

W R GRACE & CO

Form 10-K

February 28, 2019

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UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

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

For the fiscal year ended December 31, 2018

or

o 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 1-13953

W. R. GRACE & CO.

(Exact name of registrant as specified in its charter)

Delaware

65-0773649

(State or other jurisdiction of incorporation or organization) (I.R.S. Employer Identification No.)

7500 Grace Drive, Columbia, Maryland 21044-4098

(Address of principal executive offices) (Zip Code)

(410) 531-4000

(Registrant's telephone number, including area code)

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

Title of each class

Name of each exchange on which registered

Common Stock, \$.01 par value per share New York Stock Exchange, Inc.

Preferred Stock Purchase Rights

Securities registered pursuant to Section 12(g) of the Exchange 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 ý No o

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

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 ý No o

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 ý No o

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§ 229.405 of this chapter) is not contained herein, and will not be contained, to the best of 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. ý

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated

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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 Exchange Act). Yes No

The aggregate market value of W. R. Grace & Co. voting and non-voting common equity held by non-affiliates as of June 30, 2018 (the last business day of the registrant’s most recently completed second fiscal quarter) based on the closing sale price of \$73.31 as reported on the New York Stock Exchange was \$4,383,984,405.

Indicate by check mark whether the registrant has filed all documents and reports required to be filed by Sections 12, 13 or 15(d) of the Securities Exchange Act of 1934 subsequent to the distribution of securities under a plan confirmed by a court. Yes No

At January 31, 2019, 66,739,557 shares of W. R. Grace & Co. Common Stock, \$.01 par value per share, were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the definitive Proxy Statement to be delivered to our stockholders in connection with the Annual Meeting of Shareholders to be held on May 8, 2019, are incorporated by reference into Part III.

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Unless the context indicates otherwise, in this Report the terms “Grace,” “we,” “us,” or “our” mean W. R. Grace & Co. and/or its consolidated subsidiaries and affiliates, and the term the “Company” means W. R. Grace & Co. Unless otherwise indicated, the contents of websites mentioned in this report are not incorporated by reference or otherwise made a part of this Report.

GRACE®, the GRACE® logo and, except as otherwise indicated, the other trademarks, service marks or trade names used in the text of this Report are trademarks, service marks or trade names of operating units of W. R. Grace & Co. or its subsidiaries and/or affiliates. RESPONSIBLE CARE® is a trademark, registered in the United States and/or other countries, of the American Chemistry Council. UNIPOL® is a trademark of The Dow Chemical Company or an affiliated company of Dow. W. R. Grace & Co.–Conn. and/or its affiliates are licensed to use the UNIPOE® trademark in the area of polypropylene. FINANCIAL ACCOUNTING STANDARDS BOARD® and FASB ACCOUNTING STANDARDS CODIFICATION® are trademarks, registered in the United States and other countries, of Financial Accounting Foundation. IRS® is a trademark, registered in the United States and/or other countries, of Internal Revenue Service, Department of the Treasury.

The Financial Accounting Standards Board is referred to in this Report as the “FASB.” The FASB issues, among other things, Accounting Standards Codifications (which are referred to herein as “ASC”) and Accounting Standards Updates (which are referred to herein as “ASU”). The U.S. Internal Revenue Service is referred to in this Report as the “IRS.”

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PART I

Item 1. BUSINESS

BUSINESS OVERVIEW

W. R. Grace & Co. is engaged in the production and sale of specialty chemicals and specialty materials on a global basis through two reportable business segments: Grace Catalysts Technologies, which includes catalysts and related products and technologies used in refining, petrochemical and other chemical manufacturing applications; and Grace Materials Technologies, which includes specialty materials, including silica-based and silica-alumina-based materials, used in consumer/pharma, chemical process, and coatings applications.

Grace is the successor to a company that began in 1854 and originally became a public company in 1953. We entered the specialty chemicals and specialty materials industries in 1954, the year in which we acquired the Davison Chemical Company. W. R. Grace & Co. is a Delaware corporation.

Developments

On April 3, 2018, using cash on hand and borrowings under our credit agreement, we acquired the assets of the polyolefin catalysts business of Albemarle Corporation. We acquired the business for \$418.0 million, net of cash acquired and including customary post-closing adjustments. The business is included in the Specialty Catalysts operating segment of the Grace Catalysts Technologies reportable segment. The acquisition is complementary to our existing specialty catalysts business and strengthens our commercial relationships, catalysts technology portfolio, and manufacturing network.

On January 27, 2016, Grace entered into a separation agreement with GCP Applied Technologies Inc., then a wholly-owned subsidiary of Grace (“GCP”), pursuant to which Grace agreed to transfer its Grace Construction Products operating segment and the packaging technologies business of its Grace Materials Technologies operating segment to GCP (the “Separation”). Grace and GCP completed the Separation on February 3, 2016 (the “Distribution Date”), by means of a pro rata distribution to the Company’s stockholders of all of the outstanding shares of GCP common stock (the “Distribution”), with one share of GCP common stock distributed for each share of Company common stock held as of the close of business on January 27, 2016. As a result of the Distribution, GCP became an independent public company. GCP’s historical financial results through the Distribution Date are reflected in Grace’s Consolidated Financial Statements as discontinued operations.

On February 3, 2014, Grace concluded a voluntary reorganization under Chapter 11 of the United States Bankruptcy Code in the United States Bankruptcy Court for the District of Delaware, when the joint plan of reorganization (the “Joint Plan”) filed by Grace and certain other parties became effective.

Global Scope

We operate our business on a global scale with approximately 72% of our 2018 sales outside the United States. We operate and/or sell to customers in over 70 countries and in over 30 currencies. We manage our operating segments on a global basis, to serve global markets. Currency fluctuations affect our reported results of operations, cash flows, and financial position.

Profitable Growth Strategy

We create value for customers and investors by profitably growing our specialty chemicals and specialty materials businesses and achieving high levels of efficiency and cash flow. To meet these objectives, we:

- Invest to accelerate growth and extend our competitive advantages;
- Invest in great people to strengthen our high-performance culture;
- Execute the Grace Value Model to drive operating excellence; and
- Acquire to build our technology and manufacturing capabilities for our customers.

Our businesses are well-positioned to grow through our customer-driven innovation, commercial and operating excellence and thoughtful, disciplined merger and acquisition approach. Our businesses are interconnected through shared materials science and our highly-integrated global manufacturing and supply chain operations.

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Our organic growth drivers include: global demand for plastics and petrochemical feedstocks; global demand for cleaner fuels and heavy oil upgrading; rising living standards and growing middle class incomes; stricter environmental standards; and increased focus on health and wellness.

The Grace Value Model (“GVM”)

In 2018, we introduced investors to the Grace Value Model, our framework for creating and delivering value to customers, investors and employees. At the company level, we create value through our focused portfolio, strong strategic position, and disciplined capital allocation. At the business level, we create value through customer-driven innovation, commercial excellence, and operating excellence. Linking and enabling all of these elements are great talent, high-performance culture, and integrated business management processes. Our ability to rigorously execute the Grace Value Model is a principal source of our competitive advantage in the global marketplace and our financial performance. The Grace Value Model is illustrated as follows:

Our Approach to Mergers & Acquisitions (“M&A”)

Our approach to M&A prioritizes strategic fit, synergies and returns. We seek investments that improve our technology, research and development and/or commercial capabilities; enhance and/or leverage our manufacturing capabilities; and include attractive growth and profitability opportunities. Our recent acquisitions have been very synergistic, with strong growth and returns driven by significant cost and capital synergies. We establish minimum return requirements for every investment, based on specific risk-adjusted hurdle rates, and expect all acquisitions to be accretive to earnings per share (“EPS”).

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Our Reportable Business Segments

GRACE CATALYSTS TECHNOLOGIES

Catalysts Technologies uses our significant catalysts knowledge and applications expertise to design and manufacture products to create significant value for our customers. Our customers include major oil refiners as well as plastics and chemicals manufacturers. We believe that our technological expertise and broad technology platform provide a competitive advantage, allowing us to quickly design products that help our customers create value in their operations and their end markets.

The following table sets forth Catalysts Technologies sales of similar products as a percentage of Grace total revenue.

(In millions)	Year Ended December 31,					
	2018		2017		2016	
	Sales	% of Grace Revenue	Sales	% of Grace Revenue	Sales	% of Grace Revenue
Refining catalysts	\$802.0	41.5 %	\$758.1	44.2 %	\$724.9	45.3 %
Polyolefin and chemical catalysts	661.5	34.2 %	518.4	30.2 %	438.8	27.5 %
Total	\$1,463.5	75.7 %	\$1,276.5	74.4 %	\$1,163.7	72.8 %

A description of our Catalysts Technologies products and services and their applications follows:

Products and Services	Overview/Use	Key Brands
Refining Technologies		
FCC Catalysts	Crack the hydrocarbon chains in distilled crude oil to produce transportation fuels, such as gasoline and diesel fuels, and feeds for production of petrochemicals	MIDAS® • IMPACT® • NEKTOR™ • GENESIS ACHIEVE®
FCC Additives	Used to reduce sulfur in gasoline, maximize propylene production from refinery FCC units, and reduce emissions of sulfur oxides, nitrogen oxides, and carbon monoxide from refinery FCC units	D-PRISM® • GSR® • SURCA® • OLEFINSMAX® • OLEFINSULTRA® • DESOX® • DENOX® • XNOX® • CP® P
Methanol-to-Olefins (MTO) Catalysts	Used to convert methanol, often derived from coal, into petrochemical feeds such as ethylene and propylene	GCQ™
Hydroprocessing Catalysts (HPC)	Marketed through the ART joint venture with Chevron (discussed below), these catalysts are used in process reactors to upgrade heavy oils into lighter, more useful products, enabling less expensive feedstock usage in the petroleum refining process and to produce products that meet more stringent environmental regulations	ICR® • GR® • SmART Catalyst System® • APART®
Polyolefin and Chemical Catalysts (also referred to as Specialty Catalysts)		
Polyethylene Catalysts/Polypropylene Catalysts/Catalyst Supports	Used in the production of polyethylene (PE) and polypropylene (PP) thermoplastic resins, which can be customized to enhance the performance of a wide range of industrial and consumer end-use applications including high pressure pipe, geomembranes, food packaging, automotive parts, medical devices, and textiles	PE - MAGNAPORE® • SYLOPOL® • LYNX® PP - CONSISTA® • SHAC® • LYNX® • POLYTRAK® • HYAMPP®

Gas-Phase Polypropylene Process Technology Licensing	Provides licensees with a proven, cost-effective, flexible, and reliable capability to manufacture polypropylene products having a wide spectrum of performance attributes enabling customers to manufacture products for a broad array of end-use applications	UNIPOL [®] PP Process Technology • UNIPOL UNIPPAC [®] Process Control Software
Chemical Catalysts	Used in a variety of petrochemical chain conversions and fine chemical production	RANEY [®] • DAVICAT [®]

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Grace Catalysts Technologies—Refining Catalysts

FCC Catalysts

We are a global leader in developing and manufacturing fluid catalytic cracking, or FCC, catalysts and additives that are designed to enable petroleum refiners to increase profits by improving product yields, value and quality. Our FCC products also enable refiners to reduce emissions from their FCC units and reduce sulfur content in the transportation fuels they produce. Oil refining is a highly specialized discipline and FCC catalysts must be tailored to meet local variations in crude oil feedstocks and a refinery's product mix. We work regularly with our customers to identify the most appropriate catalyst and additive formulations for their changing needs.

Many countries and regions, including the U.S., European Union, Japan, Russia, India and China have imposed regulatory limitations on the sulfur content of gasoline and diesel fuel. We have developed a portfolio of products designed to assist refiners in meeting their gasoline sulfur-reduction targets, including our D-PRISM® and GSR® additives and our SURCA® catalyst family.

Also, many U.S. petroleum refiners have entered into consent decrees with the U.S. Environmental Protection Agency (the "EPA") under which the refiners have agreed to reduce emissions of nitrogen oxides and sulfur oxides. The European Union has also imposed requirements on refineries with respect to nitrogen oxides and sulfur oxides emissions. Our additives are designed to assist refineries in meeting their obligations to reduce these pollutants. Our Super DESOX® additive reduces sulfur oxides emissions from commercial FCC units. Our DENOX® additives are designed to achieve reductions in nitrogen oxides emissions comparable to those obtained from capital intensive alternatives available to a refinery, while our non-platinum-based combustion promoters XNOX® and CP® P are designed to enable refiners to control carbon monoxide emissions without increasing nitrogen oxides.

Hydroprocessing Catalysts

We market most of our hydroprocessing catalysts through our Advanced Refining Technologies LLC ("ART") joint venture with Chevron Products Company ("Chevron"). We hold a 50% economic interest in ART, which is not consolidated in our financial statements so ART's sales are excluded from our sales. We established ART to combine our technology with that of Chevron and to develop, market and sell hydroprocessing catalysts to customers in the petroleum refining industry worldwide.

We are a leading supplier of hydroprocessing catalysts designed for processing high resid content feedstocks. We offer products for fixed-bed resid hydrotreating, on-stream catalyst replacement, and ebullating-bed resid hydrocracking processes.

We also offer a full line of catalysts, customized for individual refiners, used in distillate hydrotreating to produce ultra-low sulfur content gasoline and diesel fuel, including our SmART CATALYST SYSTEM® and APART® catalyst systems. As discussed above, regulatory limitations on the sulfur content of gasoline and diesel fuel are becoming more common. These products are designed to help refiners to reduce the sulfur content of their products. We have rights to sell hydrocracking and lubes hydroprocessing catalysts to licensees of Chevron Lummus Global ("CLG") and other petroleum refiners for unit refills. These rights allow us to streamline hydroprocessing catalyst supply and improve technical service for refining customers by establishing ART as their single point of contact for all their hydroprocessing catalyst needs.

Polyolefin Catalysts, Catalyst Supports and Polypropylene Process Technology

We are a leading provider of catalyst systems and catalyst supports to the polyolefins industry for a variety of polyethylene and polypropylene process technologies.

We use a combination of proprietary catalyst and support technology and technology licensed from third parties to provide unique catalyst-based solutions to our customers and to provide a broad technology portfolio for enhancing collaboration opportunities with technology leaders.

Also, we are a leading licensor of gas-phase polypropylene process technology to polypropylene manufacturers. Our UNIPOL® polypropylene technology is designed to have fewer moving parts and require less equipment than other competing technologies, which reduces operating costs. This technology provides our

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licensees with a flexible and reliable capability to manufacture products for a broad array of end-use applications. The polypropylene process licensing industry is technology-intensive, and licensors must adapt the technology and the related licenses to meet individual customer needs.

Manufacturing, Marketing and Raw Materials

Our Catalysts Technologies products are manufactured by a network of globally coordinated plants. Our integrated planning organization is responsible for the effective utilization of our manufacturing capabilities. For a discussion of our principal manufacturing plants for Catalysts Technologies, see Item 2, "Properties," below.

We use a global organization of technical professionals with extensive experience in refining processes, catalyst development, and catalyst applications to market our refining catalysts and additives. These professionals work to tailor our technology to the needs of each specific customer. We generally negotiate prices for our refining catalysts because our formulations are specific to the needs of each customer and each customer receives individual attention and technical service. We sell a significant portion of our hydroprocessing catalysts through multiple-year supply agreements with our geographically diverse customer base.

We use a global direct sales force for our polyolefin catalysts, supports and technologies and chemical catalysts that seeks to maintain close working relationships with our customers. These relationships enable us to cooperate with major polymer and chemical producers to develop catalyst technologies that complement their process or application developments. We have geographically distributed our sales and technical service professionals to make them responsive to the needs of our geographically diverse customers. We typically operate under long-term contracts with our customers.

The principal raw materials for Catalysts Technologies products include molybdenum oxide, zeolite, caustic soda, alumina and derivatives, sodium silicate, nickel, rare earths, and tungsten salt. Multiple suppliers are generally available for each of these materials; however, some of our raw materials may be provided by single sources of supply. We seek to mitigate the risk of using single source suppliers by identifying and qualifying alternative suppliers or, for unique materials, by using alternative formulations from other suppliers or by passing price increases on to customers. In some instances, we produce our own raw materials and intermediates.

Prices for many of our raw materials, including metals, and energy can be volatile. In response to increases in raw material and energy costs, we generally take actions to mitigate the effects of higher costs including increasing prices, developing alternative formulations for our products, increasing productivity, and hedging purchases of certain raw materials.

As in many chemical businesses, we consume significant quantities of natural gas in the production of Catalysts Technologies products. World events and other economic factors cause volatility in the price of natural gas. Increases or decreases in the cost of natural gas and raw materials can have a significant impact on our operating margins. We have implemented a risk management program under which we hedge natural gas in a way that is designed to provide protection against price volatility.

Seasonality

Seasonality does not have a significant overall effect on our Catalysts Technologies reportable segment. However, under traditional patterns, sales of FCC catalysts have tended to be lower in the first calendar quarter due to maintenance outages taken prior to the shift in production by refineries from home heating oil for the winter season to gasoline production for the summer season. FCC catalysts and ebullating-bed hydroprocessing catalysts are consumed at a relatively steady rate and are replaced regularly. Fixed-bed hydroprocessing catalysts are consumed over a period of years and are replaced in bulk in an irregular pattern. Since our customers periodically shut down their refining processes to replace fixed-bed hydroprocessing catalysts in bulk, our hydroprocessing catalyst sales to any customer can vary substantially over the course of a year and between years based on that customer's catalyst replacement schedule.

Backlog of Orders; Working Capital

While at any given time there may be some backlog of orders, this backlog is not material in respect to our total annual sales for Catalysts Technologies, nor are the changes, from time to time, significant. There have not been any significant out-of-the-ordinary practices related to working capital items for Catalysts Technologies.

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Competition

Competition in FCC catalysts and additives is based on value delivered to refiners, which is based on differentiated technology, catalyst performance, technical and customer service, and price. Our principal global FCC catalyst competitors are Albemarle, BASF, and SINOPEC. Our principal global competitors in FCC additives are Johnson Matthey, Albemarle, and BASF. We also have multiple regional competitors for FCC catalysts and additives.

Competition in the hydroprocessing catalyst industry is based on value delivered to refiners, which is based on differentiated technology, catalyst performance, technical and customer service, and price. Criterion, Albemarle, Haldor Topsoe, UOP, and Axens are our principal global competitors in hydroprocessing catalysts. We also have multiple regional competitors.

Competition in the polyolefin catalyst, catalyst supports, and polypropylene process licensing industry is technology-intensive. Our competition in this industry includes Univation, LyondellBasell, PQ, and Lummus Novolen Technology. Most competitors sell their products and/or license their technology worldwide.

GRACE MATERIALS TECHNOLOGIES

Materials Technologies uses our significant specialty silica, zeolite and fine chemical knowledge and applications expertise to design and manufacture products to create significant value for our customers. Our customers include coatings manufacturers, consumer product manufacturers, plastics manufacturers, petrochemical and natural gas processors, and pharmaceutical companies. We believe that our technological expertise and broad technology platform provide a competitive advantage, allowing us to tailor our products to specific customer requirements and help them create value in their operations and end markets.

The following table sets forth Materials Technologies sales of similar products as a percentage of Grace total revenue.

	Year Ended December 31,								
	2018			2017			2016		
(In millions)	Sales	% of Grace Revenue	%	Sales	% of Grace Revenue	%	Sales	% of Grace Revenue	%
Coatings	\$155.4	8.1	%	\$142.2	8.3	%	\$136.5	8.5	%
Consumer/Pharma	132.6	6.9	%	123.3	7.2	%	121.9	7.6	%
Chemical process	157.3	8.1	%	153.5	8.9	%	142.6	8.9	%
Other	23.3	1.2	%	21.0	1.2	%	33.9	2.2	%
Total	\$468.6	24.3	%	\$440.0	25.6	%	\$434.9	27.2	%

Our materials are integrated into our customers' manufacturing processes and when combined with our technical support, can increase the efficiency and performance of their operations and their products. By working closely with our customers, we seek to help them respond quickly to changing consumer demands. In addition, we focus on developing and manufacturing products that differentiate our customers' products and help them meet evolving regulatory and environmental requirements. For example, our coatings additives are designed to be used in more sustainable water-based and VOC-compliant coatings. Our pharmaceutical excipients help improve bioavailability, extend shelf-life, and/or make drug manufacturing more efficient. Our dental silicas are

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engineered to provide high cleaning with gentle abrasivity. Our beer stabilization silicas offer greater productivity to breweries while reducing solid waste and water usage. Our custom manufacturing of advanced intermediates supports pharmaceutical drug development processes, enabling commercialization of life-saving therapies.

Manufacturing, Marketing and Raw Materials

Our Materials Technologies products are manufactured by a network of globally integrated plants that are positioned to service our customers. Our integrated planning organization is responsible for the effective utilization of our manufacturing capabilities. Our global footprint allows us to partner effectively with both multinational and regional companies requiring multiple manufacturing facilities complemented by regional technical expertise in local languages. For a discussion of our principal manufacturing plants for Materials Technologies, see Item 2, “Properties,” below.

We use country-based direct sales forces and further support our customers with application-specific technical customer service teams to market our Materials Technologies products. Our sales force seeks to develop long-term relationships with our customers and focuses on consultative sales, technical support and key account growth programs. To ensure full geographic coverage, our direct sales organization is further supplemented by a network of distributors.

The principal raw materials for Materials Technologies products include sodium silicate, zeolite, sand, soda ash, sulfuric acid, and caustic soda. Multiple suppliers are generally available for each of these materials; however, some of our raw materials may be provided by single sources of supply. We seek to mitigate the risk of using single source suppliers by identifying and qualifying alternative suppliers or, for unique materials, by using alternative formulations from other suppliers. In some instances, we produce our own raw materials and intermediates.

Prices for some of our raw materials and energy can be volatile. In response to increases in input costs, we generally take actions intended to mitigate the effects of higher costs including increasing prices, developing alternative formulations for our products, and increasing productivity.

As in many chemical businesses, we consume significant quantities of natural gas in the production of Materials Technologies products. World events and other economic factors can cause volatility in the price of natural gas. Increases or decreases in the cost of natural gas and raw materials can have a significant impact on our operating margins. We have implemented a risk management program under which we hedge natural gas in a way that is intended to provide protection against price volatility.

Seasonality

Seasonality does not have a significant overall effect on our Materials Technologies reportable segment; however, sales of our adsorbents for dual frame windows are affected by seasonal and weather-related factors and the level of construction activity, and sales of our stabilizers and clarification aids for beer, juices and other beverages are affected by the level of consumption of beverages. These impacts are mitigated by the global scope of our business.

Backlog of Orders; Working Capital

While at any given time there may be some backlog of orders, this backlog is not material in respect to our total annual sales for Materials Technologies, nor are the changes, from time to time, significant. There have not been any significant out-of-the-ordinary practices relating to working capital items for Materials Technologies.

Competition

There are many manufacturers of engineered materials that market their products on a global basis including Evonik, PQ, and UOP. Competition is generally based on product performance, technical service, quality and reliability, price, and other differentiated product features to address the needs of customers, end-users and brand owners. Our products compete on the basis of distinct technology, product quality, and customer support. Competition for these products is highly fragmented, with a large number of companies that sell their products on a global or regional basis.

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Competition in the specialty chemicals and specialty materials industry is often based on technological superiority and innovation. Our ability to maintain our margins and effectively compete with other suppliers depends on our ability to introduce new products based on innovative technology, as well as our ability to obtain patent or other intellectual property protection. Our research and development programs emphasize development of new products and processes, improvement of existing products and processes, and application of existing products and processes to new industries and uses. We conduct most of our research activity in North America and Europe.

We selectively file and obtain patents in our Refining Technologies business, as well as in our chemical catalysts product line in our Specialty Catalysts business, for strategic new products or for significant business opportunities. We routinely file and obtain patents in a number of countries around the world that are significant to our polyolefin catalysts product line in our Specialty Catalysts business. In our Materials Technologies business, we focus our research on the development and use of materials-based specialty products, and expertise for diverse applications. We file patents and use trade secret protection to protect our unique products, processes and expertise in strategic segments of the business, and to cover key product innovations in adjacent market segments. We file and obtain patents and trademarks in various countries to strengthen and protect our product offerings globally.

We file patents in order to protect our investments in innovation, research, and product development. Numerous patents and patent applications protect our products, formulations, manufacturing processes, equipment, and improvements. We also benefit from the use of trade secret information, including know-how and other proprietary information relating to many of our products and processing technologies. There can be no assurance, however, that our patents, patent applications and precautions to protect trade secrets and know-how will provide sufficient protection for our intellectual property. In addition, other companies may independently develop technology that could replicate, and thus diminish the advantage provided by, our trade secrets. Other companies may also develop alternative technology or design-arounds that could circumvent our patents or may acquire patent rights applicable to our business which might interpose a limitation on expansion of our business in the future.

ENVIRONMENT, HEALTH AND SAFETY MATTERS

We are subject, along with other manufacturers of specialty chemicals, to stringent regulations under numerous regional, national, provincial, state and local environment, health and safety laws and regulations relating to the manufacture, storage, handling, disposal and stewardship of chemicals and other materials. Environmental laws require that certain responsible parties, as defined in the relevant statute, fund remediation actions regardless of legality of original disposal or ownership of a disposal site. We are involved in various response actions to address the presence of chemical substances as required by applicable laws.

We have expended substantial funds to comply with environmental laws and regulations and expect to continue to do so in the future. The following table sets forth our expenditures in the past three years, and our estimated expenditures in 2019 and 2020, for (i) the operation and maintenance of manufacturing facilities and the disposal of wastes; (ii) capital expenditures for environmental control facilities; and (iii) site remediation:

	Operation of Facilities and Waste Disposal	Capital Expenditures	Site Remediation
2016	\$ 62	\$ 10	\$ 18
2017	51	7	20
2018	56	8	18
2019(1)(2)	59	23	20
2020(1)(2)	61	13	7

(1)

Amounts are based on environmental response matters for which sufficient information is available to estimate costs. We do not have sufficient information to estimate all of Grace's possible future environmental response costs. As we receive new information, our estimate of such costs may change materially.

- (2) Amounts do not include estimated expenditures related to the replacement of the dam spillway on the Libby, Montana, mine site.

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Additional information about our environmental remediation activities is provided in this Report in Item 8 “Financial Statements and Supplementary Data” in the Financial Supplement under Note 10, “Commitments and Contingent Liabilities,” to the Consolidated Financial Statements, which information is incorporated herein by reference.

Environment, Health and Safety Programs

We continuously seek to improve our environment, health and safety performance. To the extent applicable, we extend the basic elements of the American Chemistry Council’s RESPONSIBLE CARE® program to all our locations worldwide, embracing specific performance objectives in the key areas of management systems, product stewardship, employee health and safety, community awareness and emergency response, distribution, process safety and pollution prevention.

Sustainability

We succeed when we deliver value to our customers, and that success is increasingly based on how we help them meet their sustainability goals. Many of our products and technical services improve the efficiency of our customers’ processes, reduce energy or water use, cut harmful emissions, conserve material inputs, and/or reduce waste. Many of our technologies enable our customers to make products that meet the toughest environmental standards or to reformulate products to address rising consumer and regulatory expectations for sustainability, human health, and safety. As a leading manufacturer of process catalysts, including hydroprocessing catalysts that reduce sulfur emissions, we have become an active participant in the circular economy, with an increasing business in arranging for the recycling or reprocessing of spent catalysts.

Security

We have implemented the RESPONSIBLE CARE® Security Code through a company-wide security program focused on the security of our people, processes, and systems. We have reviewed existing security (including cybersecurity) vulnerability and taken actions to enhance security systems where deemed necessary. In addition, we are complying with the Department of Homeland Security’s Chemical Facility Anti-Terrorism Standards, including identifying facilities subject to the standards, conducting security vulnerability assessments and developing site security plans, as necessary.

EMPLOYEE RELATIONS

As of December 31, 2018, we employed approximately 3,900 persons, of whom approximately 2,100 were employed in the United States and approximately 1,000 were employed in Germany. Of our total employees, approximately 2,400 were salaried and 1,500 were hourly.

Approximately 700 of our manufacturing employees at 5 manufacturing sites in the United States are represented by unions. We have operated without a labor work stoppage for more than 20 years. We have works councils representing the majority of our European sites serving approximately 1,100 employees.

OTHER INFORMATION, AVAILABILITY OF REPORTS AND OTHER DOCUMENTS

W. R. Grace & Co. is a Delaware corporation. Our principal executive offices are located at 7500 Grace Drive, Columbia, Maryland 21044. We maintain an Internet website at www.grace.com. Our telephone number at our principal executive offices is +1 410.531.4000.

Our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports, filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, are available, free of charge, on our website as soon as reasonably practicable after such reports are electronically filed with, or furnished to, the Securities and Exchange Commission, or SEC. These reports may be accessed through our website’s investor information page. These reports as well as our proxy and information statements may also be accessed through the SEC’s website at www.sec.gov.

In addition, the charters for the Audit, Compensation, Nominating and Governance, and Corporate Responsibility Committees of our Board of Directors, our corporate governance principles and code of ethics are available, free of charge, on our website at www.grace.com/en-us/corporate-leadership/pages/governance.aspx. Printed copies of the charters, governance principles and code of ethics may be obtained free of charge by contacting Grace Shareholder Services at +1 410.531.4167.

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The information on our website is not, and shall not be deemed to be, a part of this report or incorporated into any other filings we make with the SEC.

Our Principal Executive Officer (and Acting Principal Financial Officer) has submitted certifications to the SEC pursuant to the Sarbanes Oxley Act of 2002 as exhibits to this Report.

Important information can be found throughout this Form 10-K and shareholders and potential investors are encouraged in particular to review Item 1A, "Risk Factors."

EXECUTIVE OFFICERS

See "Executive Officers of the Registrant" following Part I, Item 4 of this Report for information about our Executive Officers.

Item 1A. RISK FACTORS

This Report, including the Financial Supplement, contains, and our other public communications may contain, forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. All statements other than statements of historical fact, including statements regarding: expected financial positions; results of operations; cash flows; financing plans; business strategy; operating plans; capital and other expenditures; environmental expenditures; competitive positions; growth opportunities for existing products; benefits from new technology and cost reduction initiatives, plans and objectives; and markets for securities, are forward looking. Such statements generally include the words "believes," "plans," "intends," "targets," "will," "expects," "suggests," "anticipates," "continues" or similar expressions. For these statements, we claim the protection of the safe harbor for forward-looking statements contained in Section 27A of the Securities Act and Section 21E of the Exchange Act. We are subject to risks and uncertainties that could cause our actual results to differ materially from our projections or that could cause other forward-looking statements to prove incorrect. Factors that could cause actual events to differ materially from those contained in the forward-looking statements include those factors set forth below and elsewhere in this Annual Report on Form 10-K. Our reported results should not be considered as an indication of our future performance. Readers are cautioned not to place undue reliance on our projections and forward-looking statements, which speak only as of the date those projections and statements are made. We undertake no obligation to publicly release any revisions to the projections and forward-looking statements contained in this document, or to update them to reflect events or circumstances occurring after the date of this document. In addition to general economic, business and market conditions, we are subject to other risks and uncertainties, including, without limitation, the following:

Risks Related to the Business

The global scope of our operations subjects us to the risks of doing business in foreign countries, and with other parties located in foreign jurisdictions, which could adversely affect our business, financial condition and results of operations.

