful accounts	$ 7.9	3.8	(7.5)	$ 4.2
Year Ended December 31, 2016				
Valuation and qualifying accounts deducted from assets to which they apply:				
Allowance for doubtful accounts	$ 4.4	6.2	(2.7)	$ 7.9

(a) Includes impact of translation of foreign currencies.

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