We operate our business on a global scale with approximately 72% of our 2018 sales outside the United States. We operate and/or sell to customers in over 70 countries and in over 30 currencies. We currently have many production facilities, research and development facilities and administrative and sales offices located outside North America, including facilities and offices located in EMEA (Europe Middle East Africa), Asia Pacific and Latin America. We expect non-U.S. sales to continue to represent a substantial majority of our revenue. Accordingly, our business is subject to risks related to the differing legal, political, social and regulatory requirements and economic conditions of many jurisdictions. Risks inherent in non-U.S. operations include the following:

- commercial agreements may be more difficult to enforce and receivables more difficult to collect;
- intellectual property rights may be more difficult to enforce;
- increased shipping costs, disruptions in shipping or reduced availability of freight transportation;
- we may have difficulty transferring our profits or capital from foreign operations to other countries where such funds could be more profitably deployed;
- we may experience unexpected adverse changes in export duties, quotas and tariffs and difficulties in obtaining export licenses;

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some foreign countries have adopted, and others may impose, additional withholding and other taxes or adopt other restrictions on foreign trade or investment, including import, currency exchange and capital controls, charges and limitations;

foreign governments may nationalize private enterprises;

our business and profitability in a particular country could be affected by political or economic repercussions on a domestic, country-specific or global level from terrorist activities and the response to such activities;

we may be affected by unexpected adverse changes in foreign laws or regulatory requirements;

we may have to pay increased cash taxes in the event of a change in tax laws, regulations or interpretations in one or more foreign jurisdictions, and our business, financial condition or results of operations, or liquidity could be adversely affected; and

we are exposed to geopolitical risk, where unexpected changes in global, regional, or local political or social conditions could adversely affect our foreign operations.

Our success as a global business will depend, in part, upon our ability to succeed in differing legal, regulatory, economic, social and political conditions by developing, implementing and maintaining policies and strategies that are effective in each location where we do business.

In addition to the risks and uncertainties that we discussed above, recent world events have increased the risks posed by international trade disputes, tariffs, and sanctions. We procure a wide spectrum of commodities globally to support our production. For materials sourced from nations that could be impacted by trade disputes, tariffs or sanctions, we could potentially face increased costs, supply disruptions and/or costs associated with securing alternative materials. Additionally, such disputes, tariffs, and sanctions could potentially lead to a reduction in our sales of products, technology, and services. We view geopolitical risk along with other potential supply chain and sales risks, and work actively to diversify and mitigate these potential impacts; however, such events could adversely affect our business, financial condition and results of operations.

We are exposed to currency exchange rate changes that impact our profitability.

We are exposed to currency exchange rate risk through our U.S. and non-U.S. operations. Changes in currency exchange rates may materially affect our operating results. For example, changes in currency exchange rates may affect the relative prices at which we and our competitors sell products in the same region and the cost of materials used in our operations. A substantial portion of our net sales and assets are denominated in currencies other than the U.S. dollar, particularly the euro. When the U.S. dollar strengthens against other currencies, at a constant level of business, our reported sales, earnings, assets and liabilities are reduced because the non-U.S. currencies translate into fewer U.S. dollars.

We incur a currency transaction risk whenever one of our operating subsidiaries enters into either a purchase or a sales transaction using a currency different from the operating subsidiary's functional currency. Given the volatility of exchange rates, we may not be able to manage our currency transaction risks effectively, or volatility in currency exchange rates may expose our financial condition or results of operations to a significant additional risk.

Prices for certain raw materials and energy are volatile and can have a significant effect on our manufacturing and supply chain strategies as we seek to maximize our profitability. If we are unable to successfully adjust our strategies in response to volatile raw materials and energy prices, such volatility could have a negative effect on our earnings in future periods.

We use metals, natural gas, petroleum-based materials, and other materials in the manufacture of our products. We consume substantial amounts of energy in our manufacturing processes. Prices for these materials and energy are volatile and can have a significant effect on our pricing, sales, manufacturing and supply chain strategies as we seek to maximize our profitability. Our ability to successfully adjust strategies in response to volatile raw material and energy prices is a significant factor in maintaining or improving our profitability. If we are unable to successfully adjust our strategies in response to volatile prices, such volatility could have a negative effect on our sales and earnings in future periods.

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A substantial portion of our raw materials are commodities whose prices fluctuate as market supply and demand fundamentals change.

We attempt to manage exposure to price volatility of major commodities through:

• long-term supply contracts;

• contracts with customers that permit adjustments for changes in prices of commodity-based materials and energy;

• forward buying programs that layer in our expected requirements systematically over time; and

• limited use of financial instruments.

Although we regularly assess our exposure to raw material price volatility, we cannot always predict the prospects of volatility and we cannot always cover the risk in a cost effective manner.

We have a policy of maintaining, when available, multiple sources of supply for raw materials. However, certain of our raw materials may be provided by single sources of supply. We may not be able to obtain sufficient raw materials due to unforeseen developments that would cause an interruption in supply. Even if we have multiple sources of supply for raw materials, these sources may not make up for the loss of a major supplier.

If we are not able to continue our technological innovation and successful introduction of new products, our customers may turn to other suppliers to meet their requirements.

The specialty chemicals and specialty materials industries and the end-use markets into which we sell our products experience ongoing technological change and product improvements. A key element of our business strategy is to invest in research and development activities with the goal of introducing new high-performance, technically differentiated products. We may not be successful in developing new technology and products that effectively compete with products introduced by our competitors, and our customers may not accept, or may have lower demand for, our new products. If we fail to keep pace with evolving technological innovations or fail to improve our products in response to our customers' needs, then our business, financial condition and results of operations could be adversely affected as a result of reduced sales of our products.

We spend large amounts of money for environmental compliance in connection with our current and former operations.

As a manufacturer of specialty chemicals and specialty materials, we are subject to stringent regulations under numerous U.S. federal, state, local and foreign environmental, health and safety laws and regulations relating to the generation, storage, handling, discharge, disposition and stewardship of chemicals and other materials. We have expended substantial funds to comply with such laws and regulations and have established a policy to minimize our emissions to the environment. Nevertheless, legislative, regulatory and economic uncertainties (including existing and potential laws and regulations pertaining to climate change) make it difficult for us to project future spending for these purposes, and if there is an acceleration in new regulatory requirements, we may be required to expend substantial additional funds to remain in compliance.

We are subject to environmental clean-up costs, fines, penalties and damage claims that have been and continue to be costly.

In the U.S., we are subject to lawsuits and regulatory actions, in connection with current and former operations (including some divested businesses and off-site disposal facilities), that seek clean-up or other remedies. We are also subject to similar risks outside of the U.S.

We operated a vermiculite mine in Libby, Montana, until 1990. Some of the vermiculite ore that was mined at the Libby mine contained naturally occurring asbestos. We are cooperating with the U.S. Environmental Protection Agency (or the "EPA") and other federal, state and local governmental agencies in a remedial investigation and feasibility study (or the "RI/FS") of the Libby mine and the surrounding area, known as Operable Unit 3 (or "OU3"), to determine the location, scope and extent of required remediation. The RI/FS will determine the specific areas within OU3 requiring remediation and will identify possible remedial action alternatives. Possible remedial actions within OU3 are wide-ranging, from institutional controls such as land use restrictions, to more active measures involving soil removal, containment projects, or other protective measures. As part of the RI/FS process, we contracted an engineering and consulting firm to develop a range of possible remedial

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alternatives and associated cost estimates for OU3. Based on this work, we recorded a pre-tax charge of \$70.0 million in the 2018 third quarter for the estimated costs of remediation of OU3.

The estimated costs of remediation are preliminary and consist of several components, each of which may vary significantly as the remedial alternatives are further developed and analyzed by the regulatory bodies providing oversight. It is reasonably possible that the ultimate costs of remediation could range between \$30 million and \$170 million. The ultimate remedy will be determined by the EPA after the RI/FS is finalized. Such remedy will be set forth in a Record of Decision (or “ROD”) that is expected to be issued by the EPA during or after 2020. Costs associated with the more active remedial alternatives would be expected to be incurred over a decade or more. We will reevaluate our estimated liability as remedial alternatives evolve based on further work by the engineering and consulting firm and discussions with the EPA as the RI/FS process moves toward a ROD. Depending on the remedial alternatives that the EPA selects in the ROD, the total cost of remediating OU3 may exceed our current estimate by material amounts. The EPA is also investigating or remediating formerly owned or operated sites that processed Libby vermiculite into finished products. We are cooperating with the EPA on these investigation and remediation activities, and have recorded a liability to the extent that our review has indicated that a probable liability has been incurred and the cost is estimable.

We have recorded liabilities for all environmental matters for which a loss is considered to be probable and sufficient information is available to reasonably estimate the loss. We also face legacy environmental liability for response costs at sites not related to our former vermiculite mining and processing activities. This liability relates to our former businesses or operations, including our share of liability at off-site disposal facilities. Our estimated liability is based upon regulatory requirements and environmental conditions at each site. As we receive new information, our estimated liability may increase materially.

We may be required to make one or more contingent deferred payments to the asbestos property damage trust, or PD Trust, in respect of property damage claims related to our former Zonolite attic insulation (“ZAI”) product installed in the U.S. (“ZAI PD Claims”); we may also be obligated to make additional payments to the PD trust in respect of “Other PD Claims” (those being asbestos property damage claims other than ZAI PD Claims); and our obligations to make payments to the PD Trust in respect of Other PD Claims is not capped.

Under the Joint Plan of reorganization that concluded Grace’s status as a debtor under Chapter 11, as discussed above, the PD Trust has been established and funded under Section 524(g) of the Bankruptcy Code. The order of the Bankruptcy Court confirming the Joint Plan contains a channeling injunction, which provides that all pending and future asbestos-related property damage claims and demands (or “PD Claims”) can only be brought against the PD Trust. The PD Trust contains two accounts. One of these accounts is the “ZAI PD Account,” which is funded in respect of claims related to our former Zonolite Attic Insulation product, or “ZAI.” The other account, the “PD Account,” is funded solely in respect of PD Claims excluding those PD Claims related to ZAI (which we refer to as “Other PD Claims”). Grace emerged from bankruptcy on February 3, 2014 (the “Effective Date”).

We have satisfied all of our financial obligations to the PI Trust. We have contingent financial obligations remaining to the PD Trust. With respect to ZAI PD Claims, the PD Trust was funded with \$34.4 million on the Effective Date and \$30.0 million on February 3, 2017. We are also obligated to make up to 10 contingent deferred payments of \$8 million per year to the PD Trust in respect of ZAI PD Claims during the 20-year period which began on February 3, 2019, with each such payment due only if the assets of the PD Trust in respect of ZAI PD Claims fall below \$10 million during the preceding year. As of December 31, 2018, we have evaluated the activity in the PD Trust with respect to ZAI PD Claims and other trust expenses. Through December 31, 2018, the PD Trust has paid approximately \$15 million in ZAI PD Claims, approximately \$6 million in operating and education expenses, and approximately \$15 million in one-time attorneys’ fees. The trust balance was approximately \$30 million as of December 31, 2018. We expect ZAI PD Claims payments to decline over time, but we have limited information to estimate the amount and timing of future claims payments. It is reasonably possible that we will make one or more contingent deferred payments. We estimate the present value of reasonably possible future payments to range between \$0 million and \$20 million. We have not accrued for any contingent deferred payments as we do not believe that payment is probable. We will continue to evaluate new information as it becomes available and will revise our estimate of the amount and

timing of future claims payments and any contingent deferred payments at that time. We are not obligated to make additional payments to the PD Trust in

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respect of ZAI PD Claims beyond the payments described above. We have satisfied all of our financial obligations with respect to Canadian ZAI PD Claims.

Unresolved and future Other PD Claims are to be litigated pursuant to procedures approved by the Bankruptcy Court and, to the extent such Other PD Claims are determined to be allowed claims, are to be paid in cash by the PD Trust. We are obligated to make a payment to the PD Account every six months in the amount of any Other PD Claims allowed during the preceding six months plus interest (if any) and the amount of PD Account expenses for the preceding six months (the "PD Obligation"). The aggregate amount we are required to pay under the PD Obligation is not capped so we may have to make additional payments to the PD Account in respect of the PD Obligation.

Our indebtedness may materially affect our business, including our ability to fulfill our obligations, react to changes in our business and incur additional debt to fund future needs.

We have a substantial amount of debt. As of December 31, 2018, we had \$1,040.9 million of unsecured indebtedness outstanding and \$942.4 million of secured indebtedness outstanding. Our indebtedness may have material effects on our business, including to:

- require us to dedicate a substantial portion of our cash flow to debt payments, thereby reducing funds available for working capital, capital expenditures, acquisitions, research and development, distributions to shareholders (which fall within the discretion of our Board of Directors taking into account financial, liquidity and other considerations), share repurchase programs and other purposes;

- restrict us from making strategic acquisitions or taking advantage of favorable business opportunities;

- limit our flexibility in planning for, or reacting to, changes in our business and the industries in which we operate;

- increase our vulnerability to adverse economic, credit and industry conditions, including recessions;

- make it more difficult for us to satisfy our debt service and other obligations;

- place us at a competitive disadvantage compared to our competitors that have relatively less debt; and

- limit our ability to borrow additional funds, or to dispose of assets to raise funds, if needed, for working capital, capital expenditures, acquisitions, research and development and other purposes.

If we incur additional debt, the risks related to our indebtedness may intensify.

Restrictions imposed by agreements governing our indebtedness may limit our ability to operate our business, finance our future operations or capital needs, or engage in other business activities. If we fail to comply with certain restrictions under these agreements, our debt could be accelerated and we may not have sufficient cash to pay our accelerated debt.

The agreements governing our indebtedness contain various covenants that limit, among other things, our ability, and the ability of certain of our subsidiaries, to:

- incur certain liens;

- enter into sale and leaseback transactions; and

- consolidate, merge or sell all or substantially all of our assets or the assets of our guarantors.

As a result of these covenants, we will be limited in the manner in which we can conduct our business, and may be unable to engage in favorable business activities or finance future operations or capital needs. Accordingly, these restrictions may limit our flexibility to operate our business. A failure to comply with the restrictions contained in these agreements, including maintaining the financial ratios required by our credit facilities, could lead to an event of default which could result in an acceleration of our indebtedness. We cannot assure you that our future operating results will be sufficient to enable us to comply with the covenants contained in the agreements governing our indebtedness or to remedy any such default. In addition, in the event of an acceleration, we may not have or be able to obtain sufficient funds to make any accelerated payments.

Our indebtedness exposes us to interest expense increases if interest rates increase.

As of December 31, 2018, approximately \$297.2 million of our borrowings were at variable interest rates and expose us to interest rate risk, excluding \$598.5 million hedged by cross-currency swaps effective in November 2018, and \$100.0 million hedged by interest rate swaps effective in April 2018. If interest rates increase, our debt service obligations on the variable rate indebtedness would increase even though the amount borrowed would

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remain the same, and our net income would decrease. An increase of 100 basis points in the interest rates payable on our variable rate indebtedness would increase our annual estimated debt-service requirements by \$3.0 million, assuming our consolidated variable interest rate indebtedness outstanding as of December 31, 2018, remains the same. We have unfunded and underfunded pension plan liabilities. We will require future operating cash flow to fund these liabilities. We have no assurance that we will generate sufficient cash to satisfy these obligations.

We maintain U.S. and non-U.S. defined benefit pension plans covering current and former employees who meet or met age and service requirements. Our net pension liability and cost is materially affected by the discount rate used to measure pension obligations, the longevity and actuarial profile of our workforce, the level of plan assets available to fund those obligations and the actual and expected long-term rate of return on plan assets. Significant changes in investment performance or a change in the portfolio mix of invested assets can result in corresponding increases and decreases in the valuation of plan assets or in a change in the expected rate of return on plan assets. Assets available to fund the pension benefit obligation of the U.S. advance-funded pension plans at December 31, 2018, were approximately \$833 million, or approximately \$65 million less than the measured pension benefit obligation on a U.S. GAAP basis. In addition, any changes in the discount rate could result in a significant increase or decrease in the valuation of pension obligations, affecting the reported funded status of our pension plans as well as the net periodic pension cost in the following years. Similarly, changes in the expected return on plan assets can result in significant changes in the net periodic pension cost in the following years.

Our ability to use net operating losses and tax credits to reduce future tax payments may be limited if there is a change in ownership of Grace or if Grace does not generate sufficient U.S. taxable income or foreign source income. Our ability to use these attributes is also subject to time limitations. Changes in tax laws and regulations may reduce their value and availability.

Our ability to use future tax deductions and tax credits, including net operating losses (“NOLs”), is dependent on our ability to generate sufficient future taxable income in the U.S. and sufficient foreign source income. Under U.S. federal income tax law, a corporation is generally permitted to carry forward NOLs for a 20-year period (indefinitely in the case of NOLs occurring in taxable years after December 31, 2017) for deduction against future taxable income. Federal tax credits may be carried forward for 10 years. Also, our ability to use NOLs and tax credits and their value may be adversely affected by changes in tax laws and regulations.

In addition, our ability to utilize federal and state NOLs and U.S. federal tax credits may be limited by Section 382 of the Internal Revenue Code resulting from future changes in the ownership of outstanding Company common stock.

We intend to pursue acquisitions, joint ventures and other transactions that complement or expand our businesses. We may not be able to complete proposed transactions and even if completed, the transactions may involve a number of risks that may materially and adversely affect our business, financial condition and results of operations.

We intend to continue to pursue opportunities to buy other businesses or technologies that could complement, enhance or expand our current businesses or product lines or that might otherwise offer us growth opportunities. We may have difficulty identifying appropriate opportunities or, if we do identify opportunities, we may not be successful in completing transactions for a number of reasons. Any transactions that we are able to identify and complete may involve a number of risks, including:

- the diversion of management’s attention from our existing businesses to integrate the operations and personnel of the acquired or combined business or joint venture;
- possible adverse effects on our operating results during the integration process;
- failure of the acquired business to achieve expected operational objectives;
- possible assumption of unexpected liabilities;
- inability to obtain indemnification from other parties to transactions; and
- our possible inability to achieve the intended objectives of the transaction.

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In addition, we may not be able to successfully or profitably integrate, operate, maintain and manage any newly acquired operations or their employees. We may not be able to maintain uniform standards, controls, procedures and policies, which may lead to operational inefficiencies.

We work with dangerous materials that can injure our employees, damage our facilities, disrupt our operations, and contaminate the environment.

Some of our operations involve the handling of hazardous materials that may pose the risk of fire, explosion, or the release of hazardous substances. Such events could result from natural disasters, operational failures or terrorist attacks, and might cause injury or loss of life to our employees and others, environmental contamination, and property damage. These events might cause a temporary shutdown of an affected plant, or portion thereof, and we could be subject to penalties or claims as a result of any of these events. A disruption of our operations caused by these or other events could have a material adverse effect on our results of operations.

Some of our employees are unionized, represented by works councils or employed subject to local laws that are less favorable to employers than the laws in the United States.

As of December 31, 2018, we had approximately 3,900 global employees. Approximately 700 of our approximately 2,100 U.S. employees are unionized at 5 manufacturing sites. In addition, a large number of our employees are employed in countries in which employment laws provide greater bargaining or other rights to employees than the laws in the United States. Such employment rights require us to work collaboratively with the legal representatives of the employees to effect any changes to labor arrangements. For example, most of our employees in Europe are represented by works councils that have co-determination rights on any changes in conditions of employment, including certain salaries and benefits and staff changes, and may impede efforts to restructure our workforce. A strike, work stoppage or slowdown by our employees or significant dispute with our employees, whether or not related to these negotiations, could result in a significant disruption of our operations or higher ongoing labor costs.

We may be subject to claims of infringement of the intellectual property rights of others, which could hurt our business.

From time to time, we face infringement claims from our competitors or others alleging that our processes or products infringe on their proprietary technologies. Any claims that our products or processes infringe the intellectual property rights of others, regardless of the merit or resolution of the claims, could cause us to incur significant costs in responding to, defending and resolving the claims, and may divert the efforts and attention of our management and technical personnel from our business. If we are found to be infringing on the proprietary technology of others, we may be liable for damages, and we may be required to change our processes, redesign our products, pay others to use the technology, or stop using the technology or producing the infringing product. Even if we ultimately prevail, the existence of the lawsuit could prompt our customers to switch to products that are not the subject of infringement suits.

We are subject to business continuity risks that may adversely affect our business, financial condition and results of operations.

We are subject to significant risks from both natural disasters and accidents such as fires, storms, and floods, and other disruptive events, such as war, insurrection, and terrorist actions. These types of occurrences can negatively affect our manufacturing, supply chain, logistics, transportation, information technology, and communications functions.

Similarly, they can strike major suppliers and customers, thus restricting or delaying our supply of raw materials or energy as well as reducing or deferring demand for our products and services. Also, we have centralized certain administrative functions, primarily in North America, Europe and Asia, to improve efficiency and reduce costs. To the extent that these central locations are disrupted or disabled, key business processes, such as invoicing, payments and general management operations, could be interrupted.

As we operate worldwide in a competitive environment, global economic and financial market conditions may adversely affect our business, financial condition and results of operations.

We compete by selling value-added products, technologies and services. Increased levels and numbers of competitors, globally or regionally, could negatively impact our results of operations. Economic conditions around the world can have a direct impact on our revenues. A global or regional economic downturn or market uncertainty could reduce the

demand for our products, technologies and services, which could negatively impact our results

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of operations. Since many of our customers are refiners, our fluid catalytic cracking (FCC) catalyst business is highly dependent on the economics of the petroleum refining industry. Demand for our FCC products is affected by refinery throughput, the type and quality of refinery feedstocks, and the demand for transportation fuels and other refinery products, such as propylene. Also, disruptions in the financial markets could have an adverse effect on our ability to finance our operations and growth plans, and could negatively impact our suppliers and customers in similar manners. Our ability to operate our businesses and our financial condition could be significantly undermined by cybersecurity breaches.

Despite our implementation of security measures, our information technology (“IT”) systems are subject to cyberattack and other similar disruptions. Breaches by hackers, the introduction of computer viruses and other cybersecurity incidents affecting our IT systems could result in disruptions to our operations. Also, such incidents could include theft of our trade secrets and other intellectual property, as well as confidential customer, employee and business information, which could be used by unauthorized parties and publicly disclosed. This could negatively affect our relationships with customers and our ability to compete effectively, and could ultimately harm our reputation, business, financial condition and results of operations. In addition, we may be required to incur significant costs to protect against damage caused by cybersecurity breaches in the future.

A failure of our information technology infrastructure could adversely impact our business and operations.

We rely upon the capacity, reliability and security of our IT infrastructure and our ability to expand and continually update this infrastructure in response to the changing needs of our business. If we experience a problem with the functioning of an important IT system, the resulting disruptions could have an adverse effect on our business. Our IT systems affect virtually every aspect of our business, including supply chain, manufacturing, logistics, finance and communications. We and certain of our third-party vendors receive and store personal information in connection with our human resources operations and other aspects of our business. Any IT system failure, natural disaster, accident, or intentional breach could result in disruptions to our operations.

Risks Related to the Separation

In connection with the Separation, GCP will indemnify us and we will indemnify GCP for certain liabilities. There can be no assurance that the indemnities from GCP will be sufficient to insure us against the full amount of such liabilities, or that GCP’s ability to satisfy its indemnification obligation will not be impaired in the future.

Pursuant to the Separation and Distribution Agreement and other agreements we entered into in connection with the Separation, GCP agreed to indemnify us for certain liabilities, and we agreed to indemnify GCP for certain liabilities. However, third parties might seek to hold us responsible for liabilities that GCP agreed to assume or retain under these agreements, and there can be no assurance that GCP will be able to fully satisfy its indemnification obligations under these agreements.

A court could deem the Distribution in the Separation to be a fraudulent conveyance and void the transaction or impose substantial liabilities upon us.

If the transaction is challenged by a third party, notwithstanding the fact that we received an opinion from a nationally recognized financial firm that we were solvent and had adequate surplus to make the Distribution, a court could deem the distribution of GCP common stock or certain internal restructuring transactions undertaken by us in connection with the Separation to be a fraudulent conveyance or transfer. Fraudulent conveyances or transfers are defined to include transfers made or obligations incurred with the actual intent to hinder, delay or defraud current or future creditors or transfers made or obligations incurred for less than reasonably equivalent value when the debtor was insolvent, or that rendered the debtor insolvent, inadequately capitalized or unable to pay its debts as they become due. In such circumstances, a court could void the transactions or impose substantial liabilities upon us, which could adversely affect our financial condition and our results of operations. Among other things, the court could require our stockholders to return to us some or all of the shares of GCP common stock issued in the Distribution or require us to fund liabilities of other companies involved in the Separation for the benefit of creditors. Whether a transaction is a fraudulent conveyance or transfer will vary depending upon the laws of the applicable jurisdiction.

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Item 1B. UNRESOLVED STAFF COMMENTS

None.

Item 2. PROPERTIES

We operate manufacturing plants and other facilities (including offices, warehouses, labs and other service facilities) throughout the world. Some of these plants and facilities are shared by our reportable segments. We consider our major operating properties to be in good operating condition and suitable for their current use. We believe that the productive capacity of our plants and other facilities, supplemented by tolling arrangements, is generally adequate for current operations. The table below summarizes our principal manufacturing plants by reportable segment and region as of December 31, 2018:

	Number of Facilities(1)				
	Europe	Middle	Asia	Latin	Total
	North America	East Africa (EMEA)	Pacific	America	
Catalysts Technologies	10	3	2	—	15
Owned	8	1	2	—	11
Leased	2	2	—	—	4
Materials Technologies	4	2	1	1	8
Owned	2	1	1	—	4
Leased	2	1	—	1	4

(1) Shared facilities are counted in both reportable segments. The total number of facilities included in the above table, without regard to sharing between reportable segments, is 20, of which we own 12 and lease 8.

Generally, we own the machinery and equipment at our principal manufacturing plants. We also own the land on which most of our largest manufacturing plants are situated; however, certain manufacturing plants are located on leased land, normally long-term. We own our Corporate Headquarters in Columbia, Maryland. We also lease and operate a shared services facility in Manila, Philippines.

The table below sets forth our principal manufacturing plants by reportable segment.

Catalysts Technologies	Materials Technologies
Aiken, South Carolina	Dueren, Germany*
Baton Rouge, Louisiana*	East Chicago, Indiana*
Chattanooga, Tennessee	Hesperia, California*
Chicago, Illinois	Kuantan, Malaysia
Lake Charles, Louisiana	Sorocaba, Brazil*
Norco, Louisiana*	
Pasadena, Texas	
Qingdao, China	
Stenungsund, Sweden*	Shared
Tarragona, Spain*	Albany, Oregon
Valleyfield, Quebec, Canada	Curtis Bay, Maryland
Yeosu, South Korea	Worms, Germany

*Denotes leased site.

For information on our net properties and equipment by region and country, see disclosure set forth in Item 8 (Financial Statements and Supplementary Data) in the Financial Supplement under Note 18 (Segment Information) to our Consolidated Financial Statements, which disclosure is incorporated herein by reference.

Security agreements previously in effect with respect to certain of our United States facilities were terminated in connection with the 2018 Credit Agreement. For a description of our credit agreement see Item 8 (Financial

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Statements and Supplementary Data) in the Financial Supplement under Note 5 (Debt) to the Consolidated Financial Statements.

Item 3. LEGAL PROCEEDINGS

CHAPTER 11 PROCEEDINGS AND ASBESTOS CLAIMS

Disclosures provided in this Report in Item 1 (Business) and Item 8 (Financial Statements and Supplementary Data) in the Financial Supplement under Note 10 (Commitments and Contingent Liabilities, under the caption “Legacy Liabilities”) to the Consolidated Financial Statements, are incorporated herein by reference.

ENVIRONMENTAL INVESTIGATIONS AND CLAIMS

Disclosures provided in this Report in Item 1 (Business) under the caption “Environment, Health and Safety Matters” and Item 8 (Financial Statements and Supplementary Data) in the Financial Supplement under Note 10 (Commitments and Contingent Liabilities, under the caption “Legacy Environmental Liabilities”) to the Consolidated Financial Statements, are incorporated herein by reference.

Item 4. MINE SAFETY DISCLOSURES

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 (17 CFR 229.104) is included in Exhibit 95 to this Report.

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EXECUTIVE OFFICERS OF THE REGISTRANT

Pursuant to General Instruction G(3) of Form 10-K, the following list of executive officers of Grace as of February 15, 2019, is included as an unnumbered Item in Part I of this report in lieu of being included in the Grace Proxy Statement relating to the Annual Meeting of Stockholders to be held on May 8, 2019. Our executive officers are elected annually.

Name and Age	Office	First Elected
Hudson La Force (54)	President and Chief Executive Officer Director	November 8, 2018 November 2, 2017
Elizabeth C. Brown (55)	Senior Vice President and Chief Human Resources Officer	January 21, 2015
Keith N. Cole (60)	Senior Vice President, Government Relations and Environmental, Health and Safety	February 10, 2014
Mark A. Shelnitz (60)	Senior Vice President, General Counsel and Secretary	April 27, 2005

Messrs. La Force, Cole, and Shelnitz have been actively engaged in Grace's business as executive officers for the past five years. Mr. La Force is Grace's Principal Executive Officer and Acting Principal Financial Officer.

Ms. Brown joined Grace in 2015. From 2010 until she joined Grace, Ms. Brown held leadership positions in human resources for Tyco International Limited (now Johnson Controls, Inc.).

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PART II

Item 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED SHAREHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Except as provided below, the disclosure required by this Item appears in this Report in: Item 6 (Selected Financial Data); under the heading "Selected Financial Data" opposite the caption "Other Statistics—Common shareholders of record" in the Financial Supplement; Item 8 (Financial Statements and Supplementary Information) in the Financial Supplement in Note 14 (Shareholders' Equity) and Note 22 (Quarterly Financial Information (Unaudited)) opposite the caption "Dividends declared per share" to the Consolidated Financial Statements; and Item 12 (Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters), and such disclosure is incorporated herein by reference.

COMPANY COMMON STOCK

The principal market for Company common stock is the New York Stock Exchange, under the symbol GRA.

DIVIDENDS ON COMPANY COMMON STOCK

On February 7, 2019, we announced that the Board of Directors had approved an increase to the annual cash dividend rate, from \$0.96 to \$1.08 per share of Company common stock. Grace expects to continue growing our dividend as part of our disciplined capital allocation strategy.

Although our credit agreement and indentures (as described in Item 8 (Financial Statements and Supplementary Data) in the Financial Supplement under Note 5 (Debt) to the Consolidated Financial Statements and filed as an exhibit to this Report) contain certain restrictions on the payment of dividends on, and redemptions of, equity interests and other restricted payments, we believe that such restrictions do not currently materially limit our ability to pay dividends.

Any determination to pay cash dividends in the future may be affected by business and market conditions, our views on potential future capital requirements, the restrictions noted above, covenants contained in any agreements we may enter into in the future and changes in federal income tax law.

SHARE REPURCHASES

On February 5, 2015, we announced that the Board of Directors authorized a share repurchase program of up to \$500 million, which we completed on July 10, 2017. On February 8, 2017, we announced that the Board of Directors authorized an additional share repurchase program of up to \$250 million. Repurchases under the programs may be made through one or more open market transactions at prevailing market prices; unsolicited or solicited privately negotiated transactions; accelerated share repurchase programs; or through any combination of the foregoing, or in such other manner as determined by management. The timing of the repurchases and the actual amount repurchased will depend on a variety of factors, including the market price of Grace's shares, the strategic deployment of capital, and general market and economic conditions.

The following table presents information regarding the status of repurchases of Company common stock by or on behalf of Grace or any "affiliated purchaser" of Grace.

Issuer Purchases of Equity Securities

	Total number of shares purchased (#)	Average price paid per share (\$/share)	Total number of shares purchased as part of publicly announced plans or programs (#)	Approximate dollar value of shares that may yet be purchased under the plans or programs (\$ in millions)
10/1/2018 - 10/31/2018	108,836	66.23	108,836	151.5
11/1/2018 - 11/30/2018	196,607	64.17	196,607	138.9

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12/1/2018 - 12/31/2018	—	—	—	138.9
Total	305,443	64.90	305,443	138.9

Table of Contents**STOCK PERFORMANCE GRAPH**

The following information in Item 5 is not deemed to be “soliciting material” or to be “filed” with the SEC or subject to Regulation 14A or 14C under the Securities Exchange Act of 1934, as amended (the “Exchange Act”) or to the liabilities of Section 18 of the Exchange Act, and will not be deemed to be incorporated by reference into any filing under the Securities Act of 1933, as amended, or the Exchange Act, except to the extent Grace specifically incorporates it by reference into such a filing.

The line graph and table below compare the cumulative total shareholder return on Company common stock with the cumulative total return of companies on the Standard & Poor’s (“S&P”) 500 Stock Index, the S&P Composite 1500 Specialty Chemicals Index and S&P 1500 Diversified Chemicals Index. This graph and table assume the investment of \$100 in Company common stock on December 31, 2013. Cash dividends paid in 2016 through 2018 are assumed reinvested for the graph and table below.

	2013	2014	2015	2016	2017	2018
W. R. Grace & Co.(1)	\$ 100	\$ 96	\$ 101	\$ 86	\$ 90	\$ 85
S&P 500 Index	100	114	115	129	157	150
S&P 1500 Specialty Chemicals	100	118	116	130	162	152
S&P 1500 Diversified Chemicals	100	107	109	126	163	124

(1)W. R. Grace & Co. stock value at December 31, 2013, reflects the adjusted post-Separation market value.

Item 6. SELECTED FINANCIAL DATA

The disclosure required by this Item appears in the Financial Supplement under the heading “Selected Financial Data” which disclosure is incorporated herein by reference.

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Item 7. MANAGEMENT’S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The disclosure required by this Item appears in the Financial Supplement under the heading “Management’s Discussion and Analysis of Financial Condition and Results of Operations” which disclosure is incorporated herein by reference.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Our global operations, raw materials and energy requirements, and debt obligations expose us to various market risks. We use derivative financial instruments to mitigate certain of these risks. The following is a discussion of our primary market risk exposures, how those exposures are managed, and certain quantitative data pertaining to our market risk-sensitive instruments.

Currency Exchange Rate Risk

We operate and/or sell to customers in over 70 countries and in over 30 currencies; therefore, our results of operations are exposed to changes in currency exchange rates. We seek to minimize exposure to these changes by matching revenue streams with expenditures in the same currencies, but it is not always possible to do so. Further, where revenue streams exceed expenditures in a given currency, we seek opportunities to invoice our customers in U.S. dollars or peg the revenue stream to the U.S. dollar at the time of the sale. From time to time, we use financial instruments such as currency forward contracts, swaps, options, or combinations of them to reduce the risk of certain specific transactions. However, we do not have a policy of hedging all exposures, because management does not believe that such a level of hedging would be cost-effective. Significant uses of derivatives to mitigate the effects of changes in currency exchange rates are as follows.

In May 2016, Grace entered into a fixed-to-fixed cross-currency swap maturing in October 2021 to hedge its net investment in non-U.S. subsidiaries. On every April 1 and October 1, Grace will swap interest payments. Grace will pay euro fixed at the annual rate of 3.426% on €170.0 million and receive U.S. dollars fixed at the annual rate of 5.125% on \$190.3 million. The agreement requires an exchange of the notional amounts at maturity. The following tables provide information about the cross-currency swap at December 31, 2018, specifically, the aggregate future cash flows for each of the next three years and the fair value. The fair value represents the value of the derivative contract, and is included in “other current assets” and “other liabilities” in the Consolidated Balance Sheets.

(In millions)	2019	2020	2021
Payable—interest and principal in euro	€5.8	€5.8	€174.4
Receivable—interest and principal in U.S. dollars	\$9.8	\$9.8	\$197.6

(In millions) December 31, 2018

Current asset	\$ 2.9
Noncurrent liability (12.9)	
Net fair value	\$ (10.0)

In April 2018, in connection with the Credit Agreement (see Note 5), Grace entered into new cross-currency swaps beginning on April 3, 2018, and maturing on March 31, 2023, to synthetically convert \$600.0 million of U.S. dollar-denominated floating rate debt into €490.1 million of euro-denominated debt fixed at 2.0231%. These cross-currency swaps were de-designated and terminated on November 5, 2018, and replaced with new, at-market cross-currency swaps beginning on November 5, 2018, and maturing on March 31, 2023, to synthetically convert \$600.0 million of U.S. dollar-denominated floating rate debt into €525.9 million of euro-denominated debt fixed at 1.785%. The agreements require partial exchanges of the notional amounts each quarter and the remaining amounts at maturity. The following tables provide information about the cross-currency swaps at December 31, 2018, specifically, the aggregate future cash flows for each of the next five years and the fair value. The fair value represents the value of the derivative contracts, and is included in “other current assets” and “other liabilities” in the Consolidated Balance Sheets.

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(In millions)	2019	2020	2021	2022	2023
Payable—interest and principal in euro	€14.7	€14.6	€14.5	€14.4	€505.9
Receivable—interest and principal in U.S. dollars	\$33.5	\$33.3	\$33.0	\$32.6	\$581.1

(In millions) December 31,
2018

Current asset	\$ 15.4
Noncurrent liability (19.0)	
Net fair value	\$ (3.6)

There were no significant currency forward exchange agreements outstanding at December 31, 2018.

Interest Rate Risk

As of December 31, 2018, approximately \$297.2 million of our borrowings were at variable interest rates and expose us to interest rate risk, excluding \$598.5 million hedged by cross-currency swaps effective in November 2018, and \$100.0 million hedged by interest rate swaps effective in April 2018. As a result, we have been and will continue to be subject to the variations on interest rates in respect of our floating-rate debt. A 100 basis point increase in the interest rates payable on our variable rate debt outstanding as of December 31, 2018, would increase our annual interest expense by \$3.0 million.

In connection with the Credit Agreement (see Note 5), Grace entered into new interest rate swaps beginning on April 3, 2018, and maturing on March 31, 2023, fixing the LIBOR component of the interest on \$100.0 million of term debt at 2.775%. While we have and may continue to enter into agreements intending to limit our exposure to higher interest rates, any such agreements may not offer complete protection from this risk.

See Item 8 (Financial Statements and Supplementary Data) in the Financial Supplement under Note 6 (Fair Value Measurements and Risk) to the Consolidated Financial Statements for additional disclosure around market risk, which disclosure is incorporated herein by reference.

Item 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

The disclosure required by this Item appears in the Financial Supplement which disclosure is incorporated herein by reference.

Item 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

Item 9A. CONTROLS AND PROCEDURES

Except as provided below, the disclosure required by this Item appears in the Financial Supplement under the headings “Management’s Report on Internal Control Over Financial Reporting” and “Report of Independent Registered Public Accounting Firm,” which disclosure is incorporated herein by reference.

There was no change in Grace’s internal control over financial reporting during the quarter ended December 31, 2018, that has materially affected, or is reasonably likely to materially affect, Grace’s internal control over financial reporting.

Item 9B. OTHER INFORMATION

None.

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PART III

Item 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

Incorporated by reference to the sections entitled “Proposal One: Election of Directors,” “—Nominees for Election as Directors,” “—Continuing Directors,” and “—Corporate Governance;” “Questions and Answers About the Annual Meeting and the Voting Process—Question 29: Where can I find Grace corporate governance materials?;” and “Other Information—Section 16(a) Beneficial Ownership Reporting Compliance” of a definitive proxy statement that Grace will file with the SEC no later than 120 days after December 31, 2018 (the “2019 Proxy Statement”). Required information on executive officers of Grace appears at Part I after Item 4 of this report.

Item 11. EXECUTIVE COMPENSATION

Incorporated by reference to the sections entitled “Proposal One: Election of Directors—Corporate Governance,” and “—Director Compensation,” and “Executive Compensation” of the 2019 Proxy Statement.

Item 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

Incorporated by reference to the sections entitled “Other Information—Stock Ownership of Certain Beneficial Owners and Management” and “—Equity Compensation Plan Information” of the 2019 Proxy Statement.

Item 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Incorporated by reference to the sections entitled “Proposal One: Election of Directors—Corporate Governance” and “Other Information—Related Party Transactions” of the 2019 Proxy Statement.

Item 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

Incorporated by reference to the sections entitled “Proposal Two: Ratification of the Appointment of Independent Registered Public Accounting Firm—Principal Accountant Fees and Services” and “—Audit Committee Pre-Approval Policies and Procedures” of the 2019 Proxy Statement.

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PART IV

Item 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

Financial Statements and Schedules. The required information is set forth in the Financial Supplement under the heading “Table of Contents” which is incorporated herein by reference.

Exhibits. The exhibits to this Report are listed below. Other than exhibits that are filed herewith, all exhibits listed below are incorporated by reference.

In reviewing the agreements included as exhibits to this and other Reports filed by Grace with the Securities and Exchange Commission, please remember they are included to provide you with information regarding their terms and are not intended to provide any other factual or disclosure information about Grace or other parties to the agreements. The agreements generally contain representations and warranties by each of the parties to the applicable agreement. These representations and warranties have been made solely for the benefit of the other parties to the applicable agreement. These representations and warranties:

are not statements of fact, but rather are used to allocate risk to one of the parties if the statements prove to be inaccurate;

may have been qualified by disclosures that were made to the other parties in connection with the negotiation of the applicable agreement, which disclosures are not necessarily reflected in the agreement;

may apply standards of materiality in a way that is different from what may be viewed as material to you or other investors; and

were made only as of the date of the applicable agreement or such other date or dates as may be specified in the agreement and do not reflect more recent developments.

Accordingly, these representations and warranties may not describe the actual state of affairs as of the date they were made or at any other time. Additional information about Grace may be found elsewhere in this report and Grace’s other public filings, which are available without charge through the Securities and Exchange Commission’s website at <http://www.sec.gov>.

Exhibit No.	Exhibit	Location
2.1	<u>Joint Plan of Reorganization of W. R. Grace & Co. and its Debtor Subsidiaries.</u>	Exhibit 2.01 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
2.2	<u>Order Confirming Joint Plan of Reorganization.</u>	Exhibit 2.02 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
2.3	<u>Separation and Distribution Agreement, dated as of January 27, 2016, by and among W. R. Grace & Co., W. R. Grace & Co.–Conn. and GCP Applied Technologies Inc.</u>	Exhibit 2.1 to Form 8-K (filed 1/28/16) SEC File No.: 001-13953
2.4	<u>Amended and Restated Sale and Purchase Agreement, dated as of February 21, 2018, by and between Albemarle Corporation and W. R. Grace & Co.–Conn.</u>	Exhibit 2.4 to Form 10-K (filed 2/22/18) SEC File No.: 001-13953
3.1	<u>Amended and Restated Certificate of Incorporation.</u>	Exhibit 3.01 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
3.2	<u>Amended and Restated By-laws.</u>	

4.1

Receivables Purchase Agreement, dated as of January 23, 2007, between Grace GmbH & Co. KG and Coface Finanz GmbH.

Exhibit 3.01 to
Form 8-K (filed
1/23/15) SEC File No.:
001-13953
Exhibit 4.10 to
Form 10-K (filed
3/02/07) SEC File No.:
001-13953

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Exhibit No.	Exhibit	Location
4.2	<u>Credit Agreement, dated as of February 3, 2014, by and among W. R. Grace & Co., W. R. Grace & Co.-Conn., Grace GmbH & Co. KG, a Federal Republic of Germany limited partnership, each lender from time to time party thereto, and Goldman Sachs Bank USA, as Administrative Agent.</u>	Exhibit 4.01 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
4.3	<u>First Amendment and Consent to Credit Agreement and First Amendment to Security Agreement, dated as of November 25, 2015, by and among W. R. Grace & Co., W. R. Grace & Co.-Conn., Grace GmbH & Co. KG, Alltech Associates, Inc., each lender from time to time party thereto, and Goldman Sachs Bank USA, as Administrative Agent and lender.</u>	Exhibit 10.1 to Form 8-K (filed 11/25/15) SEC File No.: 001-13953
4.4	<u>Deferred Payment Agreement (PD), dated as of February 3, 2014, by and between W. R. Grace & Co.-Conn. and the WRG Asbestos PD Trust.</u>	Exhibit 4.04 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
4.5	<u>Guarantee Agreement (PD), dated as of February 3, 2014, by and between W. R. Grace & Co. and the WRG Asbestos PD Trust.</u>	Exhibit 4.05 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
4.6	<u>Deferred Payment Agreement (PD-ZAI), dated as of February 3, 2014, by and between W. R. Grace & Co.-Conn. and the WRG Asbestos PD Trust.</u>	Exhibit 4.06 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
4.7	<u>Guarantee Agreement (PD-ZAI), dated as of February 3, 2014, by and between W. R. Grace & Co. and the WRG Asbestos PD Trust.</u>	Exhibit 4.07 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
4.8	<u>Share Issuance Agreement, dated as of February 3, 2014, by and among W. R. Grace & Co., the WRG Asbestos PD Trust and the WRG Asbestos PI Trust.</u>	Exhibit 4.08 to Form 8-K (filed 2/07/14) SEC File No.: 001-13953
4.9	<u>Indenture, dated as of September 16, 2014, by and among W. R. Grace & Co.-Conn., the guarantors party there to and Wilmington Trust, National Association, as trustee.</u>	Exhibit 4.1 to Form 8-K (filed 9/19/14) SEC File No.: 001-13953
4.10	<u>First Supplemental Indenture, dated as of September 16, 2014, by and among W. R. Grace & Co.-Conn., the guarantors party thereto and Wilmington Trust, National Association, as trustee.</u>	Exhibit 4.2 to Form 8-K (filed 9/19/14) SEC File No.: 001-13953
4.11	<u>Form of 5.125% Note due 2021 (included as Exhibit A-1 to Exhibit 4.10).</u>	Exhibit 4.3 (included as Exhibit A-1 to Exhibit 4.2) to Form 8-K (filed 9/19/14) SEC File No.: 001-13953
4.12	<u>Form of 5.625% Note due 2024 (included as Exhibit A-2 to Exhibit 4.10).</u>	Exhibit 4.4 (included as Exhibit A-2 to Exhibit 4.2) to Form 8-K (filed 9/19/14) SEC File No.: 001-13953
4.13	<u>Credit Agreement, dated as of April 3, 2018, by and among W. R. Grace & Co., W. R. Grace & Co.-Conn., certain subsidiaries thereof, Goldman Sachs Bank USA, as Administrative Agent and Collateral Agent, and the other lenders from time to time party thereto.</u>	Exhibit 4.1 to Form 8-K (filed 4/03/18) SEC File No.: 001-13953
4.14	<u>Second Supplemental Indenture, dated as of April 3, 2018, by and among W. R. Grace & Co.-Conn., the guarantors party thereto and Wilmington Trust, National Association, as trustee.</u>	Exhibit 4.2 to Form 10-Q (filed 5/09/18) SEC File No.: 001-13953
10.1		

WRG Asbestos Property Damage Settlement Trust Agreement, dated as of February 3, 2014, by and between W. R. Grace & Co., the Asbestos PD Future Claimants' Representative, the Official Committee of Asbestos Property Damage Claimants, the Asbestos PD Trustees, Wilmington Trust Company, and the members of the Zonolite Attic Insulation Trust Advisory Committee.

Exhibit 10.02 to Form 8-K
(filed 2/07/14) SEC File No.:
001-13953

10.2 W. R. Grace & Co. 2014 Stock Incentive Plan.

Exhibit 10.03 to Form 8-K
(filed 2/07/14) SEC File No.:
001-13953*

10.3 Form of Performance-based Unit Agreement (2016).

Exhibit 10.2 to Form 8-K
(filed 2/09/16) SEC File No.:
001-13953*

10.4 Form of Stock Option Award Agreement (2016).

Exhibit 10.1 to Form 8-K
(filed 2/09/16) SEC File No.:
001-13953*

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Exhibit No.	Exhibit	Location
10.5	<u>Form of Restricted Stock Award Agreement (2016).</u>	Exhibit 10.3 to Form 8-K (filed 2/09/16) SEC File No.: 001-13953*
10.6	<u>W. R. Grace & Co. Supplemental Executive Retirement Plan, as amended.</u>	Exhibit 10.7 to Form 10-K (filed 3/28/02) SEC File No.: 001-13953*
10.7	<u>W. R. Grace & Co. Executive Salary Protection Plan, as amended.</u>	Exhibit 10.8 to Form 10-K (filed 3/28/02) SEC File No.: 001-13953*
10.8	<u>Form of Executive Change in Control Severance Agreement between Grace and certain officers.</u>	Exhibit 10.17 to Form 10-K (filed 3/13/03) SEC File No.: 001-13953*
10.9	<u>Severance Plan for Leadership Team Officers of W. R. Grace & Co.</u>	Exhibit 10.2 to Form 8-K (filed 2/04/16) SEC File No.: 001-13953*
10.10	<u>2015 Executive Annual Incentive Compensation Plan.</u>	Exhibit 10.1 to Form 8-K (filed 5/12/15) SEC File No.: 001-13953*
10.11	<u>Tax Sharing Agreement, dated as of January 27, 2016, by and among W. R. Grace & Co., W. R. Grace & Co.–Conn. and GCP Applied Technologies Inc.</u>	Exhibit 10.1 to Form 8-K (filed 1/28/16) SEC File No.: 001-13953
10.12	<u>Letter Agreement dated February 28, 2008, between Fred Festa, on behalf of Grace, and Hudson La Force III (includes indemnification provision).</u>	Exhibit 10.1 to Form 8-K (filed 3/07/08) SEC File No.: 001-13953*
10.13	<u>Letter Agreement dated November 13, 2013, between Fred Festa, on behalf of Grace, and Keith N. Cole (includes indemnification provision).</u>	Exhibit 10.20 to Form 10-K (filed 2/25/15) SEC File No.: 001-13953*
10.14	<u>Letter Agreement dated December 3, 2014, between Fred Festa, on behalf of Grace, and Elizabeth C. Brown (includes indemnification provision).</u>	Exhibit 10.1 to Form 10-Q (filed 5/07/15) SEC File No.: 001-13953*
10.15	<u>Restricted Stock Unit Award Agreement, dated February 22, 2018, between W. R. Grace & Co. and Fred Festa, in connection with transition to Non-executive Chairman.</u>	Exhibit 10.1 to Form 10-Q (filed 5/09/18) SEC File No.: 001-13953*
10.16	<u>Stock Option Award Agreement, dated February 22, 2018, between W. R. Grace & Co. and Fred Festa, in connection with transition to Non-Executive Chairman.</u>	Exhibit 10.2 to Form 10-Q (filed 5/09/18) SEC File No.: 001-13953*
10.17	<u>W. R. Grace & Co. 2018 Stock Incentive Plan</u>	Exhibit 10.1 to Form 8-K (filed 5/14/18) SEC File No.: 001-13953*
10.18	<u>Form of W. R. Grace & Co. Performance-Based Units (“PBUs”) Grant Agreement (2018).</u>	Exhibit 10.2 to Form 10-Q (filed 8/08/18) SEC File No.: 001-13953*
10.19	<u>Form of W. R. Grace & Co. Restricted Share Units (“RSUs”) Grant Agreement (2018).</u>	Exhibit 10.3 to Form 10-Q (filed 8/08/18) SEC File No.: 001-13953*
10.20		

	<u>Form of W. R. Grace & Co. Nonstatutory Stock Option (“NSOs”) Grant Agreement (2018).</u>	Exhibit 10.4 to Form 10-Q (filed 8/08/18) SEC File No.: 001-13953*
10.21	<u>Separation Agreement and General Release, dated as of May 31, 2018, by and between W. R. Grace & Co.–Conn., et al., and Thomas E. Blaser.</u>	Exhibit 10.5 to Form 10-Q (filed 8/08/18) SEC File No.: 001-13953*
10.22	<u>Letter Agreement, dated as of February 20, 2019, by and among W. R. Grace & Co., 40 North Management LLC, 40 North GP III LLC, 40 North Latitude Master Fund Ltd. and 40 North Latitude Fund LP.</u>	Exhibit 99.1 to Form 8-K (filed 2/20/19) SEC File No.: 001-13953*
21	<u>List of Subsidiaries of W. R. Grace & Co.</u>	Filed herewith
23	<u>Consent of Independent Registered Public Accounting Firm.</u>	Filed herewith
24	<u>Powers of Attorney.</u>	Filed herewith
31(i).1	<u>Certification of Periodic Report by Chief Executive Officer under Section 302 of the Sarbanes-Oxley Act of 2002.</u>	Filed herewith
31(i).2	<u>Certification of Periodic Report by Chief Financial Officer under Section 302 of the Sarbanes-Oxley Act of 2002.</u>	Filed herewith
32	<u>Certification of Periodic Report by Chief Executive Officer and Chief Financial Officer under Section 906 of the Sarbanes-Oxley Act of 2002.</u>	Filed herewith
95	<u>Mine Safety Disclosure Exhibit.</u>	Filed herewith
101.INS	XBRL Instance Document	Filed herewith
101.SCH	XBRL Taxonomy Extension Schema	Filed herewith

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Exhibit No.	Exhibit	Location
101.CAL	XBRL Taxonomy Extension Calculation Linkbase	Filed herewith
101.DEF	XBRL Taxonomy Extension Definition Linkbase	Filed herewith
101.LAB	XBRL Taxonomy Extension Label Linkbase	Filed herewith
101.PRE	XBRL Taxonomy Extension Presentation Linkbase	Filed herewith

* Management contracts and compensatory plans, contracts or arrangements required to be filed as exhibits to this Report.

Item 16. FORM 10-K SUMMARY

None.

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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.

W. R. GRACE & CO.

By: /s/ HUDSON LA FORCE

Hudson La Force

President and Chief Executive Officer (Principal Executive Officer and Acting Principal Financial Officer)

By: /s/ WILLIAM C. DOCKMAN

William C. Dockman

Vice President and Controller (Principal Accounting Officer)

Dated: February 28, 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 and in the capacities indicated on February 28, 2019.

Signature	Title
R. F. Cummings, Jr.*	}
A. E. Festa*	}
D. H. Gulyas*	}
J. Fasone Holder*	} Directors
J. N. Quinn*	}
C. J. Steffen*	}
M. E. Tomkins*	}
S. Yanai*	}

/s/ HUDSON LA FORCE (Hudson La Force)	President and Chief Executive Officer and Director (Principal Executive Officer and Acting Principal Financial Officer)
/s/ WILLIAM C. DOCKMAN (William C. Dockman)	Vice President and Controller (Principal Accounting Officer)

By signing his name hereto, Mark A. Shelnitz is signing this document on behalf of each of the persons indicated *above pursuant to powers of attorney duly executed by such persons and filed with the Securities and Exchange Commission.

By: /s/ MARK A. SHELNITZ

Mark A. Shelnitz

(Attorney-in-Fact)

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FINANCIAL SUPPLEMENT
W. R. GRACE & CO.
ANNUAL REPORT ON FORM 10-K
FOR THE YEAR ENDED DECEMBER 31, 2018

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The Financial Statement Schedule should be read in conjunction with the Consolidated Financial Statements and Notes thereto. Financial statements of less than majority-owned persons and other persons accounted for by the equity method have been omitted as provided in Rule 3-09 of the United States Securities and Exchange Commission's (the "SEC") Regulation S-X. Financial Statement Schedules not included have been omitted because they are not applicable or the required information is shown in the Consolidated Financial Statements or Notes thereto.

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Management's Report on Internal Control Over Financial Reporting

Responsibility For Financial Information—I am responsible for the preparation, accuracy, integrity and objectivity of the Consolidated Financial Statements and the other financial information included in this report. Such information has been prepared in conformity with accounting principles generally accepted in the United States of America and accordingly, includes certain amounts that represent management's best estimates and judgments. Actual amounts could differ from those estimates.

Responsibility For Internal Controls—I and Grace's management are also responsible for establishing and maintaining adequate internal controls over financial reporting. These internal controls consist of policies and procedures that are designed to assess and monitor the effectiveness of the control environment including risk identification, governance structure, delegations of authority, information flow, communications and control activities. A chartered Disclosure Committee oversees Grace's public financial reporting process and key managers are required to confirm their compliance with Grace's policies and internal controls quarterly. While no system of internal controls can ensure elimination of all errors and irregularities, Grace's internal controls, which are reviewed and modified in response to changing conditions, have been designed to provide reasonable assurance that assets are safeguarded, policies and procedures are followed, transactions are properly executed and reported, and appropriate disclosures are made. The concept of reasonable assurance is based on the recognition that there are limitations in all systems of internal control and that the costs of such systems should be balanced with their benefits. The Audit Committee of the Board of Directors, which is composed solely of independent directors, meets regularly with Grace's senior financial management, internal auditors and independent registered public accounting firm to review audit plans and results, as well as the actions taken by management in discharging its responsibilities for accounting, financial reporting and internal controls. The Audit Committee is responsible for the selection and compensation of the independent registered public accounting firm. Grace's financial management, internal auditors and independent registered public accounting firm have direct and confidential access to the Audit Committee at all times.

Report On Internal Control Over Financial Reporting—I and Grace's management have evaluated Grace's internal control over financial reporting as of December 31, 2018. This evaluation was based on criteria for effective internal control over financial reporting set forth in Internal Control—Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on this evaluation, I and Grace's management have concluded that Grace's internal control over financial reporting is effective as of December 31, 2018. Grace's independent registered public accounting firm that audited our financial statements included in Item 15 has also audited the effectiveness of Grace's internal control over financial reporting as of December 31, 2018, as stated in their report, which appears on the following page.

Report On Disclosure Controls And Procedures—As of December 31, 2018, I and Grace's management carried out an evaluation of the effectiveness of the design and operation of Grace's disclosure controls and procedures pursuant to Rule 13a-15 under the Securities Exchange Act of 1934, as amended (the "Exchange Act"). Based upon that evaluation, I concluded that Grace's disclosure controls and procedures are effective in ensuring that information required to be disclosed in Grace's periodic filings and submissions under the Exchange Act is accumulated and communicated to me and Grace's management to allow timely decisions regarding required disclosures, and such information is recorded, processed, summarized and reported within the time periods specified in the Securities and Exchange Commission's rules and forms.

/s/ HUDSON LA FORCE

Hudson La Force

President and Chief Executive Officer

(Principal Executive Officer and Acting Principal Financial Officer)

Date: February 28, 2019

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Report of Independent Registered Public Accounting Firm
To the Shareholders and Board of Directors of W. R. Grace & Co.:

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of W. R. Grace & Co. and its subsidiaries (the “Company”) as of December 31, 2018 and 2017, and the related consolidated statements of operations, of comprehensive income (loss), of equity, and of cash flows for each of the three years in the period ended December 31, 2018, including the related notes and schedule of valuation and qualifying accounts and reserves for each of the three years in the period ended December 31, 2018 appearing under Item 15 (collectively referred to as the “consolidated financial statements”). We also have audited 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 (COSO).

In our opinion, the consolidated financial statements referred to above 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 three years in the period ended December 31, 2018 in conformity with accounting principles generally accepted in the United States of America. Also 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 COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, 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 opinions on the Company’s consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (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 audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements 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. 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 audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

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 (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in

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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 (iii) 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/ PricewaterhouseCoopers LLP

Baltimore, Maryland

February 28, 2019

We have served as the Company's auditor since 1906.

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Consent of Independent Registered Public Accounting Firm

We hereby consent to the incorporation by reference in the Registration Statements on Form S-8 (Nos. 333-224767, 333-194171, 333-173785) of W. R. Grace & Co. of our report dated February 28, 2019 relating to the financial statements, financial statement schedule, and the effectiveness of internal control over financial reporting, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP
Baltimore, Maryland
February 28, 2019

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Table of ContentsW. R. Grace & Co. and Subsidiaries
Consolidated Statements of Operations

(In millions, except per share amounts)	Year Ended December 31,		
	2018	2017	2016
Net sales	\$1,932.1	\$1,716.5	\$1,598.6
Cost of goods sold	1,165.4	1,040.4	928.8
Gross profit	766.7	676.1	669.8
Selling, general and administrative expenses	307.0	274.0	271.8
Research and development expenses	62.7	56.3	51.6
Provision for environmental remediation	73.8	24.4	28.7
Restructuring and repositioning expenses	46.4	26.7	38.6
Equity in earnings of unconsolidated affiliate	(31.8)	(25.9)	(29.8)
Interest expense and related financing costs	80.2	79.5	81.5
Other (income) expense, net	(16.5)	30.2	61.4
Total costs and expenses	521.8	465.2	503.8
Income (loss) from continuing operations before income taxes	244.9	210.9	166.0
(Provision for) benefit from income taxes	(78.1)	(200.5)	(59.0)
Income (loss) from continuing operations	166.8	10.4	107.0
Income (loss) from discontinued operations, net of income taxes	—	—	(12.9)
Net income (loss)	166.8	10.4	94.1
Less: Net (income) loss attributable to noncontrolling interests	0.8	0.8	—
Net income (loss) attributable to W. R. Grace & Co. shareholders	\$167.6	\$11.2	\$94.1
Amounts Attributable to W. R. Grace & Co. Shareholders:			
Income (loss) from continuing operations attributable to W. R. Grace & Co. shareholders	\$167.6	\$11.2	\$107.0
Income (loss) from discontinued operations, net of income taxes	—	—	(12.9)
Net income (loss) attributable to W. R. Grace & Co. shareholders	\$167.6	\$11.2	\$94.1
Earnings Per Share Attributable to W. R. Grace & Co. Shareholders			
Basic earnings per share:			
Income (loss) from continuing operations	\$2.49	\$0.16	\$1.53
Income (loss) from discontinued operations, net of income taxes	—	—	(0.19)
Net income (loss)	\$2.49	\$0.16	\$1.34
Weighted average number of basic shares	67.2	68.1	70.1
Diluted earnings per share:			
Income (loss) from continuing operations	\$2.49	\$0.16	\$1.52
Income (loss) from discontinued operations, net of income taxes	—	—	(0.19)
Net income (loss)	\$2.49	\$0.16	\$1.33
Weighted average number of diluted shares	67.3	68.2	70.5
Dividends per common share	\$0.96	\$0.84	\$0.51

The Notes to Consolidated Financial Statements are an integral part of these statements.

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W. R. Grace & Co. and Subsidiaries

Consolidated Statements of Comprehensive Income (Loss)

(In millions)	Year Ended		
	December 31,		
	2018	2017	2016
Net income (loss)	\$166.8	\$10.4	\$94.1
Other comprehensive income (loss), net of income taxes:			
Defined benefit pension and other postretirement plans	(0.9)	(1.3)	(0.6)
Currency translation adjustments	32.4	(26.0)	(1.8)
Gain (loss) from hedging activities	(5.7)	0.8	0.3
Total other comprehensive income (loss) attributable to noncontrolling interests	—	—	2.6
Total other comprehensive income (loss), net of income taxes	25.8	(26.5)	0.5
Comprehensive income (loss)	192.6	(16.1)	94.6
Less: comprehensive (income) loss attributable to noncontrolling interests	0.8	0.8	(2.6)
Comprehensive income (loss) attributable to W. R. Grace & Co. shareholders	\$193.4	\$(15.3)	\$92.0

The Notes to Consolidated Financial Statements are an integral part of these statements.

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Table of ContentsW. R. Grace & Co. and Subsidiaries
Consolidated Statements of Cash Flows

(In millions)	Year Ended December 31,		
	2018	2017	2016
OPERATING ACTIVITIES			
Net income (loss)	\$166.8	\$10.4	\$94.1
Less: loss (income) from discontinued operations	—	—	12.9
Income (loss) from continuing operations	166.8	10.4	107.0
Reconciliation to net cash provided by (used for) operating activities from continuing operations:			
Depreciation and amortization	100.8	111.5	100.3
Equity in earnings of unconsolidated affiliate	(31.8)	(25.9)	(29.8)
Dividends received from unconsolidated affiliate	—	19.0	31.0
Costs related to legacy product, environmental, and other claims	84.6	30.8	35.4
Cash paid for legacy product, environmental, and other claims	(22.9)	(54.5)	(24.6)
Provision for (benefit from) income taxes	78.1	200.5	59.0
Cash paid for income taxes	(54.0)	(61.8)	(96.6)
Income tax refunds received	0.7	34.2	11.4
Interest expense and related financing costs	80.2	79.5	81.5
Cash paid for interest	(78.4)	(70.2)	(75.7)
Loss on early extinguishment of debt	4.8	—	11.1
Defined benefit pension expense (income)	0.7	64.1	72.6
Cash paid under defined benefit pension arrangements	(66.5)	(17.8)	(15.9)
Accounts receivable reserve—Venezuela	—	10.0	—
Stock compensation expense	18.6	11.0	11.6
Changes in assets and liabilities, excluding effect of currency translation and acquisitions:			
Trade accounts receivable	2.5	(4.9)	(15.7)
Inventories	(26.1)	4.4	(0.6)
Accounts payable	24.2	(2.5)	32.0
Deferred revenue	35.6	4.7	(6.9)
All other items, net	24.1	(23.3)	(19.6)
Net cash provided by (used for) operating activities from continuing operations	342.0	319.2	267.5
INVESTING ACTIVITIES			
Capital expenditures	(216.3)	(125.2)	(116.9)
Business acquired, net of cash acquired	(418.0)	(3.5)	(246.5)
Proceeds from sale of assets	2.4	0.6	13.7
Other investing activities	13.4	(1.1)	5.3
Net cash provided by (used for) investing activities from continuing operations	(618.5)	(129.2)	(344.4)
FINANCING ACTIVITIES			
Borrowings under credit arrangements	1,024.0	114.4	39.4
Repayments under credit arrangements	(587.8)	(143.9)	(633.0)
Cash paid for debt financing costs	(11.8)	—	—
Cash paid for repurchases of common stock	(80.0)	(65.0)	(195.1)
Proceeds from exercise of stock options	6.7	16.4	17.0
Dividends paid to shareholders	(64.6)	(57.3)	(36.0)
Distribution from GCP	—	—	750.0
Cash received from hedge settlement	33.1	—	—
Other financing activities	(3.1)	0.6	(2.5)

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Net cash provided by (used for) financing activities from continuing operations	316.5	(134.8)	(60.2)
Effect of currency exchange rate changes on cash and cash equivalents	(2.5)	7.7	(3.0)
Increase (decrease) in cash and cash equivalents from continuing operations	37.5	62.9	(140.1)
Increase (decrease) in cash and cash equivalents from discontinued operations	—	—	44.8
Net increase (decrease) in cash and cash equivalents	37.5	62.9	(95.3)
Less: cash and cash equivalents of discontinued operations	—	—	(143.4)
Cash, cash equivalents, and restricted cash, beginning of period	163.5	100.6	339.3
Cash, cash equivalents, and restricted cash, end of period	\$201.0	\$163.5	\$100.6
Supplemental disclosure of cash flow information			
Capital expenditures included in accounts payable	\$31.0	\$41.4	\$23.8
Expenditures for other investing activities included in accounts payable	16.9	2.7	1.1
Net share settled stock option exercises	8.2	1.2	10.5

The Notes to Consolidated Financial Statements are an integral part of these statements.

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Table of ContentsW. R. Grace & Co. and Subsidiaries
Consolidated Balance Sheets

	December 31,	
(In millions, except par value and shares)	2018	2017
ASSETS		
Current Assets		
Cash and cash equivalents	\$200.5	\$152.8
Restricted cash and cash equivalents	0.5	10.7
Trade accounts receivable, less allowance of \$11.6 (2017—\$11.7)	288.5	285.2
Inventories	281.1	230.9
Other current assets	86.7	49.0
Total Current Assets	857.3	728.6
Properties and equipment, net of accumulated depreciation and amortization of \$1,482.8 (2017—\$1,463.4)	1,011.7	799.1
Goodwill	540.4	402.4
Technology and other intangible assets, net	356.5	255.4
Deferred income taxes	529.4	556.5
Investment in unconsolidated affiliate	156.1	125.9
Other assets	113.9	39.1
Total Assets	\$3,565.3	\$2,907.0
LIABILITIES AND EQUITY		
Current Liabilities		
Debt payable within one year	\$22.3	\$20.1
Accounts payable	248.6	210.3
Other current liabilities	243.5	217.8
Total Current Liabilities	514.4	448.2
Debt payable after one year	1,961.0	1,523.8
Unfunded defined benefit pension plans	366.0	391.9
Underfunded defined benefit pension plans	67.1	110.5
Other liabilities	319.8	169.3
Total Liabilities	3,228.3	2,643.7
Commitments and Contingencies—Note 10		
Equity		
Common stock issued, par value \$0.01; 300,000,000 shares authorized; outstanding: 66,792,968 (2017—67,780,410)	0.7	0.7
Paid-in capital	481.1	474.8
Retained earnings	676.7	573.1
Treasury stock, at cost: shares: 10,663,659 (2017—9,676,217)	(895.5)	(832.1)
Accumulated other comprehensive income (loss)	67.9	39.9
Total W. R. Grace & Co. Shareholders' Equity	330.9	256.4
Noncontrolling interests	6.1	6.9
Total Equity	337.0	263.3
Total Liabilities and Equity	\$3,565.3	\$2,907.0

The Notes to Consolidated Financial Statements are an integral part of these statements.

Table of ContentsW. R. Grace & Co. and Subsidiaries
Consolidated Statements of Equity

(In millions)	Common Stock and Paid-in Capital	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive (Loss) Income	Noncontrolling Interests	Total Equity
Balance, December 31, 2015	\$496.7	\$436.3	\$(658.4)	\$ (66.8)	\$ 4.7	\$212.5
Net income (loss)	—	94.1	—	—	—	94.1
Repurchase of common stock	—	—	(195.1)	—	—	(195.1)
Stock-based compensation	11.6	—	—	—	—	11.6
Exercise of stock options	(21.1)	—	48.6	—	—	27.5
Tax benefit related to stock plans	—	70.4	—	—	—	70.4
Shares issued	0.8	—	—	—	—	0.8
Dividends declared	—	(36.0)	—	—	—	(36.0)
Distribution of GCP	—	54.5	—	135.3	(3.7)	186.1
Other comprehensive income (loss)	—	—	—	(2.1)	2.6	0.5
Balance, December 31, 2016	488.0	619.3	(804.9)	66.4	3.6	372.4
Net income (loss)	—	11.2	—	—	(0.8)	10.4
Repurchase of common stock	—	—	(65.0)	—	—	(65.0)
Stock-based compensation	11.0	—	—	—	—	11.0
Exercise of stock options	(18.9)	—	35.0	—	—	16.1
Payments in consideration of employee tax obligations related to stock-based compensation	(2.5)	—	—	—	—	(2.5)
Shares issued	(2.1)	—	2.8	—	—	0.7
Dividends declared	—	(57.4)	—	—	—	(57.4)
Contribution from joint venture partner	—	—	—	—	4.1	4.1
Other comprehensive income (loss)	—	—	—	(26.5)	—	(26.5)
Balance, December 31, 2017	475.5	573.1	(832.1)	39.9	6.9	263.3
Net income (loss)	—	167.6	—	—	(0.8)	166.8
Repurchase of common stock	—	—	(80.0)	—	—	(80.0)
Stock-based compensation	18.6	—	—	—	—	18.6
Exercise of stock options	(4.2)	—	10.6	—	—	6.4
Payments in consideration of employee tax obligations related to stock-based compensation	(2.9)	—	—	—	—	(2.9)
Shares issued	(5.2)	—	6.0	—	—	0.8
Dividends declared	—	(64.3)	—	—	—	(64.3)
Other comprehensive income (loss)	—	—	—	25.8	—	25.8
Effect of adopting ASC 606	—	2.5	—	—	—	2.5
Effect of adopting ASU 2018-02	—	(2.2)	—	2.2	—	—
Balance, December 31, 2018	\$481.8	\$676.7	\$(895.5)	\$ 67.9	\$ 6.1	\$337.0

The Notes to Consolidated Financial Statements are an integral part of these statements.

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Notes to Consolidated Financial Statements

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies

W. R. Grace & Co., through its subsidiaries, is engaged in specialty chemicals and specialty materials businesses on a global basis through two reportable segments: Grace Catalysts Technologies, which includes catalysts and related products and technologies used in refining, petrochemical and other chemical manufacturing applications; and Grace Materials Technologies, which includes specialty materials, including silica-based and silica-alumina-based materials, used in consumer/pharma, chemical process, and coatings applications.

W. R. Grace & Co. conducts all of its business through a single wholly owned subsidiary, W. R. Grace & Co.–Conn. (“Grace–Conn.”). Grace–Conn. owns all of the assets, properties and rights of W. R. Grace & Co. on a consolidated basis, either directly or through subsidiaries.

As used in these notes, the term “Company” refers to W. R. Grace & Co. The term “Grace” refers to the Company and/or one or more of its subsidiaries and, in certain cases, their respective predecessors.

Separation Transaction On January 27, 2016, Grace entered into a separation agreement with GCP Applied Technologies Inc., then a wholly-owned subsidiary of Grace (“GCP”), pursuant to which Grace agreed to transfer its Grace Construction Products operating segment and the packaging technologies business of its Grace Materials Technologies operating segment to GCP (the “Separation”). Grace and GCP completed the Separation on February 3, 2016 (the “Distribution Date”), by means of a pro rata distribution to the Company’s shareholders of all of the outstanding shares of GCP common stock (the “Distribution”), with one share of GCP common stock distributed for each share of Company common stock held as of the close of business on January 27, 2016. As a result of the Distribution, GCP became an independent public company. GCP’s historical financial results through the Distribution Date are reflected in Grace’s Consolidated Financial Statements as discontinued operations.

Principles of Consolidation The Consolidated Financial Statements include the accounts of Grace and entities as to which Grace maintains a controlling financial interest. Intercompany transactions and balances are eliminated in consolidation. Investments in affiliated companies in which Grace can significantly influence operating and financial policies, but does not have a controlling financial interest, are accounted for under the equity method.

Grace conducts certain of its business through joint ventures with unaffiliated third parties. For joint ventures in which Grace has a controlling financial interest, Grace consolidates the results of such joint ventures in the Consolidated Financial Statements. Grace recognizes a liability for cumulative amounts due to the third parties based on the financial results of the joint ventures, and deducts the amount of income attributable to noncontrolling interests in the measurement of its consolidated net income.

Reportable Segments Grace reports financial results of each of its reportable segments that engage in business activities that generate revenues and expenses and whose operating results are regularly reviewed by Grace’s Chief Executive Officer.

Use of Estimates The preparation of financial statements in conformity with U.S. generally accepted accounting principles (“U.S. GAAP”) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the Consolidated Financial Statements, and the reported amounts of revenues and expenses for the periods presented. Actual amounts could differ from those estimates, and the differences could be material. Changes in estimates are recorded in the period identified. Grace’s accounting measurements that are most affected by management’s estimates of future events are:

- Realization values of net deferred tax assets, which depend on projections of future taxable income (see Note 7);
- Pension and postretirement liabilities, which depend on assumptions regarding participant life spans, future inflation, discount rates and total returns on invested funds (see Note 8);
- Carrying values of goodwill and other intangible assets, which depend on assumptions of future earnings and cash flows (see Note 4 and Note 20); and

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

Contingent liabilities, which depend on an assessment of the probability of loss and an estimate of ultimate obligation, such as litigation and environmental remediation (see Note 10).

Revenue Recognition Grace generates revenues predominantly from sales of manufactured products to customers and in part from licensing of technology. Under ASC 606, revenue from customer arrangements is recognized when control is transferred to the customer.

Product Sales

In its implementation of ASC 606, Grace assessed its customer arrangements at the operating segment level, and based on the similarity of arrangements, Grace elected to use the portfolio method practical expedient. Based on the promises made to customers in product sales arrangements, Grace determined that it has a performance obligation to manufacture and deliver products to its customers. Grace makes certain other promises in its customer arrangements that are immaterial in the context of the contracts. Revenue is recognized at amounts based on agreed-upon prices in sales contracts and/or purchase orders. Grace offers various incentives to its product sales customers that result in variable consideration, including but not limited to volume discounts, which reward bulk purchases by lowering the price for future purchases, and volume rebates, which encourage customers to purchase volume levels that would reduce their current prices. These incentives are immaterial in the context of the contracts.

For product sales, control is transferred at the point in time at which risk of loss and title have transferred to the customer, which is determined based on shipping terms. Terms of delivery and terms of payment are generally included in customer contracts of sale, order confirmation documents, and invoices. Payment is generally due within 30 to 60 days of invoicing. Grace defers revenue recognition until no other significant Grace performance obligations remain. Grace's customer arrangements do not contain significant acceptance provisions.

Taxes that Grace collects that are assessed by a governmental authority, and that are both imposed on and concurrent with any of its revenue-producing activities, are excluded from revenue. Grace considers shipping and handling activities that it performs as activities to fulfill the sales of its products. Amounts billed for shipping and handling are included in net sales, while costs incurred for shipping and handling are included in cost of sales, in accordance with the practical expedient provided by ASC 606.

Technology Licensing

For Grace's technology licensing business, Grace determined that the customer arrangements contain multiple deliverables to enable licensees to realize the full benefit of the technology. These deliverables include licensing the technology itself; developing engineering design packages; and providing training, consulting, and technical services. Under these arrangements, the license grant is not a distinct performance obligation, as the licensee only can benefit from the license in conjunction with other integral services such as development of the engineering design package, training, consulting, or technical services provided over the contract period. Therefore, Grace accounts for the license grant and integral services as a single performance obligation. Certain deliverables and services not included in the core bundled deliverables are accounted for as separate performance obligations.

The transaction price is specified in the technology licensing agreements and is substantially fixed. Some services are priced on a per-diem basis, but these are not material in the context of the contracts. Grace invoices its technology licensing customers as certain project milestones are achieved. Payment terms are similar to those of Grace's product sales.

Revenue for each performance obligation is recognized when control is transferred to the customer, which is generally over a period of time. As a result, Grace generally recognizes revenue for each performance obligation ratably over the period of the contract, which is up to 7 years, depending on the scope of the licensee's project. Based on the timing of payments, Grace records deferred revenue related to these agreements. See Note 17.

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

Cash Equivalents Cash equivalents consist of liquid instruments and investments with maturities of three months or less when purchased. The recorded amounts approximate fair value.

Inventories Inventories are stated at the lower of cost or net realizable value. The method used to determine cost is first-in/first-out, or “FIFO.” Market values for raw materials are based on current cost and, for other inventory classifications, net realizable value. Inventories are evaluated regularly for salability, and slow moving and/or obsolete items are adjusted to expected salable value. Inventory values include direct and certain indirect costs of materials and production. Abnormal costs of production are expensed as incurred.

Long Lived Assets Properties and equipment are stated at cost. Depreciation of properties and equipment is generally computed using the straight-line method over the estimated useful life of the asset. Estimated useful lives range from 20 to 30 years for buildings, 3 to 7 years for information technology equipment, 5 to 25 years for operating machinery and equipment, and 5 to 10 years for furniture and fixtures. Interest is capitalized in connection with major project expenditures. Fully depreciated assets are retained in properties and equipment and related accumulated depreciation accounts until they are removed from service. In the case of disposals, assets and related accumulated depreciation are removed from the accounts and the net amount, less any proceeds from disposal, is charged or credited to earnings. Obligations for costs associated with asset retirements, such as requirements to restore a site to its original condition, are accrued at net present value and amortized along with the related asset.

During the 2018 first quarter, Grace, with the assistance of an outside accounting firm, completed a study to evaluate the useful lives of its operating machinery and equipment, including a review of historical asset retirement data as well as review and analysis of relevant industry practices. As a result of this study, effective January 1, 2018, Grace revised the accounting useful lives of certain machinery and equipment, which was determined to be a change in accounting estimate and is being applied prospectively. As a result of this change in accounting estimate, Grace’s depreciation expense with respect to such machinery and equipment was reduced by \$23.5 million, resulting in an increase to net income of \$18.0 million or \$0.27 per diluted share for the year ended December 31, 2018. Estimated useful lives for operating machinery and equipment previously ranged from 3 to 10 years.

Intangible assets with finite lives consist of technology, customer lists, trademarks and other intangibles and are amortized over their estimated useful lives, ranging from 1 to 30 years.

Grace reviews long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be fully recoverable. There were no impairment charges recorded in any of the periods presented.

Goodwill Goodwill arises from business combinations, and it is reviewed for impairment on an annual basis at October 31 and whenever events or changes in circumstances indicate that the carrying amount may not be fully recoverable. Recoverability is assessed at the reporting unit level most directly associated with the business combination that generated the goodwill. For the purpose of measuring impairment, Grace has identified its operating segments as reporting units. Grace has evaluated its goodwill annually with no impairment charge required in any of the periods presented.

Financial Instruments Grace uses commodity forward, swap and/or option contracts; currency forward, swap, and/or option contracts; and interest rate swap contracts to manage exposure to fluctuations in commodity prices, currency exchange rates, and interest rates. Grace does not hold or issue derivative financial instruments for trading purposes. Derivative instruments are recorded at fair value in the Consolidated Balance Sheets as either assets or liabilities. For derivative instruments designated as fair value hedges, changes in the fair values of the derivative instruments closely offset changes in the fair values of the hedged items in “other (income) expense, net” in the Consolidated Statements of Operations. For derivative instruments designated as cash flow hedges, the gain or loss on the hedge is reported in “accumulated other comprehensive income (loss)” in the Consolidated Balance Sheets until it is cleared to earnings

during the same period in which the hedged item affects earnings. The changes in the fair values of derivative instruments that are not designated as hedges are

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

recorded in current period earnings. Cash flows from derivative instruments are reported in the same category as the cash flows from the items being hedged.

Income Taxes Deferred tax assets and liabilities are recognized with respect to the expected future tax consequences of events that have been recorded in the Consolidated Financial Statements. Grace reduces the carrying amounts of deferred tax assets by a valuation allowance if, based on the available evidence, it is more likely than not that such assets will not be realized. The need to establish valuation allowances for deferred tax assets is assessed quarterly. In assessing the requirement for, and amount of, a valuation allowance in accordance with the more likely than not standard, Grace gives appropriate consideration to all positive and negative evidence related to the realization of the deferred tax assets. This assessment considers, among other matters, the nature, frequency and severity of current and cumulative losses, forecasts of future profitability, domestic and foreign source income, the duration of statutory carryforward periods, and Grace's experience with operating loss and tax credit carryforward expirations.

Tax benefits from an uncertain tax position are recognized only if it is more likely than not that the tax position will be sustained upon examination by the taxing authorities based on the technical merits of the position. Tax benefits recognized in the Consolidated Financial Statements from such a position are measured based on the largest benefit that has a greater than fifty percent likelihood of being realized upon ultimate settlement. Grace evaluates such likelihood based on relevant facts and tax law. Grace adjusts its recorded liability for income tax matters due to changes in circumstances or new uncertainties, such as amendments to existing tax law. Grace's ultimate tax liability depends upon many factors, including negotiations with taxing authorities in the jurisdictions in which it operates, outcomes of tax litigation, and resolution of disputes arising from federal, state, and foreign tax audits. Due to the varying tax laws in each jurisdiction management, with the assistance of local tax advisors as necessary, assesses individual matters in each jurisdiction on a case-by-case basis. Grace researches and evaluates its income tax positions, including why it believes they are compliant with income tax regulations, and these positions are documented as appropriate.

The TCJA (see "U.S. Tax Reform," below) subjects a U.S. entity to tax on global intangible low-taxed income ("GILTI") earned by certain foreign subsidiaries. An entity can make an accounting policy election to either recognize deferred taxes for temporary basis differences expected to reverse as GILTI in future years or to provide for the tax expense related to GILTI in the year the tax is incurred as a period expense only. Because Grace was evaluating the provision of GILTI as of December 31, 2017, it recorded no GILTI-related deferred amounts in 2017. After further consideration in the current year, Grace has elected to account for GILTI as a period expense in the year the tax is incurred. Grace has also adopted the tax law ordering approach for evaluating the impact of GILTI on the assessment of the realizability of US deferred tax assets.

Pension Benefits Grace's method of accounting for actuarial gains and losses relating to its global defined benefit pension plans is referred to as "mark-to-market accounting." Under mark-to-market accounting, Grace's pension costs consist of two elements: 1) ongoing costs recognized quarterly, which include service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits; and 2) mark-to-market gains and losses recognized annually in the fourth quarter resulting from changes in actuarial assumptions, such as discount rates and the difference between actual and expected returns on plan assets. Should a significant event occur, Grace's pension obligation and plan assets are remeasured at an interim period, and the gains or losses on remeasurement are recognized in that period.

Stock-Based Compensation The Company recognizes expenses related to stock-based compensation payment transactions in which it receives employee services in exchange for (a) equity instruments of the Company or (b) liabilities that are based on the fair value of the Company's equity instruments or that may be settled by the issuance of equity instruments. Stock-based compensation cost for restricted stock units ("RSUs") and share settled performance

based units (“PBUs”) are measured based on the high/low average of the Company’s common stock on the date of grant. Cash settled performance based units are remeasured at the end of each reporting period based on the closing fair market value of the Company’s common stock. Stock-based

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

compensation cost for stock options is estimated at the grant date based on each option's fair value as calculated by the Black-Scholes option pricing model. The Company recognizes stock-based compensation cost as expense ratably on a straight-line basis over the requisite service period.

Currency Translation Assets and liabilities of foreign subsidiaries (other than those located in countries with highly inflationary economies) are translated into U.S. dollars at current exchange rates, while revenues, costs and expenses are translated at average exchange rates during each reporting period. The resulting translation adjustments are included in "accumulated other comprehensive income (loss)" in the Consolidated Balance Sheets. The financial statements of any subsidiaries located in countries with highly inflationary economies are remeasured as if the functional currency were the U.S. dollar; the remeasurement creates translation adjustments that are reflected in net income in the Consolidated Statements of Operations.

Reclassifications Certain amounts in prior years' Consolidated Financial Statements have been reclassified to conform to the current year presentation. Such reclassifications have not materially affected previously reported amounts in the Consolidated Financial Statements.

Recently Issued Accounting Standards In February 2016, the FASB issued ASU 2016-02 "Leases (Topic 842)." This update is intended to increase transparency and comparability among organizations by recognizing lease assets and lease liabilities on the balance sheet and disclosing key information about leasing arrangements. The core principle of Topic 842 is that a lessee should recognize the assets and liabilities that arise from leases. A lessee should recognize in the statement of financial position a liability to make lease payments (the lease liability) and a right-of-use asset representing its right to use the underlying asset for the lease term, including optional payments where they are reasonably certain to occur. Currently, as a lessee, Grace is a party to a number of leases which, under existing guidance, are classified as operating leases and not recorded on the balance sheet but expensed as incurred. Under the new standard, many of these leases will be recorded on the Consolidated Balance Sheets. In July 2018, the FASB issued ASU 2018-11 "Leases (Topic 842): Targeted Improvements," which provides an additional transition method that allows entities to initially apply the new standard at the adoption date and recognize a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption. Grace will adopt these standards in the 2019 first quarter under the modified retrospective approach permitted by ASU 2018-11. Grace is finalizing its implementation of the new standard and expects to recognize material lease assets and lease liabilities on its Consolidated Balance Sheet upon adoption of Topic 842, but does not expect the standard to have a material impact on the Consolidated Statement of Operations.

In January 2018, the FASB issued ASU 2018-01 "Leases (Topic 842): Land Easement Practical Expedient for Transition to Topic 842." This update provides an optional transition practical expedient that allows an entity to elect not to evaluate under Topic 842 existing or expired land easements not previously accounted for as leases. All land easements entered into or modified after the adoption of Topic 842 must be evaluated under Topic 842. Grace, which typically does not account for easements under current lease accounting, will use the transition practical expedient when adopting Topic 842 in the 2019 first quarter.

In August 2018, the FASB issued ASU 2018-14 "Compensation—Retirement Benefits—Defined Benefit Plans—General (Subtopic 715-20)." This update adds, removes, and clarifies disclosure requirements related to defined benefit pension and other postretirement plans. Grace is required to adopt the amendments in this update on January 1, 2021. Grace is currently evaluating the timing of adoption and does not expect the update to have a material effect on the Consolidated Financial Statements.

In October 2018, the FASB issued ASU 2018-16 "Derivatives and Hedging (Topic 815): Inclusion of the Secured Overnight Financing Rate (SOFR) Overnight Index Swap (OIS) Rate as a Benchmark Interest Rate for Hedge Accounting Purposes." This update permits use of the OIS rate based on SOFR as a U.S. benchmark interest rate for

hedge accounting purposes under Topic 815. Grace currently carries debt and derivatives that rely on the London Interbank Offered Rate (“LIBOR”) as a benchmark rate. LIBOR is expected to be phased out as a benchmark rate by the end of 2021. Grace expects its debt and financial instruments to continue to use LIBOR until the rate is no longer available. To the extent LIBOR ceases to exist, Grace may need to renegotiate any

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

credit agreements and/or derivative contracts that utilize LIBOR as a factor in determining the interest rate. Currently, there is not a firm timeframe for this change. This update currently has no foreseeable impact on Grace's Consolidated Financial Statements; however, it may have an effect in the future.

Recently Adopted Accounting Standards

Revenue Recognition

In May 2014, the FASB issued ASU 2014-09 "Revenue from Contracts with Customers (Topic 606)" ("ASC 606"). This update was intended to remove inconsistencies and weaknesses in revenue requirements; provide a more robust framework for addressing revenue issues; improve comparability of revenue recognition practices across entities, industries, jurisdictions and capital markets; provide more useful information to users of financial statements through improved disclosure requirements; and simplify the preparation of financial statements by reducing the number of requirements to which an entity must refer. Grace adopted ASC 606 with a date of initial application of January 1, 2018. Grace applied the standard to all customer contracts. As a result, Grace has changed its accounting policy for revenue recognition as detailed below.

Grace applied ASC 606 using the modified retrospective method, that is, by recognizing the cumulative effect of initially applying ASC 606 as an adjustment to "retained earnings" at the date of initial application. Results for periods beginning after December 31, 2017, are presented under ASC 606, while the comparative information has not been adjusted and continues to be reported in accordance with Grace's historical accounting under ASC 605 "Revenue Recognition" ("ASC 605").

Impact of Adoption

Except for the changes below, Grace has consistently applied its accounting policy for revenue recognition to all periods presented in the Consolidated Financial Statements.

Grace recorded a net increase to "retained earnings" of \$2.5 million as of January 1, 2018, which represents the cumulative impact of adopting ASC 606, with a \$3.2 million reduction to "other liabilities" and a \$0.7 million reduction to "deferred income taxes." The cumulative adjustment results from a change in accounting for contingent revenue related to technology licensing arrangements. Under ASC 605, certain revenue was not realized until a contractual contingency was resolved. Upon adoption of ASC 606, Grace estimates all forms of variable consideration, including contingent amounts, at the inception of the arrangement and recognizes it over the period of performance.

The tables below present the effect of the adoption of ASC 606 on Grace's Consolidated Statements of Operations and Consolidated Balance Sheets.

Consolidated Statements of Operations

(In millions)	Year Ended December 31, 2018		
	Under ASC 605	As Reported (ASC 606)	Effect of Change
Net sales	\$ 1,930.3	\$ 1,932.1	\$ 1.8
Gross profit	764.9	766.7	1.8
Income (loss) before income taxes	243.1	244.9	1.8
Provision for income taxes	(77.7)	(78.1)	(0.4)
Net income (loss)	165.4	166.8	1.4
Net income (loss) attributable to W. R. Grace & Co. Shareholders	166.2	167.6	1.4

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

Consolidated Balance Sheets

(In millions)	December 31, 2018		Effect of Change
	Under ASC 605	As Reported ASC 606)	
Deferred income taxes	\$530.5	\$ 529.4	\$ (1.1)
Other liabilities	324.8	319.8	(5.0)
Retained earnings	672.8	676.7	3.9

ASU 2016-18 “Statement of Cash Flows (Topic 230): Restricted Cash”

In November 2016, the FASB issued ASU 2016-18 “Statement of Cash Flows (Topic 230): Restricted Cash,” which requires that a statement of cash flows explain the change during the period in the total of cash, cash equivalents, and amounts generally described as restricted cash or restricted cash equivalents. Therefore, amounts generally described as restricted cash and restricted cash equivalents should be included with cash and cash equivalents when reconciling the beginning-of-period and end-of-period total amounts shown on the statement of cash flows. Grace adopted the update in the 2018 first quarter. The table below presents the effect of the adoption of ASU 2016-18 on previously reported amounts.

(In millions)	Year Ended December 31, 2017		
	Previously Reported	Revised	Effect of Change
Other investing activities	\$(1.8)	\$(1.1)	\$ 0.7
Net cash provided by (used for) investing activities	(129.9)	(129.2)	0.7
Cash, cash equivalents, and restricted cash, beginning of period	90.6	100.6	10.0
Cash, cash equivalents, and restricted cash, end of period	152.8	163.5	10.7

(In millions)	Year Ended December 31, 2016		
	Previously Reported	Revised	Effect of Change
Other investing activities	\$4.7	\$ 5.3	\$ 0.6
Net cash provided by (used for) investing activities	(345.0)	(344.4)	0.6
Cash, cash equivalents, and restricted cash, beginning of period	329.9	339.3	9.4
Cash, cash equivalents, and restricted cash, end of period	90.6	100.6	10.0

ASU 2017-07 “Compensation—Retirement Benefits (Topic 715)”

In March 2017, the FASB issued ASU 2017-07 “Compensation—Retirement Benefits (Topic 715).” This update requires that the service cost component of net benefit cost be presented with other compensation costs arising from services rendered. The remaining net benefit cost is either presented as a line item in the statement of operations outside of a subtotal for income from operations, if presented, or disclosed separately. In addition, only the service cost component of net benefit cost can be capitalized. Grace adopted the update in the 2018 first quarter.

The changes in classification of net benefit costs within the Consolidated Statements of Operations have been retrospectively applied to all periods presented. The change in costs capitalizable into inventory was applied

prospectively in accordance with the update. The tables below present the effect of the adoption of ASU 2017-07 on previously reported amounts.

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

Consolidated Statements of Operations

	Year Ended December 31, 2017		
(In millions)	Previously Reported	Revised	Effect of Change
Cost of goods sold	\$1,053.2	\$1,040.4	\$(12.8)
Gross profit	663.3	676.1	12.8
Selling, general and administrative expenses	302.6	274.0	(28.6)
Research and development expenses	53.5	56.3	2.8
Other (income) expense	(8.4)	30.2	38.6

	Year Ended December 31, 2016		
(In millions)	Previously Reported	Revised	Effect of Change
Cost of goods sold	\$942.7	\$928.8	\$(13.9)
Gross profit	655.9	669.8	13.9
Selling, general and administrative expenses	308.8	271.8	(37.0)
Research and development expenses	48.8	51.6	2.8
Other (income) expense	13.3	61.4	48.1

Other Recently Adopted Accounting Standards

In January 2017, the FASB issued ASU 2017-01 “Business Combinations (Topic 805),” which provides a screen to determine when an integrated set of assets and activities is not a business. The screen requires that when substantially all of the fair value of the gross assets acquired (or disposed of) is concentrated in a single identifiable asset or a group of similar identifiable assets, the set is not a business. This screen reduces the number of transactions that need to be further evaluated. If the screen is not met, the amendments in this update (1) require that to be considered a business, a set must include, at a minimum, an input and a substantive process that together significantly contribute to the ability to create output, and (2) remove the evaluation of whether a market participant could replace missing elements. The amendments in this update also narrow the definition of the term “output” so that the term is consistent with how outputs are described in ASC 606. Grace adopted the update in the 2018 first quarter and applied the new definition of a business to the acquisition closed during the 2018 second quarter.

In January 2017, the FASB issued ASU 2017-04 “Intangibles—Goodwill and Other (Topic 350).” This update modifies the concept of impairment from the condition that exists when the carrying amount of goodwill exceeds its implied fair value to the condition that exists when the carrying amount of a reporting unit exceeds its fair value. An entity no longer will determine goodwill impairment by calculating the implied fair value of goodwill by assigning the fair value of a reporting unit to all of its assets and liabilities as if that reporting unit had been acquired in a business combination (“Step 2”). Because these amendments eliminate Step 2 from the goodwill impairment test, they should reduce the cost and complexity of evaluating goodwill for impairment. Grace adopted the update in the 2018 fourth quarter, and it did not have a material effect on the Consolidated Financial Statements.

In May 2017, the FASB issued ASU 2017-09 “Compensation—Stock Compensation (Topic 718).” This update clarifies the existing definition of the term “modification,” which is currently defined as “a change in any of the terms or conditions of a share-based payment award.” The update requires entities to account for modifications of share-based

payment awards unless the (1) fair value, (2) vesting conditions, and (3) classification as an equity instrument or a liability instrument of the modified award are the same as the original

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Notes to Consolidated Financial Statements (Continued)

1. Basis of Presentation and Summary of Significant Accounting and Financial Reporting Policies (Continued)

award before modification. Grace adopted the update in the 2018 first quarter, and it did not have an effect on the Consolidated Financial Statements.

In February 2018, the FASB issued ASU 2018-02 “Income Statement—Reporting Comprehensive Income (Topic 220).” This update addresses the revaluation of deferred tax assets and liabilities due to the Tax Cuts and Jobs Act of 2017 impacting income from continuing operations, even if the initial income tax effects were recognized in other comprehensive income. The update allows entities to reclassify the tax effects that were originally in other comprehensive income from accumulated other comprehensive income to retained earnings. The update requires entities to disclose whether the election was made and a description of the income tax effects. The update can be: (a) applied to the period of adoption, or (b) applied retrospectively to each period in which the Tax Cuts and Jobs Act of 2017 is in effect. Grace adopted the update in the 2018 fourth quarter and reclassified \$2.2 million from “accumulated other comprehensive income (loss)” to “retained earnings” as of December 31, 2018.

U.S. Tax Reform On December 22, 2017, the Tax Cuts and Jobs Act of 2017 (the “TCJA”) was signed into law, making significant changes to the Internal Revenue Code. Changes include a federal corporate tax rate decrease from 35% to 21% for tax years beginning after December 31, 2017, the transition of U.S. international taxation from a worldwide tax system to a territorial system, and a one-time transition tax on the mandatory deemed repatriation of foreign earnings. On December 22, 2017, the SEC issued Staff Accounting Bulletin No. 118 (“SAB 118”) to address the application of U.S. GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the TCJA.

In 2017 and the first nine months of 2018, Grace recorded provisional amounts for certain enactment-date effects of the TCJA by applying the guidance in SAB 118 because it had not yet completed its enactment-date accounting for these effects. During the fourth quarter of 2018, Grace completed its accounting for all of the enactment-date income tax effects of the TCJA. As further discussed below, during 2018, Grace recognized a benefit of \$17.1 million from adjustments to the provisional amounts recorded at December 31, 2017, and included these adjustments as a component of income tax expense from continuing operations.

The provisional amount related to the remeasurement of certain deferred tax assets and liabilities, based on the rates at which they are expected to reverse in the future, was a charge of \$120.1 million at December 31, 2017. Upon further analysis of certain aspects of the TCJA and refinement of its calculations during the year ended December 31, 2018, Grace reduced the provisional amount by \$4.9 million.

The provisional amounts related to the one-time transition tax on the mandatory deemed repatriation of foreign earnings and the state and foreign taxes on the unremitted earnings were \$37.4 million and \$4.9 million, respectively, at December 31, 2017. Upon further analyses of the TCJA and notices and regulations issued and proposed by the U.S. Department of the Treasury and the Internal Revenue Service, Grace finalized its calculation of the transition tax liability during 2018. Grace decreased the December 31, 2017, provisional amount by \$9.5 million for the deemed repatriation of foreign earnings and by \$2.7 million for the state and foreign taxes on unremitted earnings. These amounts are included as a component of income tax expense from continuing operations.

Additionally, in 2017, Grace provisionally released valuation allowances on a portion of its state net operating losses and federal tax credits of \$2.0 million and \$17.4 million. Grace made no adjustments to these provisional amounts in 2018.

See Note 7 for more information related to income taxes and U.S. tax reform.

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Notes to Consolidated Financial Statements (Continued)

2. Inventories

Inventories are stated at the lower of cost or net realizable value, and cost is determined using FIFO. Inventories consisted of the following at December 31, 2018 and 2017:

(In millions)	December 31,	
	2018	2017
Raw materials	\$56.3	\$48.8
In process	49.1	33.0
Finished products	144.5	124.7
Other	31.2	24.4
	\$281.1	\$230.9

3. Properties and Equipment

(In millions)	December 31,	
	2018	2017
Land	\$28.4	\$14.2
Buildings	425.0	404.5
Information technology and equipment	142.9	136.6
Machinery, equipment and other	1,668.9	1,571.8
Projects under construction	229.3	135.4
Properties and equipment, gross	2,494.5	2,262.5
Accumulated depreciation and amortization	(1,482.8)	(1,463.4)
Properties and equipment, net	\$1,011.7	\$799.1

Capitalized interest costs amounted to \$3.2 million, \$1.5 million, and \$1.3 million in 2018, 2017, and 2016, respectively. Depreciation and lease amortization expense relating to properties and equipment was \$80.9 million, \$96.1 million, and \$85.7 million in 2018, 2017, and 2016, respectively. Grace's expense for operating leases was \$13.5 million, \$11.3 million, and \$10.0 million in 2018, 2017, and 2016, respectively.

At December 31, 2018, minimum future non-cancelable payments for operating leases are:

	(In millions)
2019	\$ 8.3
2020	6.2
2021	3.4
2022	1.9
2023	1.3
Thereafter	11.4
	\$ 32.5

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Notes to Consolidated Financial Statements (Continued)

4. Goodwill and Other Intangible Assets

The carrying amount of goodwill attributable to each reportable segment and the changes in those balances during the years ended December 31, 2018 and 2017, are as follows:

(In millions)	Catalysts Technologies	Materials Technologies	Total Grace
Balance, December 31, 2016	\$ 353.5	\$ 40.7	\$394.2
Goodwill acquired during the year	—	2.4	2.4
Foreign currency translation	4.2	1.6	5.8
Balance, December 31, 2017	357.7	44.7	402.4
Goodwill acquired during the year	140.6	—	140.6
Foreign currency translation	(2.0)	(0.6)	(2.6)
Balance, December 31, 2018	\$ 496.3	\$ 44.1	\$540.4

Grace's net book value of other intangible assets at December 31, 2018 and 2017, was \$356.5 million and \$255.4 million, respectively, detailed as follows:

(In millions)	12/31/2018		12/31/2017	
	Gross Carrying Amount	Accumulated Amortization	Gross Carrying Amount	Accumulated Amortization
Technology	\$226.2	\$ 52.4	\$214.7	\$ 41.5
Customer lists	161.2	15.7	55.8	8.8
Trademarks	29.8	4.0	25.5	2.6
Other	16.1	4.7	16.0	3.7
Total	\$433.3	\$ 76.8	\$312.0	\$ 56.6

Amortization expense related to intangible assets was \$19.9 million, \$15.4 million, and \$13.9 million in 2018, 2017, and 2016, respectively.

At December 31, 2018, estimated future annual amortization expense for intangible assets is:

	(In millions)
2019	\$ 21.6
2020	21.6
2021	21.3
2022	21.2
2023	21.1
Thereafter	249.7
	\$ 356.5

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Notes to Consolidated Financial Statements (Continued)

5. Debt

Components of Debt

(In millions)	December 31,		
	2018	2017	
2018 U.S. dollar term loan, net of unamortized debt issuance costs of \$8.7	\$938.9	\$—	
5.125% senior notes due 2021, net of unamortized debt issuance costs of \$4.2 at December 31, 2018 (2017—\$5.8)	695.8	694.2	
5.625% senior notes due 2024, net of unamortized debt issuance costs of \$3.0 at December 31, 2018 (2017—\$3.5)	297.0	296.5	
Debt payable to unconsolidated affiliate	48.1	42.4	
2014 U.S. dollar term loan, net of unamortized debt issuance costs and discounts (2017—\$4.3)—	—	404.1	
2014 Euro term loan, net of unamortized debt issuance costs and discounts (2017—\$1.0)	—	94.0	
Other borrowings(1)	3.5	12.7	
Total debt	1,983.3	1,543.9	
Less debt payable within one year	22.3	20.1	
Debt payable after one year	\$1,961.0	\$1,523.8	
Weighted average interest rates on total debt	3.9	% 4.7	%

(1) Represents borrowings under various lines of credit and other borrowings, primarily by non-U.S. subsidiaries. See Note 6 for a discussion of the fair value of Grace's debt.

The principal maturities of debt outstanding at December 31, 2018, were as follows:

	(In millions)
2019	\$ 22.3
2020	18.7
2021	713.0
2022	16.3
2023	15.3

Thereafter 1,197.7

Total debt \$ 1,983.3

Credit Agreement

On April 3, 2018, Grace entered into a Credit Agreement (the "Credit Agreement"), which provides for new senior secured credit facilities, consisting of:

(a) a \$950 million term loan due in 2025, with interest at LIBOR +175 basis points, and

(b) a \$400 million revolving credit facility due in 2023, with interest at LIBOR +175 basis points.

The term loan will amortize in equal quarterly installments in aggregate annual amounts of \$9.5 million, with the first payment due on December 31, 2018.

The Credit Agreement contains customary affirmative covenants, including, but not limited to: (i) maintenance of existence, and compliance with laws; (ii) delivery of consolidated financial statements and other information; (iii) payment of taxes; (iv) delivery of notices of defaults and certain other material events; and (v) maintenance of adequate insurance. The Credit Agreement also contains customary negative covenants, including but not limited to restrictions on: (i) dividends on, and redemptions of, equity interests and other

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Notes to Consolidated Financial Statements (Continued)

5. Debt (Continued)

restricted payments; (ii) liens; (iii) loans and investments; (iv) the sale, transfer or disposition of assets and businesses; (v) transactions with affiliates; and (vi) a maximum first lien leverage ratio.

Events of default under the Credit Agreement include, but are not limited to: (i) failure to pay principal, interest, fees or other amounts under the Credit Agreement when due, taking into account any applicable grace period; (ii) any representation or warranty proving to have been incorrect in any material respect when made; (iii) failure to perform or observe covenants or other terms of the Credit Agreement subject to certain grace periods; (iv) a cross-default and cross-acceleration with certain other material debt; (v) bankruptcy events; (vi) certain defaults under ERISA; and (vii) the invalidity or impairment of security interests.

To secure its obligations under the Credit Agreement, Grace and certain of its U.S. subsidiaries have granted security interests in substantially all equity and debt interests in Grace–Conn. or any other Grace subsidiary owned by them and in substantially all their non-real estate assets and property.

Grace used a portion of the proceeds to repay in full the borrowings outstanding under its 2014 credit agreement, which was terminated, as well as to make a voluntary \$50.0 million accelerated contribution to its U.S. qualified pension plans. In connection with the repayment of debt, Grace recorded a \$4.8 million loss on early extinguishment of debt, which is included in “other (income) expense” in the Consolidated Statement of Operations.

Grace had no outstanding draws on its revolving credit facility as of December 31, 2018; however, the available credit under that facility was reduced to \$367.6 million by outstanding letters of credit.

During the 2016 first quarter, in connection with the Separation, GCP distributed \$750 million to Grace. Grace used \$600 million of those funds to repay \$526.9 million of its U.S. dollar term loan, including the \$250 million borrowed under a delayed draw facility, and €67.3 million of its euro term loan. As a result, Grace recorded a loss on early extinguishment of \$11.1 million. See Note 21 for information related to the Separation.

Senior Notes

On September 16, 2014, Grace–Conn. (the “Issuer”) issued \$1,000.0 million of senior unsecured notes (the “Notes”) in two tranches:

- (a) \$700 million in aggregate principal amount of Notes due 2021 at a coupon rate of 5.125%, and
- (b) \$300 million in aggregate principal amount of Notes due 2024 at a coupon rate of 5.625%.

The Notes were priced at 100% of par and were offered and sold pursuant to exemptions from registration under the Securities Act of 1933, as amended, (the “Securities Act”). The net proceeds received from issuance were \$985.5 million, a portion of which was used to terminate Grace’s obligations under the deferred payment agreement with the PI Trust (as defined in Note 10) for \$632.0 million and to repay amounts outstanding under Grace’s revolving credit facility. The remaining proceeds from the Notes were used to partially fund the settlement of the warrant issued to the PI Trust and for other general corporate purposes. Interest is payable on the Notes on each April 1 and October 1. Grace may redeem some or all of the Notes at any time at a price equal to the greater of (i) 100% of the principal amount of the Notes redeemed plus accrued and unpaid interest and (ii) the sum, as determined by an independent investment banker, of the present values of the remaining scheduled payments of principal and interest (exclusive of interest accrued to the date of redemption) discounted to the redemption date on a semiannual basis (assuming a 360-day year consisting of twelve 30-day months) at the treasury rate plus 50 basis points, in each case, plus accrued and unpaid interest. In the event of a change in control, Grace will be required to offer to purchase the Notes at a price equal to 101% of the aggregate principal amount outstanding plus accrued and unpaid interest.

The Notes are jointly and severally guaranteed on a full and unconditional senior unsecured basis by the Company and Alltech Associates, Inc., a wholly-owned subsidiary of the Issuer (the “Guarantors”). The Notes and guarantees are senior obligations of the Issuer and the Guarantors, respectively, and will rank equally with all of the existing and future unsubordinated obligations of the Issuer and the Guarantors, respectively. The Notes are

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Notes to Consolidated Financial Statements (Continued)

5. Debt (Continued)

effectively subordinated to any secured indebtedness to the extent of the value of the assets securing such indebtedness, and structurally subordinated to the debt and other liabilities of Grace's non-guarantor subsidiaries. The Notes were issued subject to covenants that limit the Issuer's and certain of its subsidiaries' ability, subject to certain exceptions and qualifications, to (i) create or incur liens on assets, (ii) enter into any sale and leaseback transaction and (iii) in the case of the Issuer, merge or consolidate with another company. Grace is in compliance with these covenants.

The Notes were also issued subject to customary events of default which include (subject in certain cases to customary grace and cure periods), among others, nonpayment of principal or interest; breach of other agreements in the Indenture; failure to pay certain other indebtedness; failure to discharge a final judgment for the payment of \$75 million or more (excluding any amounts covered by insurance or indemnities) rendered against the Issuer or any of its significant subsidiaries; and certain events of bankruptcy or insolvency. Generally, if any event of default occurs, the trustee or the holders of at least 25% in aggregate principal amount of the then outstanding series of Notes may declare all the Notes of such series to be due and payable immediately.

The foregoing is a summary of the Credit Agreement, the indentures, and the Notes. Grace has filed the full text of such agreements with the SEC, which are readily available on the Internet at www.sec.gov.

6. Fair Value Measurements and Risk

Certain of Grace's assets and liabilities are reported at fair value on a gross basis. ASC 820 "Fair Value Measurements and Disclosures" defines fair value as the value that would be received at the measurement date in the principal or "most advantageous" market. Grace uses principal market data, whenever available, to value assets and liabilities that are required to be reported at fair value.

Grace has identified the following financial assets and liabilities that are subject to the fair value analysis required by ASC 820:

Fair Value of Debt and Other Financial Instruments Debt payable is recorded at carrying value. Fair value is determined based on Level 2 inputs, including expected future cash flows (discounted at market interest rates), estimated current market prices, and quotes from financial institutions.

At December 31, 2018, the carrying amounts and fair values of Grace's debt were as follows:

(In millions)	12/31/2018		12/31/2017	
	Carrying Amount	Fair Value	Carrying Amount	Fair Value
2018 U.S. dollar term loan(1)	\$938.9	\$914.8	\$—	\$—
5.125% senior notes due 2021(2)	695.8	697.5	694.2	728.7
5.625% senior notes due 2024(2)	297.0	301.8	296.5	321.3
2014 U.S. dollar term loan(3)	—	—	404.1	409.7
2014 Euro term loan(3)	—	—	94.0	93.7
Other borrowings	51.6	51.6	55.1	55.1
Total debt	\$1,983.3	\$1,965.7	\$1,543.9	\$1,608.5

(1) Carrying amounts are net of unamortized debt issuance costs and discounts of \$8.7 million as of December 31, 2018.

Carrying amounts are net of unamortized debt issuance costs of \$4.2 million and \$3.0 million at December 31, (2)2018, and \$5.8 million and \$3.5 million as of December 31, 2017, related to the 5.125% senior notes due 2021 and 5.625% senior notes due 2024, respectively.

(3)

Carrying amounts are net of unamortized debt issuance costs and discounts of \$4.3 million and \$1.0 million as of December 31, 2017, related to the U.S. dollar term loan and euro term loan, respectively.

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Notes to Consolidated Financial Statements (Continued)

6. Fair Value Measurements and Risk (Continued)

At December 31, 2018, the recorded values of other financial instruments such as cash equivalents and trade receivables and payables approximated their fair values, based on the short-term maturities and floating rate characteristics of these instruments.

Currency Derivatives Because Grace operates and/or sells to customers in over 70 countries and in over 30 currencies, its results are exposed to fluctuations in currency exchange rates. Grace seeks to minimize exposure to these fluctuations by matching sales with expenditures in the same currencies, but it is not always possible to do so. From time to time, Grace uses financial instruments such as currency forward contracts, options, swaps, or combinations thereof to reduce the risk of certain specific transactions. However, Grace does not have a policy of hedging all exposures, because management does not believe that such a level of hedging would be cost-effective. Forward contracts with maturities of not more than 36 months are used and designated as cash flow hedges of forecasted repayments of intercompany loans. The effective portion of gains and losses on these currency hedges is recorded in “accumulated other comprehensive income (loss)” and reclassified into “other (income) expense, net” to offset the remeasurement of the underlying hedged loans. Excluded components (forward points) on these hedges are amortized to income on a systematic basis.

Grace also enters into foreign currency forward contracts and swaps to hedge a portion of its net outstanding monetary assets and liabilities. These forward contracts and swaps are not designated as hedging instruments under applicable accounting guidance, and therefore all changes in the fair value of the forward contracts and swaps are recorded in “other (income) expense, net,” in the Consolidated Statements of Operations. These forward contracts and swaps are intended to offset the foreign currency gains or losses associated with the underlying monetary assets and liabilities. The valuation of Grace’s currency exchange rate forward contracts and swaps is determined using an income approach. Inputs used to value currency exchange rate forward contracts and swaps consist of: (1) spot rates, which are quoted by various financial institutions; (2) forward points, which are primarily affected by changes in interest rates; and (3) discount rates used to present value future cash flows, which are based on the London Interbank Offered Rate (LIBOR) curve or overnight indexed swap rates. Total notional amounts for forward contracts and swaps outstanding at December 31, 2018, were \$171.6 million.

Cross-Currency Swap Agreements Grace uses cross-currency swaps designated as cash flow hedges to manage fluctuations in currency exchange rates and interest rates on variable rate debt. The effective portion of gains and losses on these cash flow hedges is recorded in “accumulated other comprehensive income (loss)” and reclassified into “other (income) expense, net” and “interest expense and related financing costs” during the hedged period. In April 2018, in connection with the Credit Agreement (see Note 5), Grace entered into new cross-currency swaps beginning on April 3, 2018, and maturing on March 31, 2023, to synthetically convert \$600.0 million of U.S. dollar-denominated floating rate debt into €490.1 million of euro-denominated debt fixed at 2.0231%. These cross-currency swaps were de-designated and terminated on November 5, 2018, and replaced with new, at-market cross-currency swaps beginning on November 5, 2018, and maturing on March 31, 2023, to synthetically convert \$600.0 million of U.S. dollar-denominated floating rate debt into €525.9 million of euro-denominated debt fixed at 1.785%. Grace received \$33.1 million in cash proceeds from the swap settlement. The valuation of these cross-currency swaps is determined using an income approach, using LIBOR and EURIBOR (Euro Interbank Offered Rate) swap curves, currency basis spreads, and euro/U.S. dollar exchange rates.

Debt and Interest Rate Swap Agreements Grace uses interest rate swaps designated as cash flow hedges to manage fluctuations in interest rates on variable rate debt. The effective portion of gains and losses on these interest rate cash flow hedges is recorded in “accumulated other comprehensive income (loss)” and reclassified into “interest expense and related financing costs” during the hedged interest period.

In connection with its emergence financing, Grace entered into interest rate swaps beginning on February 3, 2015, and maturing on February 3, 2020, fixing the LIBOR component of the interest on \$250.0 million of Grace's term debt at a rate of 2.393%. These interest rate swaps were de-designated and terminated in April 2018 in connection with Grace's entry into a new credit agreement.

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Notes to Consolidated Financial Statements (Continued)

6. Fair Value Measurements and Risk (Continued)

In connection with the Credit Agreement (see Note 5), Grace entered into new interest rate swaps beginning on April 3, 2018, and maturing on March 31, 2023, fixing the LIBOR component of the interest on \$100.0 million of term debt at 2.775%. The valuation of these interest rate swaps is determined using an income approach, using prevailing market interest rates and discount rates to present value future cash flows based on the forward LIBOR yield curves. Credit risk is also incorporated into derivative valuations.

The following tables present the fair value hierarchy for financial assets and liabilities measured at fair value on a recurring basis as of December 31, 2018 and 2017:

(In millions)	Fair Value Measurements at December 31, 2018, Using			
	Total	Quoted Prices in Active Markets for Identical Assets or Liabilities (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets				
Currency derivatives	\$3.7	\$	—\$ 3.7	\$ —
Total Assets	\$3.7	\$	—\$ 3.7	\$ —
Liabilities				
Currency derivatives	\$10.5	\$	—\$ 10.5	\$ —
Interest rate derivatives	0.8	—	0.8	—
Variable-to-fixed cross-currency derivatives	3.6	—	3.6	—
Total Liabilities	\$14.9	\$	—\$ 14.9	\$ —

(In millions)	Fair Value Measurements at December 31, 2017, Using			
	Total	Quoted Prices in Active Markets for Identical Assets or Liabilities (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets				
Currency derivatives	\$3.1	\$	—\$ 3.1	\$ —
Total Assets	\$3.1	\$	—\$ 3.1	\$ —
Liabilities				
Interest rate derivatives	\$1.8	\$	—\$ 1.8	\$ —
Currency derivatives	23.8	—	23.8	—

Total Liabilities \$25.6 \$ —\$ 25.6 \$ —

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Notes to Consolidated Financial Statements (Continued)

6. Fair Value Measurements and Risk (Continued)

The following tables present the location and fair values of derivative instruments included in the Consolidated Balance Sheets as of December 31, 2018 and 2017:

December 31, 2018 (In millions)	Asset Derivatives		Liability Derivatives	
	Balance Sheet Location	Fair Value	Balance Sheet Location	Fair Value
Derivatives designated as hedging instruments under ASC 815:				
Currency contracts	Other current assets	\$ 2.4	Other current assets	\$(2.9)
Interest rate contracts	Other current assets	—	Other current liabilities	0.1
Variable-to-fixed cross-currency swaps	Other current assets	—	Other current assets	(15.4)
Currency contracts	Other assets	1.3	Other liabilities	12.9
Interest rate contracts	Other assets	—	Other liabilities	0.7
Variable-to-fixed cross-currency swaps	Other assets	—	Other liabilities	19.0
Derivatives not designated as hedging instruments under ASC 815:				
Currency contracts	Other current assets	—	Other current assets	(0.1)
Currency contracts	Other current assets	—	Other current liabilities	0.6
Total derivatives		\$ 3.7		\$ 14.9
December 31, 2017 (In millions)	Asset Derivatives		Liability Derivatives	
	Balance Sheet Location	Fair Value	Balance Sheet Location	Fair Value
Derivatives designated as hedging instruments under ASC 815:				
Currency contracts	Other current assets	\$ 2.7	Other current liabilities	\$ 1.4
Interest rate contracts	Other current assets	—	Other current liabilities	1.3
Currency contracts	Other assets	—	Other liabilities	22.2
Interest rate contracts	Other assets	—	Other liabilities	0.5
Derivatives not designated as hedging instruments under ASC 815:				
Currency contracts	Other current assets	0.4	Other current liabilities	0.2
Total derivatives		\$ 3.1		\$ 25.6

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Notes to Consolidated Financial Statements (Continued)

6. Fair Value Measurements and Risk (Continued)

The following tables present the location and amount of gains and losses on derivative instruments included in the Consolidated Statements of Operations or, when applicable, gains and losses initially recognized in “other comprehensive income (loss)” (“OCI”) for the years ended December 31, 2018, 2017, and 2016:

Year Ended December 31, 2018 (In millions)	Amount of Gain (Loss) Recognized in OCI on Derivatives	Location of Gain (Loss) Recognized from Accumulated OCI into Income	Amount of Gain (Loss) Reclassified from OCI into Income
Derivatives in ASC 815 cash flow hedging relationships:			
Interest rate contracts	\$ 0.4	Interest expense	\$ (0.6)
Currency contracts(1)	6.3	Other expense	6.3
Variable-to-fixed cross-currency swaps	(0.6)	Interest expense	9.7
Variable-to-fixed cross-currency swaps	40.5	Other expense	40.5
Total derivatives	\$ 46.6		\$ 55.9
		Location of Gain (Loss) Recognized in Income on Derivatives	Amount of Gain (Loss) Recognized in Income on Derivatives
Derivatives not designated as hedging instruments under ASC 815:			
Currency contracts		Other expense	\$ (4.0)

(1) Amount of gain (loss) recognized in OCI includes \$(0.4) million excluded from the assessment of effectiveness for which the difference between changes in fair value and periodic amortization is recorded in OCI.

Year Ended December 31, 2017 (In millions)	Amount of Gain (Loss) Recognized in OCI on Derivatives	Location of Gain (Loss) Recognized from Accumulated OCI into Income	Amount of Gain (Loss) Reclassified from OCI into Income
Derivatives in ASC 815 cash flow hedging relationships:			
Interest rate contracts	\$ 0.9	Interest expense	\$ (2.7)
Currency contracts(1)	(3.6)	Other expense	(2.9)
Total derivatives	\$ (2.7)		\$ (5.6)
		Location of Gain (Loss) Recognized in Income on Derivatives	Amount of Gain (Loss) Recognized

		in Income on Derivatives
Derivatives not designated as hedging instruments under ASC 815:		
Currency contracts	Other expense	\$ 1.0

(1) Amount of gain (loss) recognized in OCI includes \$(0.6) million excluded from the assessment of effectiveness for which the difference between changes in fair value and periodic amortization is recorded in OCI.

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Notes to Consolidated Financial Statements (Continued)

6. Fair Value Measurements and Risk (Continued)

Year Ended December 31, 2016 (In millions)	Amount of Gain (Loss)	Location of Gain (Loss) Recognized Accumulated OCI on Derivatives	Reclassified from OCI into Income	Amount of Gain (Loss) Reclassified from OCI into Income
Derivatives in ASC 815 cash flow hedging relationships:				
Interest rate contracts	\$ (2.2)	Interest expense		\$ (4.1)
Currency contracts	(0.1)	Other expense		0.8
Total derivatives	\$ (2.3)			\$ (3.3)

Year Ended December 31, 2016 (In millions)	Amount of Gain (Loss) Recognized in OCI on Derivatives	Location of Gain (Loss) Recognized in Income on Derivatives	Amount of Gain (Loss) Recognized in Income on Derivatives
Derivatives not designated as hedging instruments under ASC 815:			
Currency contracts		Other expense	\$ (0.8)

The following table presents the total amounts of income and expense line items presented in the Consolidated Statements of Operations in which the effects of cash flow hedges are reported.

(In millions)	Year Ended December 31,					
	2018	2017	2016	2015	2014	2013
	Interest expense	Other income (expense)	Interest expense	Other income (expense)	Interest expense	Other income (expense)
Total amounts of income and expense line items in the Consolidated Statements of Operations in which the effects of cash flow hedges are recorded	\$(80.2)	\$ 16.5	\$(79.5)	\$(30.2)	\$(81.5)	\$(61.4)
Gain (loss) on cash flow hedging relationships in ASC 815						
Interest rate contracts						
Amount of gain or (loss) reclassified from accumulated OCI into income	\$(0.6)	\$ —	\$(2.7)	\$ —	\$(4.1)	\$ —
Variable-to-fixed cross-currency swaps						
Amount of gain (loss) reclassified from accumulated OCI into income	9.7	40.5	—	—	—	—
Currency contracts						
Amount of gain or (loss) reclassified from accumulated OCI into income	—	6.3	—	(2.9)	—	0.8
Amount excluded from effectiveness testing recognized in earnings based on amortization approach (included in	—	3.0	—	0.6	—	—

above)

Net Investment Hedges Grace uses cross-currency swaps as derivative hedging instruments in certain net investment hedges of its non-U.S. subsidiaries. The gains and losses attributable to these net investment hedges, adjusted for the impact of excluded components, are recorded net of tax to “currency translation adjustments” within “accumulated other comprehensive income (loss)” to offset the change in the carrying value of the net investment being hedged.

Recognition in earnings of amounts previously recorded to “currency translation adjustments” is limited to circumstances such as complete or substantially complete liquidation of the net investment in the hedged foreign operation. Changes in the fair value of the hedging instrument related to time value, which are excluded from the assessment of hedge effectiveness, are recorded directly to interest expense on a systematic basis. These gains were \$2.3 million for the year ended December 31, 2018. At December 31, 2018, the notional amount of €170.0 million of Grace’s cross-currency swaps was designated as a hedging instrument of its net investment in its European subsidiaries.

Grace also uses foreign currency denominated debt and deferred intercompany royalties as non-derivative hedging instruments in certain net investment hedges. At December 31, 2018, €11.2 million of Grace’s deferred

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Notes to Consolidated Financial Statements (Continued)

6. Fair Value Measurements and Risk (Continued)

intercompany royalties was designated as a hedging instrument of its net investment in its European subsidiaries. In April 2018, in connection with the Credit Agreement, Grace de-designated and repaid its euro-denominated term loan principal that had been designated as a hedge of its net investment in its European subsidiaries.

The following tables present the amount of gains and losses on derivative and non-derivative instruments designated as net investment hedges recorded to “currency translation adjustments” within “accumulated other comprehensive income (loss)” for the years ended December 31, 2018, 2017, and 2016. There were no reclassifications of the effective portion of net investment hedges out of OCI and into earnings for the periods presented in the tables below.

(In millions)	Year Ended		
	December 31,		
	2018	2017	2016
Derivatives in ASC 815 net investment hedging relationships:			
Cross-currency swap	\$6.0	\$(21.9)	\$5.6
Non-derivatives in ASC 815 net investment hedging relationships:			
Foreign currency denominated debt	\$(4.4)	\$(11.2)	\$4.6
Foreign currency denominated deferred intercompany royalties	0.5	(6.5)	2.5
	\$(3.9)	\$(17.7)	\$7.1

Credit Risk Grace is exposed to credit risk in its trade accounts receivable. Customers in the petroleum refining industry represent the greatest exposure. Grace’s credit evaluation policies mitigate credit risk exposures, and it has a history of minimal credit losses. Grace does not generally require collateral for its trade accounts receivable, but may require a bank letter of credit in certain instances, particularly when selling to customers in cash-restricted countries. Grace may also be exposed to credit risk in its derivatives contracts. Grace monitors counterparty credit risk and currently does not anticipate nonperformance by counterparties to its derivatives. Grace’s derivative contracts are with internationally recognized commercial financial institutions.

7. Income Taxes

Provision for Income Taxes The components of income from continuing operations before income taxes and the related provision for income taxes for 2018, 2017, and 2016 are as follows:

(In millions)	2018	2017	2016
Income from continuing operations before income taxes:			
Domestic	\$82.2	\$28.3	\$72.7
Foreign	162.7	182.6	93.3
Total	\$244.9	\$210.9	\$166.0
Benefit from (provision for) income taxes:			
Federal—current	\$(4.9)	\$—	\$—
Federal—deferred	(29.3)	(144.6)	(11.8)
State and local—current	1.6	0.2	(0.7)
State and local—deferred	(3.5)	(1.7)	(17.7)
Foreign—current	(49.9)	(50.8)	(36.6)
Foreign—deferred	7.9	(3.6)	7.8
Total	\$(78.1)	\$(200.5)	\$(59.0)

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Notes to Consolidated Financial Statements (Continued)

7. Income Taxes (Continued)

The difference between the benefit from (provision for) income taxes on continuing operations at the U.S. federal income tax rate of 21% for 2018 (35% for 2017 and 2016) and Grace's overall income tax provision is summarized as follows:

(In millions)	2018	2017	2016
Tax provision at U.S. federal income tax rate	\$(51.4)	\$(73.8)	\$(58.1)
Change in benefit (provision) resulting from:			
Tax on global intangible low-taxed income	(24.1)	—	—
Benefits (charges) related to U.S. tax reform	17.1	(143.0)	—
Effect of tax rates in foreign jurisdictions	(11.3)	13.3	6.8
Research and development credit	9.4	5.1	—
U.S. tax on foreign earnings	(6.8)	(1.2)	(0.9)
Decrease (increase) in valuation allowance	(6.3)	(0.3)	(2.5)
Audit settlements	5.7	—	—
Prior-period adjustments	2.8	4.5	(2.7)
Excess compensation	(2.7)	(0.1)	(0.4)
State and local income taxes, net	(1.9)	(1.8)	(4.7)
Nontaxable income/non-deductible expenses	(1.6)	(2.6)	(2.5)
Stock-based compensation	(0.7)	2.8	6.7
Other	(6.3)	(3.4)	(0.7)
Benefit from (provision for) income taxes	\$(78.1)	\$(200.5)	\$(59.0)

In 2017 Grace estimated its provision for income taxes in accordance with the TCJA and guidance available at the time and as a result recorded a provisional income tax expense of \$143.0 million in the 2017 fourth quarter.

The provisional amount related to the remeasurement of certain deferred tax assets and liabilities, based on the rates at which they are expected to reverse in the future, was \$120.1 million.

The provisional amounts related to the one-time transition tax on the mandatory deemed repatriation of foreign earnings and the state and foreign taxes on the unremitted earnings were \$37.4 million and \$4.9 million, respectively. Effective December 31, 2017, Grace is no longer indefinitely reinvested with respect to its historical unremitted earnings of its foreign subsidiaries. In the fourth quarter of 2018 Grace finalized the provisional amounts recorded in the fourth quarter of 2017, which resulted in reductions of \$9.5 million and \$2.7 million in the one-time transition tax of foreign earnings and the state and foreign taxes on the unremitted earnings, respectively. The net reduction of the transition tax was due primarily to additional review of historical tax attributes of Grace's foreign subsidiaries and changes in estimate based on guidance issued during the year. The adjustment of Grace's provisional transition tax expense was recorded as a change in estimate in accordance with SAB 118. Despite the completion of Grace's accounting for the TCJA under SAB 118, many aspects of the law remain uncertain at this time. We expect updates to federal and state guidance and regulations will continue throughout 2019. Grace will monitor and assess the impact of any new guidance as it becomes available.

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Notes to Consolidated Financial Statements (Continued)

7. Income Taxes (Continued)

The table below summarizes the provisional amounts related to the TCJA recorded in 2017 and the adjustments recorded in 2018.

(In millions)	2017 Provisional Amounts	Remeasurement under SAB 118	Total
Revaluation of deferred tax assets and liabilities	\$ 120.1	\$ (4.9)	\$ 115.2
Transition tax	37.4	(9.5)	27.9
Federal tax credit valuation release	(17.4)	—	(17.4)
State valuation release	(2.0)	—	(2.0)
Foreign and state impact of unremitted earnings	4.9	(2.7)	2.2
Total tax reform	\$ 143.0	\$ (17.1)	\$ 125.9

Deferred Tax Assets and Liabilities As of December 31, 2018 and 2017, the tax attributes giving rise to deferred tax assets and liabilities consisted of the following items.

(In millions)	December 31,	
	2018	2017
Deferred tax assets:		
Federal tax credit carryforwards	\$291.0	\$269.6
Pension liabilities	82.7	104.8
State net operating loss carryforwards	52.9	58.2
U.S. net operating loss carryforwards	44.3	89.5
Liability for environmental remediation	29.3	16.4
Research and development	24.6	22.8
Reserves and allowances	22.8	15.2
Unrealized currency gains and losses	12.8	—
Stock-based compensation	6.5	4.2
Foreign net operating loss carryforwards	5.7	6.6
Prepaid royalties	3.0	21.4
Other	6.5	10.3
Total deferred tax assets	\$582.1	\$619.0
Deferred tax liabilities:		
Intangible assets	\$(24.9)	\$(15.1)
Properties and equipment	(13.2)	(32.0)
Other	(5.6)	(11.3)
Total deferred tax liabilities	\$(43.7)	\$(58.4)
Valuation allowance:		
State net operating loss carryforwards	\$(6.6)	\$(9.2)
Federal tax credit carryforwards	(5.2)	(0.3)
Foreign net operating loss carryforwards	(4.2)	(2.8)
Foreign other	(3.9)	—
Total valuation allowance	(19.9)	(12.3)
Net deferred tax assets	\$518.5	\$548.3

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Notes to Consolidated Financial Statements (Continued)

7. Income Taxes (Continued)

Grace's net deferred tax assets decreased by \$29.8 million from December 31, 2017, to December 31, 2018, largely as a result of the utilization of net operating losses, the reduction of pension related deferred tax assets, and a reduction in prepaid royalty deferred tax assets. These reductions were partially offset by an increase in Grace's federal tax credit carryforwards and unrealized foreign currency gains and losses.

Grace reduces the carrying amounts of deferred tax assets by a valuation allowance if, based on the available evidence, it is more likely than not that such assets will not be realized (see Note 1). The valuation allowance increased by \$7.6 million from December 31, 2017, to December 31, 2018, due to increases of \$4.9 million related to expected foreign tax credit utilization, \$3.9 million related to a foreign deferred tax asset the company is unlikely to utilize, and \$1.4 million related to foreign net operating loss carryforwards, offset by a \$2.6 million reduction to the valuation allowance for state deferred taxes.

U.S. Federal and State Net Operating Losses and Credit Carryforwards Grace has \$299.4 million in federal tax credit carryforwards before unrecognized tax benefits. In order to fully utilize the credits before they expire from 2021 to 2028 Grace will need to generate income of approximately \$1.4 billion.

Grace has U.S. federal and state net operating losses. The deferred tax asset related to federal NOLs is \$48.8 million before unrecognized tax benefits. In order to fully utilize the NOLs before they expire in 2035, Grace will need to generate approximately \$232 million in U.S. taxable income. The deferred tax asset, net of federal benefit, before valuation allowance related to state NOLs is \$54.5 million before unrecognized tax benefits. In order to fully utilize the state NOLs before they expire (from 2018 to 2035), Grace would need to generate approximately \$1.9 billion in state taxable income.

Unrecognized Tax Benefits The balance of unrecognized tax benefits at December 31, 2018, was \$14.1 million compared with \$17.7 million at December 31, 2017. A rollforward of the unrecognized tax benefits for the three years ended December 31, 2018, follows.

(In millions)	Unrecognized Tax Benefits
Balance, December 31, 2015	\$ 23.1
Additions for current year tax positions	6.8
Additions for prior year tax positions	0.2
Reductions for prior year tax positions and reclassifications	(0.2)
Settlements	(3.3)
Transferred to GCP upon Separation	(7.9)
Balance, December 31, 2016	18.7
Additions for current year tax positions	0.8
Additions for prior year tax positions	0.7
Reductions for prior year tax positions and reclassifications	(2.5)
Balance, December 31, 2017	17.7
Additions for current year tax positions	0.9
Additions for prior year tax positions	4.0
Reductions for prior year tax positions and reclassifications	(2.8)
Settlements	(5.7)
Balance, December 31, 2018	\$ 14.1

The entire balance of unrecognized tax benefits as of December 31, 2018, of \$14.1 million, if recognized, would reduce the effective tax rate. The balance relates to tax positions with an indirect tax benefit that results in a corresponding deferred tax asset as of December 31, 2018. Grace accrues potential interest and any associated

penalties related to unrecognized tax benefits in “benefit from (provision for) income taxes” in the Consolidated

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Notes to Consolidated Financial Statements (Continued)

7. Income Taxes (Continued)

Statements of Operations. There were no interest and penalties accrued on unrecognized tax benefits as of December 31, 2018 and 2017.

Grace files U.S. federal income tax returns as well as income tax returns in various state and foreign jurisdictions. Grace's unrecognized tax benefits are related to income tax returns for tax years that remain subject to examination by the relevant taxing authorities. The following table summarizes these open tax years by major jurisdiction:

Tax Jurisdiction(1)	Examination in Progress	Examination Not Initiated
United States—Federal	2016	2017
United States—States	2011-2016	2017
Germany	2014-2016	2017
Sweden	None	2013-2017

(1)Includes federal, state, provincial or local jurisdictions, as applicable.

Grace notes that there are attributes generated in prior years that are otherwise closed by statute and were carried forward into years that are open to examination. Those attributes may still be subject to adjustment to the extent utilized in open years.

As a multinational taxpayer, Grace is under continual audit by various tax authorities. Grace believes that the amount of the liability for unrecognized tax benefits will be unchanged in the next 12 months.

8. Pension Plans and Other Retirement Plans

Pension Plans The following table presents the funded status of Grace's underfunded and unfunded pension plans:

(In millions)	December 31,	
	2018	2017
Overfunded defined benefit pension plans	\$5.7	\$—
Underfunded defined benefit pension plans	(67.1)	(110.5)
Unfunded defined benefit pension plans	(366.0)	(391.9)
Total underfunded and unfunded defined benefit pension plans	(433.1)	(502.4)
Pension liabilities included in other current liabilities	(14.7)	(15.0)
Net funded status	\$(442.1)	\$(517.4)

Fully-funded plans include several advance-funded plans where the fair value of the plan assets exceeds the projected benefit obligation ("PBO"). Underfunded plans include a group of advance-funded plans that are underfunded on a projected benefit obligation ("PBO") basis. Unfunded plans include several plans that are funded on a pay-as-you-go basis, and therefore, the entire PBO is unfunded.

Grace maintains defined benefit pension plans covering current and former employees of certain business units and divested business units who meet age and service requirements. Benefits are generally based on final average salary and years of service. Grace funds its U.S. qualified pension plans ("U.S. qualified pension plans") in accordance with U.S. federal laws and regulations. Non-U.S. pension plans ("non-U.S. pension plans") are funded under a variety of methods, as required under local laws and customs. The U.S. salaried plan was closed to new entrants after January 1, 2017. U.S. salaried employees and certain U.S. hourly employees hired on or after January 1, 2017, and employees in Germany hired on or after January 1, 2016, participate in enhanced defined contribution plans instead of defined benefit pension plans.

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

Grace also provides, through nonqualified plans, supplemental pension benefits in excess of U.S. qualified pension plan limits imposed by federal tax law. These plans cover officers and higher-level employees and serve to increase the combined pension amount to the level that they otherwise would have received under the U.S. qualified pension plans in the absence of such limits. The nonqualified plans are unfunded and Grace pays the costs of benefits as they are due to the participants.

During 2018, Grace implemented a special lump sum and early commencement window for certain terminated vested participants who terminated employment prior to May 1, 2018, and had not previously commenced their pension benefits. As a result of the transaction, the U.S. qualified pension plans paid \$42.2 million in lump sum distributions that reduced the PBO by \$43.5 million and resulted in a \$1.3 million gain.

Additionally, in the 2018 fourth quarter, Grace entered into an agreement with Prudential Financial, Inc. (“Prudential Financial”) to purchase a group annuity contract for \$116.4 million that transferred \$117.4 million of our U.S. pension plan obligations to Prudential Financial. Prudential Financial assumed responsibility to pay monthly annuities to certain retirees and beneficiaries that were receiving a monthly benefit from certain U.S. pension plans. Grace recognized a \$1.0 million gain on the settlement.

At the December 31, 2018, measurement date for Grace’s defined benefit pension plans, the PBO was \$1,332.7 million as measured under U.S. GAAP compared with \$1,648.7 million as of December 31, 2017. The PBO basis reflects the present value (using a 4.22% weighted average discount rate for U.S. plans and a 2.17% weighted average discount rate for non-U.S. plans as of December 31, 2018) of vested and non-vested benefits earned from employee service to date, based upon current services and estimated future pay increases for active employees.

On an annual basis a full remeasurement of pension assets and pension liabilities is performed based on Grace’s estimates and actuarial valuations. These valuations reflect the terms of the plan and use participant-specific information as well as certain key assumptions provided by management.

Defined Contribution Retirement Plan Grace sponsors a defined contribution retirement plan for its employees in the United States. This plan is qualified under section 401(k) of the U.S. tax code. Currently, Grace contributes an amount equal to 100% of employee contributions, up to 6% of an individual employee’s salary or wages. Grace’s cost related to this benefit plan was \$12.6 million, \$11.5 million, and \$11.1 million for the years ended December 31, 2018, 2017, and 2016, respectively.

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

Analysis of Plan Accounting and Funded Status The following table summarizes the changes in benefit obligations and fair values of retirement plan assets during 2018 and 2017:

(In millions)	Defined Benefit Pension Plans					
	U.S.		Non-U.S.		Total	
	2018	2017	2018	2017	2018	2017
Change in Projected Benefit Obligation (PBO):						
Benefit obligation at beginning of year	\$1,325.6	\$1,274.2	\$323.1	\$269.1	\$1,648.7	\$1,543.3
Service cost	19.2	17.1	9.5	8.4	28.7	25.5
Interest cost	40.9	42.0	5.0	4.4	45.9	46.4
Settlements	(160.9)	—	—	—	(160.9)	—
Acquisitions	—	—	0.6	0.4	0.6	0.4
Actuarial (gain) loss	(102.6)	88.3	(11.9)	13.4	(114.5)	101.7
Benefits paid	(95.1)	(91.2)	(8.4)	(7.8)	(103.5)	(99.0)
Currency exchange translation adjustments	—	—	(12.3)	35.2	(12.3)	35.2
Other	—	(4.8)	—	—	—	(4.8)
Benefit obligation at end of year	\$1,027.1	\$1,325.6	\$305.6	\$323.1	\$1,332.7	\$1,648.7
Change in Plan Assets:						
Fair value of plan assets at beginning of year	\$1,109.8	\$1,086.4	\$21.5	\$18.2	\$1,131.3	\$1,104.6
Actual return on plan assets	(41.9)	112.7	(1.7)	1.6	(43.6)	114.3
Employer contributions	56.9	9.6	9.6	8.2	66.5	17.8
Settlements	(158.6)	—	—	—	(158.6)	—
Benefits paid	(95.1)	(91.2)	(8.4)	(7.8)	(103.5)	(99.0)
Currency exchange translation adjustments	—	—	(1.5)	1.3	(1.5)	1.3
Other	—	(7.7)	—	—	—	(7.7)
Fair value of plan assets at end of year	\$871.1	\$1,109.8	\$19.5	\$21.5	\$890.6	\$1,131.3
Funded status at end of year (PBO basis)	\$(156.0)	\$(215.8)	\$(286.1)	\$(301.6)	\$(442.1)	\$(517.4)
Amounts recognized in the Consolidated Balance Sheets consist of:						
Noncurrent assets	\$5.7	\$—	\$—	\$—	\$5.7	\$—
Current liabilities	(7.0)	(7.0)	(7.7)	(8.0)	(14.7)	(15.0)
Noncurrent liabilities	(154.7)	(208.8)	(278.4)	(293.6)	(433.1)	(502.4)
Net amount recognized	\$(156.0)	\$(215.8)	\$(286.1)	\$(301.6)	\$(442.1)	\$(517.4)
Amounts recognized in Accumulated Other Comprehensive (Income) Loss consist of:						
Prior service credit	\$(3.2)	\$(3.9)	\$(0.1)	\$(0.1)	\$(3.3)	\$(4.0)
Net amount recognized	\$(3.2)	\$(3.9)	\$(0.1)	\$(0.1)	\$(3.3)	\$(4.0)

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

(In millions)	Defined Benefit Pension Plans			
	U.S.		Non-U.S.	
	2018	2017	2018	2017
Weighted Average Assumptions Used to Determine Benefit Obligations as of December 31:				
Discount rate	4.22%	3.57%	2.17%	1.84%
Rate of compensation increase	4.10%	4.10%	2.59%	2.64%
Weighted Average Assumptions Used to Determine Net Periodic Benefit Cost for Years Ended December 31:				
Discount rate for determining service cost	3.77%	4.41%	1.99%	2.09%
Discount rate for determining interest cost	3.20%	3.42%	1.57%	1.69%
Expected return on plan assets	5.25%	5.50%	4.69%	4.69%
Rate of compensation increase	4.10%	4.10%	2.64%	3.09%

The following table presents the components of net periodic benefit cost (income) and other amounts recognized in “other comprehensive (income) loss.”

(In millions)	2018		2017		2016	
	U.S.	Non-U.S.	U.S.	Non-U.S.	U.S.	Non-U.S.
Net Periodic Benefit Cost (Income)						
Service cost	\$19.2	\$ 9.5	\$17.1	\$ 8.4	\$17.8	\$ 6.8
Interest cost	40.9	5.0	42.0	4.4	40.5	5.1
Expected return on plan assets	(57.2)	(1.0)	(57.5)	(0.9)	(56.7)	(1.0)
Amortization of prior service cost (credit)	(0.6)	—	(0.4)	—	(0.2)	—
Annual mark-to-market adjustment (gain) loss	(3.4)	(9.2)	36.0	13.2	23.3	40.1
Net curtailment and settlement gain	(2.3)	—	—	—	—	(1.0)
Net periodic benefit cost (income)	\$(3.4)	\$ 4.3	\$37.2	\$ 25.1	\$24.7	\$ 50.0
Other Changes in Plan Assets and Benefit Obligations Recognized in OCI						
Net prior service credit	\$—	\$ —	\$—	\$ —	\$(1.3)	\$ —
Amortization of prior service cost (credit)	0.6	—	0.4	—	0.2	—
Total recognized in OCI	0.6	—	0.4	—	(1.1)	—
Total recognized in net periodic benefit cost (income) and OCI	\$(2.8)	\$ 4.3	\$37.6	\$ 25.1	\$23.6	\$ 50.0

The estimated prior service credit for the defined benefit pension plans that will be amortized from “accumulated other comprehensive (income) loss” into net periodic benefit cost (income) over the next fiscal year is \$0.6 million.

Funded Status of U.S. Pension Plans (In millions)	Fully-Funded U.S. Qualified Pension Plans(1)		Underfunded U.S. Qualified Pension Plans(1)		Unfunded Pay-As-You-Go U.S. Nonqualified Plans(2)	
	2018	2017	2018	2017	2018	2017
	Projected benefit obligation	\$ 32.4	\$ —	\$897.6	\$1,217.1	\$97.1
Fair value of plan assets	38.1	—	833.0	1,109.8	—	—
Funded status (PBO basis)	\$ 5.7	\$ —	\$(64.6)	\$(107.3)	\$(97.1)	\$(108.5)

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

Funded Status of Non-U.S. Pension Plans (In millions)	Underfunded Non-U.S. Pension Plans(1)		Unfunded Pay-As-You-Go Non-U.S. Pension Plans(2)	
	2018	2017	2018	2017
Projected benefit obligation	\$22.7	\$24.7	\$282.9	\$298.4
Fair value of plan assets	19.5	21.5	—	—
Funded status (PBO basis)	\$(3.2)	\$(3.2)	\$(282.9)	\$(298.4)

(1) Plans intended to be advance-funded.

(2) Plans intended to be pay-as-you-go.

The accumulated benefit obligation for all defined benefit pension plans was approximately \$1,263 million and \$1,570 million as of December 31, 2018 and 2017, respectively.

The following table presents the funded status of defined benefit pension plans that are underfunded or unfunded on an accumulated benefit obligation basis.

(In millions)	U.S.		Non-U.S.		Total	
	2018	2017	2018	2017	2018	2017
Projected benefit obligation	\$994.8	\$1,325.6	\$284.5	\$298.4	\$1,279.3	\$1,624.0
Accumulated benefit obligation	960.1	1,286.0	253.2	263.6	1,213.3	1,549.6
Fair value of plan assets	833.0	1,109.8	0.7	—	833.7	1,109.8

Estimated Expected Future Benefit Payments Including Future Service for the Fiscal Years Ending
(In millions)

	Pension Plans		
	U.S. Benefit Payments	Non-U.S. Benefit Payments	(1) Total Payments
2019	\$72.1	\$ 8.5	\$ 80.6
2020	71.9	8.4	80.3
2021	71.9	8.6	80.5
2022	72.2	8.8	81.0
2023	71.7	9.1	80.8
2024 - 2028	349.9	50.0	399.9

(1) Non-U.S. estimated benefit payments for 2019 and future periods have been translated at the applicable December 31, 2018, exchange rates.

Discount Rate Assumption The assumed discount rate for pension plans reflects the market rates for high-quality corporate bonds currently available and is subject to change based on changes in overall market interest rates. For the U.S. qualified pension plans, the assumed weighted average discount rate of 4.22% as of December 31, 2018, was selected by Grace, in consultation with its independent actuaries, based on a yield curve constructed from a portfolio of high quality bonds for which the timing and amount of cash outflows approximate the estimated payouts of the plan.

As of December 31, 2018 and 2017, the German pension plans represented approximately 92% and 91%, respectively, of the benefit obligation of the non-U.S. pension plans. The assumed weighted average discount rate as of December 31, 2018, for Germany (2.05%) was selected by Grace, in consultation with its independent actuaries, based on a yield curve constructed from a portfolio of euro-denominated high quality bonds for which the timing and

amount of cash outflows approximate the estimated payouts of the plans. The assumed discount rates for the remaining non-U.S. pension plans were determined based on the nature of the liabilities, local economic environments and available bond indices.

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

Investment Guidelines for Advance-Funded Pension Plans The investment goal for the U.S. qualified pension plans subject to advance funding is to earn a long-term rate of return consistent with the related cash flow profile of the underlying benefit obligation. The plans are pursuing a well-defined risk management strategy designed to reduce investment risks as their funded status improves.

The U.S. qualified pension plans have adopted a diversified set of portfolio management strategies to optimize the risk reward profile of the plans:

- **Liability hedging portfolio:** primarily invested in intermediate-term and long-term investment grade corporate bonds in actively managed strategies.

- **Return-seeking portfolio:** invested in a diversified set of assets designed to deliver performance in excess of the underlying liabilities with controls regarding the level of risk.

- **U.S. equity securities:** the portfolio contains domestic equities that are passively managed to the S&P 500 and Russell 2000 benchmarks and an allocation to an active portfolio benchmarked to the Russell Mid-Cap and Russell 2000 indices.

- **Non-U.S. equity securities:** the portfolio contains non-U.S. equities in an actively managed strategy benchmarked to the MSCI ACWI ex US index. Currency futures and forward contracts may be held for the sole purpose of hedging existing currency risk in the portfolio.

- **Other investments:** may include (a) high yield bonds: fixed income portfolio of securities below investment grade including up to 30% of the portfolio in non-U.S. issuers; and (b) global real estate securities: portfolio of diversified REIT and other liquid real estate related securities. These portfolios combine income generation and capital appreciation opportunities from developed markets globally.

- **Liquidity portfolio:** invested in short-term assets intended to pay periodic plan benefits and expenses.

For 2018, the expected long-term rate of return on assets for the U.S. qualified pension plans was 5.25%. Average annual returns over one-, three-, five-, and ten-year periods were approximately (3)%, 6%, 5%, and 8%, respectively. The expected return on plan assets for the U.S. qualified pension plans for 2018 was selected by Grace, in consultation with its independent actuaries, using an expected return model. The model determines the weighted average return for an investment portfolio based on the target asset allocation and expected future returns for each asset class, which were developed using a building block approach based on observable inflation, available interest rate information, current market characteristics, and historical results.

The target allocation of investment assets at December 31, 2018, and the actual allocation at December 31, 2018 and 2017, for Grace's U.S. qualified pension plans are as follows:

U.S. Qualified Pension Plans Asset Category	Target Allocation	Percentage of Plan Assets			
		December 31, 2018		December 31, 2017	
U.S. equity securities	9 %	8 %	11 %		
Non-U.S. equity securities	4 %	4 %	5 %		
Short-term debt securities	4 %	4 %	10 %		
Intermediate-term debt securities	36 %	36 %	32 %		
Long-term debt securities	45 %	46 %	40 %		
Other investments	2 %	2 %	2 %		
Total	100 %	100 %	100 %		

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

The following tables present the fair value hierarchy for the U.S. qualified pension plan assets measured at fair value as of December 31, 2018 and 2017.

(In millions)	Fair Value Measurements at December 31, 2018, Using				
	Total	Quoted Prices in Active Markets for Identical Assets or Liabilities (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	
Common/collective trust funds	\$10.5	\$	—\$ 10.5	\$	—
Annuity and immediate participation contracts	19.8	—	19.8	—	—
	\$30.3	\$	—\$ 30.3	\$	—
Investments measured at net asset value(1)	840.8				
Total Assets at Fair Value	\$871.1				

(1) In accordance with ASC 820-10, certain investments that are measured at net asset value (“NAV”) per share (or its equivalent) have not been classified in the fair value hierarchy. NAV is provided by the investment account manager as a practical expedient to estimate fair value. Fair values presented in the table are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the Consolidated Balance Sheets.

(In millions)	Fair Value Measurements at December 31, 2017, Using				
	Total	Quoted Prices in Active Markets for Identical Assets or Liabilities (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	
Common/collective trust funds	\$10.2	\$	—\$ 10.2	\$	—
Annuity and immediate participation contracts	19.0	—	19.0	—	—
	\$29.2	\$	—\$ 29.2	\$	—
Investments measured at net asset value(1)	1,080.6				
Total Assets at Fair Value	\$1,109.8				

(1) In accordance with ASC 820-10, certain investments that are measured at NAV per share (or its equivalent) have not been classified in the fair value hierarchy. NAV is provided by the investment account manager as a practical expedient to estimate fair value. Fair values presented in the table are intended to permit reconciliation of the fair

value hierarchy to the amounts presented in the Consolidated Balance Sheets.

Non-U.S. pension plans accounted for approximately 2% of total global pension assets at December 31, 2018 and 2017. Each of these plans, where applicable, follows local requirements and regulations. Some of the local requirements include the establishment of a local pension committee, a formal statement of investment policy and procedures, and routine valuations by plan actuaries.

The target allocation of investment assets for non-U.S. pension plans varies depending on the investment goals of the individual plans. The plan assets of the Canadian pension plan represent approximately 96% and 97% of the total non-U.S. pension plan assets at December 31, 2018 and 2017, respectively. The expected long-term rate of return on assets for the Canadian pension plan was 4.75% for 2018.

The target allocation of investment assets at December 31, 2018, and the actual allocation at December 31, 2018 and 2017, for the Canadian pension plan are as follows:

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

Canadian Pension Plan Asset Category	Target Allocation		Percentage of Plan Assets	
	2018		2018	2017
Equity securities	27	%	28	% 28
Bonds	58	%	58	% 58
Other investments	15	%	14	% 14
Total	100	%	100	% 100

The plan assets of the other country plans represent approximately 4% and 3% in the aggregate of total non-U.S. pension plan assets at December 31, 2018 and 2017, respectively.

The following table presents the fair value hierarchy for the non-U.S. pension plan assets measured at fair value as of December 31, 2018 and 2017.

(In millions)	Fair Value Measurements at December 31, 2018, Using			
	Total	Quoted Prices in Active Markets for Identical Assets or Liabilities (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Corporate bonds	\$0.4	\$ —	\$ 0.4	\$ —
Insurance contracts and other investments	0.4	—	0.4	—
Cash	0.1	0.1	—	—
	\$0.9	\$ 0.1	\$ 0.8	\$ —
Investments measured at net asset value(1)	18.6			
Total Assets at Fair Value	\$19.5			

(1) In accordance with ASC 820-10, certain investments that are measured at NAV per share (or its equivalent) have not been classified in the fair value hierarchy. NAV is provided by the investment account manager as a practical expedient to estimate fair value. Fair values presented in the table are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the Consolidated Balance Sheets.

(In millions)	Fair Value Measurements at December 31, 2017, Using			
	Total	Quoted Prices in Active Markets for Identical Assets or	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)

		Liabilities (Level 1)			
Corporate bonds	\$0.4	\$	—\$ 0.4	\$	—
Insurance contracts and other investments	0.3	—	0.3	—	
	\$0.7	\$	—\$ 0.7	\$	—
Investments measured at net asset value(1)	20.8				
Total Assets at Fair Value	\$21.5				

In accordance with ASC 820-10, certain investments that are measured at NAV per share (or its equivalent) have not been classified in the fair value hierarchy. NAV is provided by the investment account manager as a practical expedient to estimate fair value. Fair values presented in the table are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the Consolidated Balance Sheets.

(1) Plan Contributions and Funding Grace intends to satisfy its funding obligations under the U.S. qualified pension plans and to comply with all of the requirements of the Employee Retirement Income Security Act of 1974 (“ERISA”). For ERISA purposes, funded status is calculated on a different basis than under U.S. GAAP. Based on

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Notes to Consolidated Financial Statements (Continued)

8. Pension Plans and Other Retirement Plans (Continued)

the U.S. qualified pension plans' status as of December 31, 2018, there is a \$0.1 million minimum required payment under ERISA for 2019.

Grace intends to fund non-U.S. pension plans based on applicable legal requirements and actuarial and trustee recommendations. Grace expects to contribute approximately \$9 million to its non-U.S. pension plans in 2019.

9. Other Balance Sheet Accounts

(In millions)	December 31,	
	2018	2017
Other Current Liabilities		
Accrued compensation	\$62.4	\$60.7
Deferred revenue (see Note 17)	40.6	19.5
Environmental contingencies (see Note 10)	19.5	23.5
Pension liabilities (see Note 8)	14.7	15.0
Accrued interest (see Note 5)	13.3	16.5
Income taxes payable (see Note 7)	11.3	12.2
Other accrued liabilities	81.7	70.4
	\$243.5	\$217.8

Accrued compensation includes salaries and wages as well as estimated current amounts due under the annual and long-term incentive programs.

(In millions)	December 31,	
	2018	2017
Other Liabilities		
Environmental contingencies (see Note 10)	\$106.9	\$46.8
Liability to unconsolidated affiliate (see Note 19)	98.8	32.7
Fair value of currency and interest rate contracts (see Note 6)	32.6	22.7
Deferred revenue (see Note 17)	29.2	14.9
Deferred income taxes (see Note 7)	10.9	8.2
Asset retirement obligation	8.8	10.4
Postemployment liability	4.7	5.2
Other noncurrent liabilities	27.9	28.4
	\$319.8	\$169.3

10. Commitments and Contingent Liabilities

Legacy Liabilities

Over the years, Grace operated numerous types of businesses that are no longer part of its ongoing operations. As Grace divested or otherwise ceased operating these businesses, it retained certain liabilities and obligations, which Grace refers to as legacy liabilities. These liabilities include product, environmental, and other liabilities. Although the outcome of each of the matters discussed below cannot be predicted with certainty, Grace has assessed its risk and has made accounting estimates as required under U.S. GAAP.

Legacy Product Liabilities Grace emerged from an asbestos-related Chapter 11 bankruptcy on February 3, 2014 (the "Effective Date"). Under its plan of reorganization, all pending and future asbestos-related

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Notes to Consolidated Financial Statements (Continued)

10. Commitments and Contingent Liabilities (Continued)

claims are channeled for resolution to either a personal injury trust (the “PI Trust”) or a property damage trust (the “PD Trust”). The trusts are the sole recourse for holders of asbestos-related claims. The channeling injunctions issued by the bankruptcy court prohibit holders of asbestos-related claims from asserting such claims directly against Grace.

Grace has satisfied all of its financial obligations to the PI Trust. Grace has contingent financial obligations remaining to the PD Trust. With respect to property damage claims related to Grace’s former Zonolite attic insulation product installed in the U.S. (“ZAI PD Claims”), the PD Trust was funded with \$34.4 million on the Effective Date and \$30.0 million on February 3, 2017. Grace is also obligated to make up to 10 contingent deferred payments of \$8 million per year to the PD Trust in respect of ZAI PD Claims during the 20-year period beginning on the fifth anniversary of the Effective Date, with each such payment due only if the assets of the PD Trust in respect of ZAI PD Claims fall below \$10 million during the preceding year. As of December 31, 2018, Grace has evaluated the activity in the PD Trust with respect to ZAI PD Claims and other trust expenses. Through December 31, 2018, the PD Trust has paid approximately \$15 million in ZAI PD Claims, approximately \$6 million in operating and education expenses, and approximately \$15 million in one-time attorneys’ fees. The PD Trust balance was approximately \$30 million as of December 31, 2018. Grace expects ZAI PD Claims payments to decline over time but has limited information to estimate the amount and timing of future claims payments. It is reasonably possible that one or more contingent deferred payments will be made in the future. Grace estimates the present value of reasonably possible future payments to range between \$0 million and \$20 million. Grace has not accrued for any contingent deferred payments as it does not believe that payment is probable. Grace will continue to evaluate new information as it becomes available and will revise its estimate of the amount and timing of future claims payments and any contingent deferred payments at that time. Grace is not obligated to make additional payments to the PD Trust in respect of ZAI PD Claims beyond the payments described above. Grace has satisfied all of its financial obligations with respect to Canadian ZAI PD Claims.

With respect to other asbestos property damage claims (“Other PD Claims”), claims unresolved as of the Effective Date are to be litigated in the bankruptcy court and any future claims are to be litigated in a federal district court, in each case pursuant to procedures approved by the bankruptcy court. To the extent any such Other PD Claims are determined to be allowed claims, they are to be paid in cash by the PD Trust. Grace is obligated to make a payment to the PD Trust every six months in the amount of any Other PD Claims allowed during the preceding six months plus interest (if applicable) and the amount of PD Trust expenses for the preceding six months (the “PD Obligation”). Grace has not paid any Other PD Claims since emergence. Annual expenses have been approximately \$0.2 million per year. The aggregate amount to be paid under the PD Obligation is not capped, and Grace may be obligated to make additional payments to the PD Trust in respect of the PD Obligation. Grace has accrued for those unresolved Other PD Claims that it believes are probable and estimable. Grace has not accrued for other unresolved or unasserted Other PD Claims as it does not believe that payment is probable.

All payments to the PD Trust required after the Effective Date are secured by the Company’s obligation to issue 77,372,257 shares of Company common stock to the PD Trust in the event of default, subject to customary anti-dilution provisions.

This summary of the commitments and contingencies related to the Chapter 11 proceeding does not purport to be complete and is qualified in its entirety by reference to the plan of reorganization and the exhibits and documents related thereto, which have been filed with the SEC and are readily available on the internet at www.sec.gov.

Legacy Environmental Liabilities Grace is subject to loss contingencies resulting from extensive and evolving federal, state, local and foreign environmental laws and regulations relating to its manufacturing operations. Grace has procedures in place to minimize such contingencies; nevertheless, it has liabilities associated with past operations and additional claims may arise in the future. To address its legacy liabilities, Grace accrues for anticipated costs of

response efforts where an assessment has indicated that a probable liability has been incurred and the cost can be reasonably estimated. These accruals do not take into account any discounting for the time value of money.

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Notes to Consolidated Financial Statements (Continued)

10. Commitments and Contingent Liabilities (Continued)

Grace's environmental liabilities are reassessed regularly and adjusted when circumstances become better defined or response efforts and their costs can be better estimated, typically as a matter moves through the life-cycle of environmental investigation and remediation. These liabilities are evaluated based on currently available information relating to the nature and extent of contamination, risk assessments, feasibility of response actions, and apportionment amongst other potentially responsible parties, all evaluated in light of prior experience.

At December 31, 2018, Grace's estimated liability for legacy environmental response costs totaled \$126.4 million, compared with \$70.3 million at December 31, 2017, and was included in "other current liabilities" and "other liabilities" in the Consolidated Balance Sheets. These amounts are based on agreements in place or on Grace's estimate of costs where no formal remediation plan exists, yet there is sufficient information to estimate response costs.

Grace recorded pre-tax charges of \$73.8 million, \$24.4 million, and \$29.2 million for legacy environmental matters in 2018, 2017, and 2016, respectively, which is included in "provision for environmental remediation" in the Consolidated Statements of Operations.

Vermiculite-Related Matters

Grace purchased a vermiculite mine in Libby, Montana, in 1963 and operated it until 1990. Vermiculite concentrate from the Libby mine was used in the manufacture of attic insulation and other products. Some of the vermiculite ore contained naturally occurring asbestos.

Grace is engaged with the U.S. Environmental Protection Agency (the "EPA") and other federal, state and local governmental agencies in a remedial investigation and feasibility study ("RI/FS") of the Libby mine and the surrounding area, known as Operable Unit 3 ("OU3"). The RI/FS will determine the specific areas within OU3 requiring remediation and will identify possible remedial action alternatives. Possible remedial actions within OU3 are wide-ranging, from institutional controls such as land use restrictions, to more active measures involving soil removal, containment projects, or other protective measures.

Grace accrued \$70.2 million, \$9.5 million, and \$24.8 million in 2018, 2017, and 2016, respectively, for future costs related to vermiculite-related matters.

As part of the RI/FS process, Grace contracted an engineering and consulting firm to develop a range of possible remedial alternatives and associated cost estimates for OU3. Based on this work, Grace recorded a pre-tax charge of \$70.0 million in the 2018 third quarter for the estimated costs of remediation of OU3. Grace believes that this amount should provide for a protective remedy meeting the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act.

The estimated costs of remediation are preliminary and consist of several components, each of which may vary significantly as the remedial alternatives are further developed. It is reasonably possible that the ultimate costs of remediation could range between \$30 million and \$170 million. Grace is working closely with the EPA, and the ultimate remedy will be determined by the EPA after the RI/FS is finalized. Such remedy will be set forth in a Record of Decision ("ROD") that is expected to be issued by the EPA during or after 2020. Costs associated with the more active remedial alternatives would be expected to be incurred over a decade or more. Grace will reevaluate its estimated liability as remedial alternatives evolve based on further work by the engineering and consulting firm and discussions with the EPA as the RI/FS process moves toward a ROD. Depending on the remedial alternatives that the EPA selects in the ROD, the total cost of remediating OU3 may exceed Grace's current estimate by material amounts. The EPA is also investigating or remediating formerly owned or operated sites that processed Libby vermiculite into finished products. Grace is cooperating with the EPA on these investigation and remediation activities and has recorded a liability to the extent that its review has indicated that a probable liability has been incurred and the cost is estimable. These liabilities cover the estimated cost of investigations and, to the extent an assessment has indicated that remediation is necessary, the estimated cost of response actions. Response actions typically involve soil

excavation and removal, and replacement with clean fill. The EPA may commence additional investigations in the future at other sites that processed Libby vermiculite, but Grace does not believe,

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Notes to Consolidated Financial Statements (Continued)

10. Commitments and Contingent Liabilities (Continued)

based on its knowledge of prior and current operations and site conditions, that liability for remediation at such other sites is probable.

Grace's total estimated liability for response costs that are currently estimable for the Libby mine and surrounding area, and at vermiculite processing sites outside of Libby at December 31, 2018 and 2017, was \$81.7 million and \$25.8 million, respectively. It is possible that Grace's ultimate liability for these vermiculite-related matters will exceed current estimates by material amounts.

Non-Vermiculite-Related Environmental Matters

During 2018, Grace accrued \$3.6 million to increase non-vermiculite environmental reserves. During 2017, Grace accrued \$14.9 million to increase non-vermiculite environmental reserves, including \$7.2 million for ten years of operation and maintenance expenses following remediation at a former manufacturing site. At December 31, 2018 and 2017, Grace's estimated legacy environmental liability for response costs at sites not related to its former vermiculite mining and processing activities was \$44.7 million and \$44.5 million, respectively. This liability relates to Grace's former businesses or operations, including its share of liability at off-site disposal facilities. Grace's estimated liability is based upon regulatory requirements and environmental conditions at each site. As Grace receives new information, its estimated liability may change materially.

Other Legacy Liabilities As part of the process for renewing Grace's permit for a dam on the Libby mine site, which expires in March 2019, the Montana Department of Natural Resources and Conservation is expected to require Grace to replace the dam spillway, which is deteriorating, with a new spillway. Grace constructed the dam in 1971 to prevent vermiculite ore tailings from moving into nearby creeks and rivers. Based on information provided by third-party consultants, the cost of the new spillway is estimated to be between \$40 million and \$45 million. Grace expects to record a liability for this project at the time the permit renewal is approved. Grace anticipates that approval of the renewal of such permit will occur in the first quarter of 2019. Construction of the new spillway is expected to take three to four years.

Commercial and Financial Commitments and Contingencies

Purchase Commitments Grace uses purchase commitments to ensure supply and to minimize the volatility of major components of direct manufacturing costs including natural gas, certain metals, rare earths, and other materials. Such commitments are for quantities that Grace fully expects to use in its normal operations.

Guarantees and Indemnification Obligations Grace is a party to many contracts containing guarantees and indemnification obligations. These contracts primarily consist of:

- Product warranties with respect to certain products sold to customers in the ordinary course of business. These warranties typically provide that products will conform to specifications. Grace accrues a warranty liability on a transaction-specific basis depending on the individual facts and circumstances related to each sale.

- Performance guarantees offered to customers under certain licensing arrangements. Grace has not established a liability for these arrangements based on past performance.

- Licenses of intellectual property by Grace to third parties in which Grace has agreed to indemnify the licensee against third party infringement claims.

- Contracts providing for the sale or spin-off of a former business unit or product line in which Grace has agreed to indemnify the buyer or resulting entity against certain liabilities related to activities prior to the closing of the transaction, including environmental, tax, and employee liabilities.

- Guarantees of real property lease obligations of third parties, typically arising out of (a) leases entered into by former subsidiaries of Grace, or (b) the assignment or sublease of a lease by Grace to a third party.

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Notes to Consolidated Financial Statements (Continued)

10. Commitments and Contingent Liabilities (Continued)

Financial Assurances Financial assurances have been established for a variety of purposes, including insurance and environmental matters, trade-related commitments and other matters. At December 31, 2018, Grace had gross financial assurances issued and outstanding of \$145.5 million, composed of \$68.7 million of surety bonds issued by various insurance companies and \$76.8 million of standby letters of credit and other financial assurances issued by various banks.

11. Restructuring Expenses and Repositioning Expenses

Restructuring Expenses Restructuring expenses in 2018 primarily related to the closure of two smaller manufacturing plants, the activities from which have been moved to larger, more cost-effective plants as part of our strategy to capture synergies from our recent catalysts acquisitions. Expenses in 2017 primarily related to workforce reduction programs in Grace's manufacturing, supply chain, finance and IT functions. Expenses in 2016 primarily related to the exit of certain non-strategic product lines in Materials Technologies.

The following table presents restructuring expenses by reportable segment for the years ended December 31, 2018, 2017, and 2016.

(In millions)	Year Ended		
	December 31,		
	2018	2017	2016
Catalysts Technologies	\$13.7	\$3.7	\$3.4
Materials Technologies	0.5	(0.1)	15.1
Corporate	(0.2)	7.9	5.8
Total restructuring expenses	\$14.0	\$11.5	\$24.3

These costs are not included in segment operating income. Substantially all costs related to the restructuring programs are expected to be paid by December 31, 2021, but could be paid earlier subject to negotiations around certain plant exit costs.

The following table presents components of the change in the restructuring liability for the years ended December 31, 2018, 2017, and 2016:

(In millions)	Total
Balance, December 31, 2015	\$7.6
Accruals for severance and other costs	17.8
Payments	(16.0)
Currency translation adjustments and other	0.2
Balance, December 31, 2016	\$9.6
Accruals for severance and other costs	11.4
Payments	(14.4)
Currency translation adjustments and other	0.1
Balance, December 31, 2017	\$6.7
Accruals for severance and other costs	10.1
Payments	(6.1)
Balance, December 31, 2018	\$10.7

Repositioning Expenses Repositioning expenses included in continuing operations for the years ended December 31, 2018, 2017, and 2016 were \$32.4 million, \$15.2 million, and \$14.3 million respectively.

Expenses incurred in 2018 primarily include \$13.7 million for a multi-year program to transform Grace's manufacturing and business processes to extend its competitive advantages and improve its cost position, \$11.7 million of severance and stock compensation costs related to employee separations, and write-offs of \$8.5 million

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Notes to Consolidated Financial Statements (Continued)

11. Restructuring Expenses and Repositioning Expenses (Continued)

of previously capitalized plant engineering costs as a result of terminating an expansion project no longer necessary due to the polyolefin catalysts acquisition (see Note 20). Expenses incurred in 2017 primarily related to third-party costs associated with productivity and transformation initiatives, as well as costs related to the Separation. Expenses incurred in 2016 primarily related to the Separation. Excluding asset write-offs and stock compensation costs, substantially all of these costs have been or are expected to be settled in cash by December 31, 2019.

12. Other (Income) Expense, net

Components of other (income) expense, net are as follows:

(In millions)	Year Ended		
	December 31,		
	2018	2017	2016
Defined benefit pension (income) expense other than service cost	\$(27.8)	\$38.6	\$48.0
Third-party acquisition-related costs	7.3	2.9	2.5
Loss on early extinguishment of debt	4.8	—	11.1
Currency transaction effects	(4.0)	5.0	(1.0)
Net (gain) loss on sales of investments and disposals of assets	2.6	1.6	(1.4)
Chapter 11 expenses, net	2.6	1.4	3.4
Business interruption insurance recoveries	—	(26.6)	—
Accounts receivable reserve—Venezuela	—	10.0	—
Other miscellaneous expense (income)	(2.0)	(2.7)	(1.2)
Total other (income) expense, net	\$(16.5)	\$30.2	\$61.4

In January 2017, a Catalysts Technologies customer experienced an explosion and fire resulting in an extended outage. Grace received \$25.0 million in payments from its third-party insurer in 2017 under its business interruption insurance policy for profits lost as a result of the outage. The policy has a \$25 million limit per event.

During the 2017 third quarter, Grace recorded a \$10.0 million charge to fully reserve for a trade receivable from a Venezuela-based customer related to increased economic uncertainty and the recent political unrest and sanctions.

See Note 5 for more information related to Grace's early extinguishments of debt in 2018 and 2016.

13. Other Comprehensive Income (Loss)

The following tables present the pre-tax, tax, and after-tax components of Grace's other comprehensive income (loss) for the years ended December 31, 2018, 2017, and 2016:

Year Ended December 31, 2018 (In millions)	Pre-Tax Amount	Tax Benefit/ (Expense)	After-Tax Amount
Defined benefit pension and other postretirement plans:			
Amortization of net prior service credit included in net periodic benefit cost	\$ (1.6)	\$ 0.4	\$ (1.2)
Amortization of net deferred actuarial loss included in net periodic benefit cost	0.4	(0.1)	0.3
Benefit plans, net	(1.2)	0.3	(0.9)
Currency translation adjustments	34.6	(2.2)	32.4
Gain (loss) from hedging activities	(10.0)	4.3	(5.7)
Other comprehensive income (loss) attributable to W. R. Grace & Co. shareholders	\$ 23.4	\$ 2.4	\$ 25.8

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Notes to Consolidated Financial Statements (Continued)

13. Other Comprehensive Income (Loss) (Continued)

Year Ended December 31, 2017 (In millions)	Pre-Tax Amount	Tax Benefit/ (Expense)	After-Tax Amount
Defined benefit pension and other postretirement plans:			
Amortization of net prior service credit included in net periodic benefit cost	\$ (2.3)	\$ 0.8	\$ (1.5)
Amortization of net deferred actuarial loss included in net periodic benefit cost	0.4	(0.1)	0.3
Net deferred actuarial gain (loss) arising during period	(0.1)	—	(0.1)
Benefit plans, net	(2.0)	0.7	(1.3)
Currency translation adjustments	(23.1)	(2.9)	(26.0)
Gain (loss) from hedging activities	2.9	(2.1)	0.8
Other comprehensive income (loss) attributable to W. R. Grace & Co. shareholders	\$ (22.2)	\$ (4.3)	\$ (26.5)
Year Ended December 31, 2016 (In millions)	Pre-Tax Amount	Tax Benefit/ (Expense)	After-Tax Amount
Defined benefit pension and other postretirement plans:			
Amortization of net prior service credit included in net periodic benefit cost	\$ (2.4)	\$ 0.9	\$ (1.5)
Amortization of net deferred actuarial loss included in net periodic benefit cost	0.5	(0.2)	0.3
Net prior service credit arising during period	1.4	(0.5)	0.9
Loss on curtailment of postretirement plans	(0.5)	0.2	(0.3)
Benefit plans, net	(1.0)	0.4	(0.6)
Currency translation adjustments	(1.8)	—	(1.8)
Gain (loss) from hedging activities	0.6	(0.3)	0.3
Other comprehensive income (loss) attributable to W. R. Grace & Co. shareholders	\$ (2.2)	\$ 0.1	\$ (2.1)

The following table presents the changes in accumulated other comprehensive income (loss), net of tax, for the years ended December 31, 2018, 2017, and 2016:

	Defined Benefit Pension and Other Postretirement Plans	Currency Translation Adjustments	Gain (Loss) from Hedging Activities	Total
Balance, December 31, 2015	\$ 3.0	\$ (66.1)	\$ (3.7)	\$ (66.8)
OCI before reclassifications	0.9	(1.8)	(1.8)	(2.7)
Amounts reclassified from accumulated OCI	(1.5)	—	2.1	0.6
Net current-period other comprehensive income (loss)	(0.6)	(1.8)	0.3	(2.1)
Distribution of GCP	(0.2)	135.5	—	135.3
Balance, December 31, 2016	\$ 2.2	\$ 67.6	\$ (3.4)	\$ 66.4
OCI before reclassifications	(0.1)	(26.0)	(2.7)	(28.8)
Amounts reclassified from accumulated OCI	(1.2)	—	3.5	2.3
Net current-period other comprehensive income (loss)	(1.3)	(26.0)	0.8	(26.5)
Balance, December 31, 2017	\$ 0.9	\$ 41.6	\$ (2.6)	\$ 39.9
OCI before reclassifications	—	32.4	11.1	43.5
Amounts reclassified from accumulated OCI	(0.9)	—	(16.8)	(17.7)

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Net current-period other comprehensive income (loss)	(0.9)	32.4	(5.7)	25.8
Effect of adopting ASU 2018-02	0.2		2.2	(0.2)	2.2
Balance, December 31, 2018	\$ 0.2		\$ 76.2	\$ (8.5)	\$67.9

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Notes to Consolidated Financial Statements (Continued)

13. Other Comprehensive Income (Loss) (Continued)

Grace is a global enterprise operating in many countries with local currency generally deemed to be the functional currency for accounting purposes. The currency translation amount represents the adjustments necessary to translate the balance sheets valued in local currencies to the U.S. dollar as of the end of each period presented, and to translate revenues and expenses at average exchange rates for each period presented.

See Note 6 for a discussion of hedging activities. See Note 8 for a discussion of pension plans.

14. Shareholders' Equity

Under its Amended and Restated Certificate of Incorporation, the Company is authorized to issue 300,000,000 shares of common stock, \$0.01 par value per share. As of December 31, 2018, the W. R. Grace & Co. 2018 Stock Incentive Plan (together with the 2014 Stock Incentive Plan, collectively, the "Stock Incentive Plans") had 7,455,144 shares of unissued stock reserved for issuance in the event of the exercise of stock options or the issuance or settlement of stock-based compensation or awards. Shares issuable upon the exercise of stock options or the issuance or settlement of stock-based compensation or awards are covered by reissuing treasury stock, to the extent available; otherwise they are covered through newly issued shares. For the years ended December 31, 2018, 2017, and 2016, 243,502, 386,300, and 745,938 stock options were exercised for aggregate proceeds of \$6.7 million, \$16.4 million, and \$17.0 million, respectively. Additionally in 2018, 10,346 common shares were issued to members of the Board of Directors, in partial payment of their annual retainer; 7,719 shares were issued through net share settlement; and 54,525 shares were issued to settle vested tranches of Restricted Stock Units (RSUs).

The following table sets forth information relating to common stock activity for the years ended December 31, 2018, 2017, and 2016:

Balance of outstanding shares, December 31, 2015	70,533,515
Stock options exercised	745,938
Shares issued	110,953
Shares forfeited	(305,678)
Shares repurchased	(2,775,297)
Balance of outstanding shares, December 31, 2016	68,309,431
Stock options exercised	386,300
Shares issued	49,897
Shares forfeited through net share exercise	(29,783)
Shares repurchased	(935,435)
Balance of outstanding shares, December 31, 2017	67,780,410
Stock options exercised	243,502
Shares issued	72,590
Shares forfeited through net share exercise	(132,393)
Shares repurchased	(1,171,141)
Balance of outstanding shares, December 31, 2018	66,792,968

15. Stock Incentive Plans

The Company has granted nonstatutory stock options to certain key employees under the Stock Incentive Plans. The Stock Incentive Plans are administered by the Compensation Committee of the Board of Directors. Stock options are generally non-qualified and are at exercise prices not less than 100% of the average per share fair market value on the date of grant. Stock-based compensation awards granted under the Company's stock incentive plans are generally subject to a vesting period from the date of the grant ranging from 1 - 3 years. Currently outstanding options expire on various dates through November 2028.

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Notes to Consolidated Financial Statements (Continued)

15. Stock Incentive Plans (Continued)

On May 9, 2018, the Company's stockholders approved the W. R. Grace & Co. 2018 Stock Incentive Plan. Under this new plan, stock options have a 10 year life. The Company began issuing stock-based compensation awards from this plan in the second half of 2018. The Company's annual grant made in February 2018 was issued under the previous plan in which options have a 5 year life.

Previously outstanding stock-based compensation awards granted under equity compensation programs prior to the Separation and held by certain executives and employees were adjusted in 2016 to reflect the impact of the Separation on these awards. To preserve the aggregate intrinsic value of awards held prior to the Separation, as measured immediately before and immediately after the Separation, each holder of stock-based compensation awards generally received an adjusted award consisting of either (i) both a stock-based compensation award denominated in Company equity as it existed subsequent to the Separation and a stock-based compensation award denominated in GCP equity or (ii) solely a stock-based compensation award denominated in Company equity. In the Separation, the determination as to which type of adjustment applied to a holder's previously outstanding award was based upon the date on which the award was originally granted under the equity compensation programs prior to the Separation. The adjustment of the original awards resulted in \$0.6 million of incremental compensation cost in 2016.

The following table sets forth information relating to such options during 2018, 2017, and 2016.

Stock Option Activity	Number Of Shares	Average Exercise Price	Weighted- Average Grant Date Fair Value
Balance, December 31, 2015	2,320,687	\$ 71.01	
Options exercised	(745,938)	36.97	
Options forfeited	(9,458)	73.40	
Options terminated	(2,426)	67.06	
Options granted	377,920	68.32	\$ 12.90
Balance, December 31, 2016	1,940,785	66.83	
Options exercised	(386,300)	45.21	
Options forfeited	(34,545)	72.97	
Options terminated	(23,320)	75.60	
Options granted	316,830	71.37	13.00
Balance, December 31, 2017	1,813,450	72.04	
Options exercised	(243,502)	61.92	
Options forfeited	(90,862)	69.82	
Options terminated	(33,481)	75.07	
Options granted	428,190	67.36	12.30
Balance, December 31, 2018	1,873,795	72.34	

The following is a summary of nonvested option activity for the year ended December 31, 2018.

Stock Option Activity	Number Of Shares	Weighted- Average Grant Date Fair Value
Nonvested options outstanding at beginning of year	719,027	\$ 15.47

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Granted	428,190	12.30
Vested	(358,511)	18.14
Forfeited	(124,343)	14.99
Nonvested options outstanding at end of year	664,363	12.88

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Notes to Consolidated Financial Statements (Continued)

15. Stock Incentive Plans (Continued)

As of December 31, 2018, the intrinsic value (the difference between the exercise price and the market price) for options outstanding was immaterial. The total intrinsic value of all options exercised during the years ended December 31, 2018, 2017 and 2016 was \$1.6 million, \$10.3 million and \$25.9 million, respectively. A summary of our stock options outstanding and exercisable at December 31, 2018, follows:

Exercise Price Range	Number Outstanding	Number Exercisable	Outstanding Weighted-Average Remaining Contractual Life (Years)	Exercisable Weighted-Average Exercise Price
\$60 - \$70	710,321	226,938	3.23	68.27
\$70 - \$80	1,139,369	958,389	1.46	75.72
\$80 - \$90	24,105	24,105	0.16	80.76
	1,873,795	1,209,432		

At December 31, 2018, the weighted-average remaining contractual term of all options outstanding and exercisable was 2.11 years.

Options Granted For the years ended December 31, 2018, 2017 and 2016, the Company recognized non-cash stock-based compensation expense with respect to stock option grants of \$5.8 million, \$4.3 million and \$6.0 million, respectively, which is included in “selling, general and administrative expenses” in the Consolidated Statements of Operations. The actual tax benefit realized from stock options exercised totaled \$2.2 million, \$7.4 million, and \$11.2 million for the years ended December 31, 2018, 2017 and 2016, respectively.

The Company values options using the Black-Scholes option-pricing model, which was developed for use in estimating the fair value of traded options. The risk-free rate is based on the U.S. Treasury yield curve published as of the grant date, with maturities approximating the expected term of the options. The expected term of the options is estimated using the simplified method as allowed by ASC 718-20, whereby the average between the vesting period and contractual term is used. For options granted prior to 2018, the expected volatility was estimated using both actual stock volatility and the volatility of an industry peer group. The Company believes its actual stock volatility was not representative of future volatility during the time it was in Chapter 11. For options granted in 2018, Grace actual stock volatility was used. The following summarizes the weighted average assumptions used for estimating the fair value of stock options granted during 2018, 2017 and 2016, respectively.

	2018	2017	2016
Expected volatility	22.9% - 24.4%	23.8% - 25.1%	26.2% - 27.5%
Weighted average expected volatility	23.7%	24.8%	26.6%
Expected term	3.00 - 6.50 years	3.00 - 4.00 years	3.00 - 4.00 years
Risk-free rate	2.55%	1.66%	1.01%
Dividend yield	1.4%	1.2%	1.0%

Total unrecognized stock-based compensation expense at December 31, 2018, was \$1.8 million, and the weighted-average period over which this expense will be recognized is 0.8 of a year.

Restricted Stock and Performance Based Units During 2018 the Company granted 86,698 RSUs and 93,216 PBUs under the Company’s Long-term Incentive Plan (“LTIP”). During 2017 the Company granted 57,600 RSUs and 115,158 PBUs under the LTIP. During 2016 the Company granted 77,358 RSUs and 124,952 PBUs under the LTIP. During 2018, 2017, and 2016, awards covering 44,279, 16,395, and 15,197 shares were forfeited, respectively. The PBUs cliff vest after the completion of the performance periods ending December 31, 2020, 2019, and 2018, and have a weighted average grant date fair value of \$67.39, \$71.37 and \$68.50, respectively. The RSUs vest in three equal annual

installments and have a weighted average grant date fair value of \$67.54, \$71.37, and \$68.90, respectively. Vesting for all awards is subject to continued employment through the payment

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Notes to Consolidated Financial Statements (Continued)

15. Stock Incentive Plans (Continued)

date (subject to certain exceptions for retirement, death or disability, change in control scenarios, and in the discretion of the Compensation Committee).

The Company anticipates that approximately 64% of the awards granted in 2018 will be settled in common stock and approximately 36% will be settled in cash, assuming full vesting. The Company anticipates that approximately 65% of the awards granted in 2017 will be settled in common stock and approximately 35% will be settled in cash, assuming full vesting. The Company anticipates that approximately 67% of the awards granted in 2016 will be settled in common stock and approximately 33% will be settled in cash, assuming full vesting.

PBUs and RSUs are recorded at fair value at the date of grant. The common stock settled portion is considered an equity award with the payout being valued based on the Company's stock price on the grant date. The cash settled portion of the award is considered a liability award with payout being remeasured each reporting period based on the Company's current stock price. PBU equity and cash awards are remeasured each reporting period based on the expected payout of the award, which may range from 0% to 200% of the targets for such awards; therefore, these portions of the awards are subject to volatility until the payout is finally determined at the end of the performance period. During 2018, 2017, and 2016, the Company recognized \$13.2 million, \$10.3 million, and \$8.6 million in compensation expense for these awards. As of December 31, 2018, \$9.5 million of total unrecognized compensation expense related to the awards is expected to be recognized over the remaining weighted-average service period of 1.5 years.

16. Earnings Per Share

The following table shows a reconciliation of the numerators and denominators used in calculating basic and diluted earnings per share.

(In millions, except per share amounts)	2018	2017	2016
Numerators			
Income (loss) from continuing operations attributable to W. R. Grace & Co. shareholders	\$ 167.6	\$ 11.2	\$ 107.0
Income (loss) from discontinued operations, net of income taxes	—	—	(12.9)
Net income (loss) attributable to W. R. Grace & Co. shareholders	\$ 167.6	\$ 11.2	\$ 94.1
Denominators			
Weighted average common shares—basic calculation	67.2	68.1	70.1
Dilutive effect of employee stock	0.1	0.1	0.4

options				
Weighted average common shares—diluted calculation	67.3		68.2	70.5
Basic earnings per share attributable to W. R. Grace & Co. shareholders				
Income (loss) from continuing operations	\$ 2.49	\$	0.16	\$ 1.53
Income (loss) from discontinued operations, net of income taxes	—	—		(0.19)
Net income (loss)	\$ 2.49	\$	0.16	\$ 1.34
Diluted earnings per share attributable to W. R. Grace & Co. shareholders				
Income (loss) from continuing operations	\$ 2.49	\$	0.16	\$ 1.52
Income (loss) from discontinued operations, net of income taxes	—	—		(0.19)
Net income (loss)	\$ 2.49	\$	0.16	\$ 1.33

There were approximately 1.7 million, 1.5 million and 1.3 million anti-dilutive options outstanding for the years ended December 31, 2018, 2017 and 2016, respectively.

On February 5, 2015, the Company announced that its Board of Directors had authorized a share repurchase program of up to \$500 million, which it completed on July 10, 2017. On February 8, 2017, the Company announced that its Board of Directors had authorized an additional share repurchase program of up to

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Notes to Consolidated Financial Statements (Continued)

16. Earnings Per Share (Continued)

\$250 million. The timing of the repurchases and the actual amount repurchased will depend on a variety of factors, including the market price of the Company's shares, the strategic deployment of capital, and general market and economic conditions. During 2018, 2017 and 2016, the Company repurchased 1,171,141; 935,435; and 2,775,297 shares of Company common stock for \$80.0 million, \$65.0 million and \$195.1 million, respectively, pursuant to the terms of the share repurchase programs. As of December 31, 2018, \$138.9 million remained under the current authorization.

17. Revenues

Grace generates revenues from customer arrangements primarily by manufacturing and delivering specialty chemicals and specialty materials through its two reportable segments. See Note 18 for additional information about Grace's reportable segments.

Disaggregation of Revenue The following tables present Grace's revenues by geography and product group, within its respective reportable segments, for the years ended December 31, 2018, 2017, and 2016.

Year Ended December 31, 2018 (In millions)	North America	Europe	Asia Pacific	Latin America	Total
		Middle East Africa (EMEA)			
Refining Catalysts	\$ 282.8	\$ 266.0	\$ 193.4	\$ 59.8	\$ 802.0
Polyolefin and Chemical Catalysts	192.6	255.4	193.2	20.3	661.5
Total Catalysts Technologies	\$ 475.4	\$ 521.4	\$ 386.6	\$ 80.1	\$ 1,463.5
Coatings	\$ 28.1	\$ 75.3	\$ 43.3	\$ 8.7	\$ 155.4
Consumer/Pharma	36.2	58.0	19.0	19.4	132.6
Chemical process	35.2	81.6	32.2	8.3	157.3
Other	6.8	15.9	0.4	0.2	23.3
Total Materials Technologies	\$ 106.3	\$ 230.8	\$ 94.9	\$ 36.6	\$ 468.6
Total Grace	\$ 581.7	\$ 752.2	\$ 481.5	\$ 116.7	\$ 1,932.1
Year Ended December 31, 2017 (In millions)	North America	EMEA	Asia Pacific	Latin America	Total
Refining Catalysts	\$ 269.5	\$ 236.4	\$ 199.3	\$ 52.9	\$ 758.1
Polyolefin and Chemical Catalysts	117.4	218.1	166.4	16.5	518.4
Total Catalysts Technologies	\$ 386.9	\$ 454.5	\$ 365.7	\$ 69.4	\$ 1,276.5
Coatings	\$ 26.0	\$ 66.9	\$ 41.3	\$ 8.0	\$ 142.2
Consumer/Pharma	38.2	48.3	17.8	19.0	123.3
Chemical process	28.5	83.7	34.8	6.5	153.5
Other	6.4	14.3	0.2	0.1	21.0
Total Materials Technologies	\$ 99.1	\$ 213.2	\$ 94.1	\$ 33.6	\$ 440.0
Total Grace(1)	\$ 486.0	\$ 667.7	\$ 459.8	\$ 103.0	\$ 1,716.5

(1) Under the modified retrospective method, prior-period information has not been adjusted and continues to be reported in accordance with Grace's historical accounting under ASC 605.

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Notes to Consolidated Financial Statements (Continued)

17. Revenues (Continued)

Year Ended December 31, 2016 (In millions)	North America	EMEA	Asia Pacific	Latin America	Total
Refining Catalysts	\$ 285.8	\$235.5	\$ 141.2	\$ 62.4	\$724.9
Polyolefin and Chemical Catalysts	100.4	203.3	119.9	15.2	438.8
Total Catalysts Technologies	\$ 386.2	\$438.8	\$261.1	\$ 77.6	\$1,163.7
Coatings	\$ 25.4	\$63.9	\$38.9	\$ 8.3	\$136.5
Consumer/Pharma	43.0	47.3	14.7	16.9	121.9
Chemical process	26.8	78.2	29.3	8.3	142.6
Other	9.3	19.6	4.9	0.1	33.9
Total Materials Technologies	\$ 104.5	\$209.0	\$87.8	\$ 33.6	\$434.9
Total Grace(1)	\$ 490.7	\$647.8	\$348.9	\$ 111.2	\$1,598.6

(1) Under the modified retrospective method, prior-period information has not been adjusted and continues to be reported in accordance with Grace's historical accounting under ASC 605.

Contract Balances Grace invoices customers for product sales once performance obligations have been satisfied, generally at the point of delivery, at which point payment becomes unconditional. Accordingly, Grace's product sales contracts generally do not give rise to material contract assets or liabilities under ASC 606; however, from time to time certain customers may pay in advance. In the technology licensing business, Grace invoices licensees based on milestones achieved but has obligations to provide services in future periods, which results in contract liabilities.

The following table presents Grace's deferred revenue balances as of December 31, 2018 and 2017:

	December 31,	
(In millions)	2018	2017
Current	\$ 40.6	\$ 19.5
Noncurrent	29.2	14.9
Total	\$ 69.8	\$ 34.4

These amounts are included as deferred revenue in "other current liabilities" and "other liabilities" in Grace's Consolidated Balance Sheets. Grace records deferred revenues when cash payments are received or due in advance of performance. The increase in deferred revenue reflects cash payments from customers received or due in advance of satisfying performance obligations, offset by \$16.6 million of revenue recognized that was included in the deferred revenue balance as of December 31, 2017, and the \$3.2 million cumulative adjustment recorded to "retained earnings" as part of the adoption of ASC 606.

The noncurrent portion of the technology licensing revenue will be recognized as performance obligations under the technology licensing agreements are satisfied; the noncurrent balance is expected to be recognized over the next four years.

Remaining performance obligations represent the estimated revenue expected to be recognized in the future related to performance obligations that are unsatisfied (or partially unsatisfied). The aggregate amount of the transaction price allocated to remaining performance obligations for such contracts with a duration of more than one year was approximately \$103 million as of December 31, 2018, and includes certain amounts reported as deferred revenue above. In accordance with the practical expedient in ASC 606-10-50-14, Grace does not disclose information about remaining performance obligations that have original expected durations of one year or less, which generally relate to customer prepayments on product sales and are generally satisfied in less than one year. Grace expects to recognize revenue related to remaining performance obligations over several years, as follows:

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Notes to Consolidated Financial Statements (Continued)

17. Revenues (Continued)

Year	Approximate percentage of revenue related to remaining performance obligations recognized	
2019	31	%
2020	24	%
2021	20	%
Thereafter through 2025	25	%
	100	%

For the years ended December 31, 2018, 2017, and 2016, revenue recognized from performance obligations related to prior periods was not material. Grace has not capitalized any costs to obtain or fulfill contracts with customers under ASC 606. No material impairment losses have been recognized on any receivables or contract assets arising from contracts with customers.

18. Segment Information

Grace is a global producer of specialty chemicals and specialty materials. Grace's two reportable business segments are Grace Catalysts Technologies and Grace Materials Technologies. Grace Catalysts Technologies includes catalysts and related products and technologies used in refining, petrochemical and other chemical manufacturing applications. Advanced Refining Technologies ("ART"), Grace's joint venture with Chevron Products Company, a division of Chevron U.S.A. Inc. ("Chevron"), is managed in this segment. (See Note 19.) Grace Catalysts Technologies comprises two operating segments, Grace Refining Technologies and Grace Specialty Catalysts, which are aggregated into one reportable segment based upon similar economic characteristics, the nature of the products and production processes, type and class of customer, and channels of distribution. Grace Materials Technologies includes specialty materials, including silica-based and silica-alumina-based materials, used in consumer/pharma, chemical process, and coatings applications. The table below presents information related to Grace's reportable segments. Only those corporate expenses directly related to the reportable segments are allocated for reporting purposes. All remaining corporate items are reported separately and labeled as such.

Grace excludes defined benefit pension expense from the calculation of segment operating income. Grace believes that the exclusion of defined benefit pension expense provides a better indicator of its reportable segment performance as defined benefit pension expense is not managed at a reportable segment level.

Grace defines Adjusted EBIT to be income from continuing operations attributable to W. R. Grace & Co. shareholders adjusted for interest income and expense; income taxes; costs related to legacy product, environmental and other claims; restructuring and repositioning expenses and asset impairments; pension costs other than service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits; income and expense items related to divested businesses, product lines, and certain other investments; gains and losses on sales of businesses, product lines, and certain other investments; third-party acquisition-related costs and the amortization of acquired inventory fair value adjustment; and certain other items that are not representative of underlying trends.

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Notes to Consolidated Financial Statements (Continued)

18. Segment Information (Continued)

Reportable Segment Data

(In millions)	Year Ended December 31,		
	2018	2017	2016
Net Sales			
Catalysts Technologies	\$1,463.5	\$1,276.5	\$1,163.7
Materials Technologies	468.6	440.0	434.9
Total	\$1,932.1	\$1,716.5	\$1,598.6
Adjusted EBIT			
Catalysts Technologies segment operating income	\$440.5	\$395.4	\$367.8
Materials Technologies segment operating income	105.6	100.6	104.0
Corporate costs	(73.5)	(69.0)	(59.4)
Gain on termination and curtailment of postretirement plans related to current businesses	—	—	0.2
Certain pension costs	(15.9)	(13.0)	(12.3)
Total	\$456.7	\$414.0	\$400.3
Depreciation and Amortization			
Catalysts Technologies	\$81.7	\$87.1	\$77.4
Materials Technologies	15.5	19.6	19.5
Corporate	3.6	4.8	3.4
Total	\$100.8	\$111.5	\$100.3
Capital Expenditures			
Catalysts Technologies	\$150.3	\$100.9	\$84.9
Materials Technologies	56.1	20.9	24.0
Corporate	9.9	3.4	8.0
Total	\$216.3	\$125.2	\$116.9
Total Assets			
Catalysts Technologies	\$2,326.6	\$1,757.1	\$1,675.1
Materials Technologies	375.9	326.8	313.1
Corporate	862.8	823.1	923.6
Total	\$3,565.3	\$2,907.0	\$2,911.8

Corporate costs include corporate support function costs and other corporate costs such as professional fees and insurance premiums. Certain pension costs include only ongoing costs recognized quarterly, which include service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits.

See Note 17 for sales of similar products within each reportable segment.

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Notes to Consolidated Financial Statements (Continued)

18. Segment Information (Continued)

Reconciliation of Reportable Segment Data to Financial Statements

Grace Adjusted EBIT for the years ended December 31, 2018, 2017 and 2016 is reconciled below to income from continuing operations before income taxes presented in the accompanying Consolidated Statements of Operations.

(In millions)	Year Ended December 31,		
	2018	2017	2016
Grace Adjusted EBIT	\$456.7	\$414.0	\$400.3
Costs related to legacy product, environmental and other claims	(84.6)	(30.8)	(35.4)
Restructuring and repositioning expenses	(46.4)	(26.7)	(38.6)
Pension MTM adjustment and other related costs, net	15.2	(51.1)	(60.3)
Third-party acquisition-related costs	(7.3)	(2.9)	(2.5)
Amortization of acquired inventory fair value adjustment	(6.9)	—	(8.0)
Loss on early extinguishment of debt	(4.8)	—	(11.1)
Income and expense items related to divested businesses	2.3	(2.3)	0.1
Accounts receivable reserve—Venezuela	—	(10.0)	—
Gain (loss) on sale of product line	—	—	1.7
Gain on termination and curtailment of postretirement plans related to divested businesses	—	—	0.3
Interest expense, net	(78.5)	(78.5)	(80.5)
Net income (loss) attributable to noncontrolling interests	(0.8)	(0.8)	—
Income (loss) from continuing operations before income taxes	\$244.9	\$210.9	\$166.0

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Notes to Consolidated Financial Statements (Continued)

18. Segment Information (Continued)

Geographic Area Data

The table below presents information related to the geographic areas in which Grace operates. Sales are attributed to geographic areas based on customer location.

(In millions)	Year Ended December 31,		
	2018	2017	2016
Net Sales			
United States	\$533.8	\$437.3	\$446.2
Canada	47.9	48.7	44.5
Total North America	581.7	486.0	490.7
Europe Middle East Africa	752.2	667.7	647.8
Asia Pacific	481.5	459.8	348.9
Latin America	116.7	103.0	111.2
Total	\$1,932.1	\$1,716.5	\$1,598.6
Long-Lived Assets(1)			
United States	\$793.0	\$599.8	\$564.5
Canada	16.5	15.5	13.9
Total North America	809.5	615.3	578.4
Germany	172.5	142.2	109.7
Rest of Europe Middle East Africa	48.9	45.3	39.5
Total Europe Middle East Africa	221.4	187.5	149.2
Asia Pacific	72.9	21.1	21.5
Latin America	6.7	7.9	7.5
Total	\$1,110.5	\$831.8	\$756.6

(1) Long-lived assets include properties and equipment and the noncurrent asset related to a hydroprocessing catalyst plant to be transferred to ART upon completion. (See Note 19.)

19. Related Party Transactions

Unconsolidated Affiliate Grace accounts for its 50% ownership interest in ART, its joint venture with Chevron, using the equity method of accounting. Grace's investment in ART amounted to \$156.1 million and \$125.9 million as of December 31, 2018 and 2017, respectively, and the amount included in "equity in earnings of unconsolidated affiliate" in the accompanying Consolidated Statements of Operations totaled \$31.8 million, \$25.9 million and \$29.8 million for the years ended December 31, 2018, 2017 and 2016, respectively. ART is a private, limited liability company, taxed as a partnership, and accordingly does not have a quoted market price available.

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Notes to Consolidated Financial Statements (Continued)

19. Related Party Transactions (Continued)

The table below presents summary financial data related to ART's balance sheet and results of operations.

(In millions)	December 31,	
	2018	2017
Summary Balance Sheet information:		
Current assets	\$307.4	\$239.8
Noncurrent assets	160.2	91.5
Total assets	\$467.6	\$331.3
Current liabilities	\$133.3	\$82.4
Noncurrent liabilities	25.3	0.3
Total liabilities	\$158.6	\$82.7

(In millions)	Year Ended December 31,		
	2018	2017	2016
Summary Statement of Operations information:			
Net sales	\$487.5	\$447.3	\$388.9
Costs and expenses applicable to net sales	410.6	379.8	322.1
Income before income taxes	65.5	53.6	60.8
Net income	64.2	52.1	59.3

Grace and ART transact business on a regular basis and maintain several agreements in order to operate the joint venture. These agreements are treated as related party activities with an unconsolidated affiliate. Product manufactured by Grace for ART is accounted for on a net basis, with a mark-up, in "cost of goods sold" in the Consolidated Statements of Operations. Grace also receives reimbursement from ART for fixed costs, research and development, selling, general and administrative services, and depreciation. Grace records reimbursements against the respective line items on Grace's Consolidated Statement of Operations. The table below presents summary financial data related to transactions between Grace and ART.

(In millions)	Year Ended December 31,		
	2018	2017	2016
Product manufactured for ART	\$229.1	\$213.8	\$210.4
Mark-up on product manufactured for ART included as a reduction of Grace's cost of goods sold	4.5	4.2	4.2
Charges for fixed costs; research and development; selling, general and administrative services; and depreciation to ART	41.8	41.7	33.8

The table below presents balances in Grace's Consolidated Financial Statements related to ART.

(in millions)	December 31,	
	2018	2017
Accounts receivable	\$16.2	\$20.1
Noncurrent asset	98.8	32.7
Accounts payable	32.0	22.3
Debt payable within one year	9.8	8.6
Debt payable after one year	38.3	33.8

Noncurrent liability 98.8 32.7

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Notes to Consolidated Financial Statements (Continued)

19. Related Party Transactions (Continued)

The noncurrent asset and noncurrent liability in the table above represent spending to date related to a residue hydroprocessing catalyst production plant that is under construction in Lake Charles, Louisiana. Grace manages the design and construction of the plant, and the asset will continue to be included in “other assets” in Grace’s Consolidated Balance Sheets until construction is completed. Grace has likewise recorded a liability for the transfer of the asset to ART upon completion, included in “other liabilities” in the Consolidated Balance Sheets.

Grace and ART maintain an agreement whereby ART loans Grace funds for maintenance capital expenditures at manufacturing facilities used to produce catalysts for ART. Grace makes principal and interest payments on the loans on a monthly basis. These unsecured loans have repayment terms of up to eight years, unless earlier repayment is demanded by ART. The loans bear interest at the three-month LIBOR plus 1.25%.

Grace and Chevron provide lines of credit in the amount of \$15.0 million each at a commitment fee of 0.1% of the credit amount. These agreements have been approved by the ART Executive Committee for renewal until February 2020. No amounts were outstanding at December 31, 2018 and 2017.

Joint Venture Arrangement In 2018, Grace formed a joint venture in a developing country in Asia. The purpose of the joint venture is to establish a logistics facility and catalyst testing laboratory and to be the exclusive FCC catalysts and additives supplier to certain customers in the country. Grace’s joint venture partner is the parent company of the customers. Grace has an 87.5% ownership interest in the joint venture and consolidates the activities of the entity. Grace’s Consolidated Financial Statements as of and for the year ended December 31, 2018, include trade accounts receivable and revenues of \$3.7 million and \$14.0 million, respectively, from these customers.

20. Acquisitions

On April 3, 2018, using cash on hand and borrowings under the Credit Agreement, Grace acquired the assets of the polyolefin catalysts business of Albemarle Corporation. Grace acquired the business for \$418.0 million, net of cash acquired and including customary post-closing adjustments. The business is included in the Specialty Catalysts operating segment of the Catalysts Technologies reportable segment. The acquisition is complementary to Grace's existing specialty catalysts business and strengthens Grace's commercial relationships, catalysts technology portfolio, and manufacturing network.

The acquisition purchase price has been preliminarily allocated to the tangible and identifiable intangible assets and liabilities acquired based on their estimated fair values at the acquisition date in accordance with ASC 805 “Business Combinations.” The excess of the purchase price over the fair value of the tangible and intangible assets acquired was recorded as goodwill. The goodwill recognized is attributable to the expected growth and operating synergies that Grace expects to realize from this acquisition. The full \$140.6 million of goodwill generated from the acquisition will be deductible for U.S. income tax purposes. The purchase price allocation is still preliminary as Grace is waiting for the valuation to be finalized. Grace does not expect any material adjustments to the preliminary valuation. During the six months ended December 31, 2018, Grace recorded adjustments related to deferred taxes, working capital, and intangible assets.

The Consolidated Statements of Operations for the year ended December 31, 2018, includes approximately \$86 million of sales attributable to this acquisition. Disclosure of earnings attributable to this acquisition is not practicable due to the integration of operations into Grace’s existing business.

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Notes to Consolidated Financial Statements (Continued)

20. Acquisitions (Continued)

The table below presents the preliminary allocation of the acquisition purchase price.

	(In millions)
Accounts receivable	\$ 13.9
Inventories	28.6
Other current assets	0.7
Properties and equipment	119.8
Goodwill	140.6
Intangible assets	121.2
Other assets	0.5
Liabilities assumed	(7.3)
Net assets acquired, net of cash acquired	\$ 418.0

The table below presents the intangible assets acquired and the periods over which they will be amortized.

	Amount (In millions)	Weighted Average Amortization Period (in years)
Customer Lists	\$ 105.4	20.0
Technology	11.5	15.0
Trademarks	4.3	15.0
Total	\$ 121.2	19.3

21. Discontinued Operations

As a result of the Separation and Distribution, GCP is now an independent public company and its common stock is listed under the symbol "GCP" on the New York Stock Exchange. Grace does not beneficially own any shares of GCP common stock and will not consolidate the financial results of GCP in its future financial reporting, as GCP is no longer a related party to Grace subsequent to the Separation. GCP's historical financial results through the Distribution Date are reflected in Grace's Consolidated Financial Statements as discontinued operations.

Separation and Distribution Agreement Prior to the completion of the Separation and the Distribution, W. R. Grace & Co., Grace-Conn. and GCP entered into a Separation and Distribution Agreement and certain related agreements that govern the post-Separation relationship between Grace and GCP. The Separation and Distribution Agreement identifies the transfer of Grace's assets and liabilities that are specifically identifiable or otherwise allocable to GCP, the elimination of Grace's equity interest in GCP, the removal of certain non-recurring separation costs directly related to the Separation and Distribution, the cash distribution from GCP to Grace, and the reduction in Grace's debt using the cash received from GCP, and it provides for when and how these transfers, assumptions and assignments have occurred or will occur.

The foregoing is a summary of the Separation and Distribution Agreement. Grace has filed the full texts of the Separation and Distribution Agreement and a related Tax Sharing Agreement with the SEC, which are readily available on the Internet at www.sec.gov.

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Notes to Consolidated Financial Statements (Continued)

21. Discontinued Operations (Continued)

GCP's historical financial results through the Distribution Date and other effects of the Separation for the year ended December 31, 2016, are presented as discontinued operations as summarized below:

(In millions)	Year Ended December 31, 2016
Net sales	\$ 99.6
Cost of goods sold	62.6
Gross profit	37.0
Selling, general and administrative expenses	21.6
Research and development expenses	1.7
Repositioning expenses	22.0
Interest expense and related financing costs	0.7
Other expense, net	3.9
Total costs and expenses	49.9
(Loss) Income from discontinued operations before income taxes	(12.9)
Benefit from (provision for) income taxes	0.1
(Loss) Income from discontinued operations after income taxes	(12.8)
Less: Net income attributable to noncontrolling interests	(0.1)
Net (loss) income from discontinued operations	\$ (12.9)

(In millions)	Year Ended December 31, 2016
---------------	---------------------------------------

Cash flows from discontinued operations	
Net cash provided by (used for) operating activities	\$ 23.9
Net cash provided by (used for) investing activities	(9.5)
Net cash provided by (used for) financing activities	31.4
Effect of currency exchange rate changes on cash and cash equivalents	(1.0)
Increase (decrease) in cash and cash equivalents from discontinued operations	\$ 44.8

In January 2016, GCP completed the sale of \$525.0 million aggregate principal amount of 9.500% Senior Notes due in 2023. GCP used a portion of these proceeds to fund a \$500.0 million distribution to Grace in connection with the Separation and the Distribution.

In February 2016, GCP entered into a credit agreement that provides for new senior secured credit facilities in an aggregate principal amount of \$525.0 million, consisting of term loans in an aggregate principal amount of \$275.0 million maturing in 2022 and of revolving loans in an aggregate principal amount of \$250.0 million maturing in 2021, which were undrawn at closing. GCP used a portion of these proceeds to fund a \$250.0 million distribution to Grace in connection with the Separation and the Distribution.

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Notes to Consolidated Financial Statements (Continued)

22. Quarterly Financial Information (Unaudited)

(In millions, except per share amounts)	March 31	June 30	September 30(2)	December 31(3)
2018				
Net sales	\$ 431.5	\$485.7	\$ 494.9	\$ 520.0
Gross profit	169.5	198.7	202.2	196.3
Net income (loss)	43.4	38.6	15.9	68.9
Net income (loss) attributable to W. R. Grace & Co. shareholders	43.6	38.8	16.1	69.1
Net income (loss) per share:(1)				
Basic earnings (loss) per share:	\$ 0.64	\$0.58	\$ 0.24	\$ 1.03
Diluted earnings (loss) per share:	0.64	0.58	0.24	1.03
Dividends declared per share	0.24	0.24	0.24	0.24

(1) Per share results for the four quarters may differ from full-year per share results, as a separate computation of the weighted average number of shares outstanding is made for each quarter presented.

(2) Third quarter “net income (loss)” and “net income (loss) attributable to W. R. Grace & Co. shareholders” include the effects of a pre-tax charge of \$70.0 million for the estimated costs of future remediation-related activities at the former vermiculite mine site in Libby, Montana.

(3) Fourth quarter “gross profit,” “net income (loss),” and “net income (loss) attributable to W. R. Grace & Co. shareholders” include the effects of the annual pension mark-to-market adjustment.

(In millions, except per share amounts)	March 31	June 30	September 30	December 31(2)
2017				
Net sales	\$ 398.0	\$429.5	\$ 429.5	\$ 459.5
Gross profit	153.2	167.2	171.3	184.4
Net income (loss)	42.9	43.5	47.1	(123.1)
Net income (loss) attributable to W. R. Grace & Co. shareholders	42.9	43.9	47.4	(123.0)
Net income (loss) per share:(1)				
Basic earnings (loss) per share:	\$ 0.63	\$0.64	\$ 0.70	\$ (1.81)
Diluted earnings (loss) per share:	0.63	0.64	0.70	(1.81)
Dividends declared per share	0.21	0.21	0.21	0.21

(1) Per share results for the four quarters may differ from full-year per share results, as a separate computation of the weighted average number of shares outstanding is made for each quarter presented.

(2) Fourth quarter “gross profit,” “net income (loss),” and “net income (loss) attributable to W. R. Grace & Co. shareholders” include the effects of the annual pension mark-to-market adjustment, as well as adjustments related to the estimated impacts of the U.S. Tax Cuts and Jobs Act of 2017.

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SELECTED FINANCIAL DATA

(In millions, except per share amounts)	2018	2017	2016	2015	2014
Statement of Operations					
Net sales	\$1,932.1	\$1,716.5	\$1,598.6	\$1,628.2	\$1,757.3
Income (loss) from continuing operations ⁽¹⁾⁽²⁾	166.8	10.4	107.0	123.9	116.9
Financial Position					
Total assets	3,565.3	2,907.0	2,911.8	3,645.7	4,057.1
Debt payable after one year	1,961.0	1,523.8	1,507.6	2,111.5	1,882.5
Shareholders' equity	337.0	263.3	372.4	212.5	369.0
Data Per Common Share					
Income (loss) from continuing operations—basic	\$2.49	\$0.16	\$1.53	\$1.72	\$1.55
Income (loss) from continuing operations—diluted	2.49	0.16	1.52	1.71	1.54
Dividends declared	0.96	0.84	0.51	—	—
Other Statistics					
Common shareholders of record	4,369	4,646	4,895	5,142	5,839

Adjustments related to our legacy liabilities, Chapter 11, and pension mark-to-market accounting are included in (1) and affect the period-to-period comparability of “income (loss) from continuing operations” and the related data per common share. See Note 18 to the Consolidated Financial Statements for a detail of these items.

(2) For 2017, “Income (loss) from continuing operations” includes a charge of \$143.0 million related to the estimated impacts of the U.S. Tax Cuts and Jobs Act of 2017.

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Management's Discussion and Analysis of Financial Condition and Results of Operations

See "Analysis of Operations" for a discussion of our non-GAAP performance measures. Our references to "advanced economies" and "emerging regions" refer to classifications established by the International Monetary Fund.

Results of Operations

2018 Performance Summary

Following is a summary of our financial performance for the year ended December 31, 2018, compared with the prior year.

Net sales increased 12.6% to \$1,932.1 million.

Income from continuing operations attributable to Grace increased to \$167.6 million, including a pre-tax charge of \$70.0 million for the estimated costs to remediate our former vermiculite mine site.

Adjusted EBIT increased 10.3% to \$456.7 million.

Diluted earnings per share from continuing operations increased to \$2.49 per diluted share.

Adjusted EPS increased 21.8% to \$4.14 per diluted share.

Summary Description of Business

We are engaged in specialty chemicals and specialty materials businesses on a worldwide basis through our two reportable segments, Grace Catalysts Technologies and Grace Materials Technologies. See Item 1 (Business—Business Overview) of this Report for a summary description of our business.

Analysis of Operations

We have set forth in the table below our key operating statistics with percentage changes for the years ended December 31, 2018, 2017, and 2016. Please refer to this Analysis of Operations when reviewing this Management's Discussion and Analysis of Financial Condition and Results of Operations. In the table we present financial information in accordance with U.S. GAAP, as well as the non-GAAP financial information described below. We believe that the non-GAAP financial information provides useful supplemental information about the performance of our businesses, improves period-to-period comparability and provides clarity on the information our management uses to evaluate the performance of our businesses. In the table, we have provided reconciliations of these non-GAAP financial measures to the most directly comparable financial measure calculated and presented in accordance with U.S. GAAP. The non-GAAP financial measures should not be considered as a substitute for financial measures calculated in accordance with U.S. GAAP, and the financial results calculated in accordance with U.S. GAAP and reconciliations from those results should be evaluated carefully.

We define Adjusted EBIT (a non-GAAP financial measure) to be income from continuing operations attributable to W. R. Grace & Co. shareholders adjusted for interest income and expense; income taxes; costs related to legacy product, environmental and other claims; restructuring and repositioning expenses and asset impairments; pension costs other than service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits; income and expense items related to divested businesses, product lines, and certain other investments; gains and losses on sales of businesses, product lines, and certain other investments; third-party acquisition-related costs and the amortization of acquired inventory fair value adjustment; and certain other items that are not representative of underlying trends.

We define Adjusted EBITDA (a non-GAAP financial measure) to be Adjusted EBIT adjusted for depreciation and amortization.

We define Adjusted EBIT Return On Invested Capital (a non-GAAP financial measure) to be Adjusted EBIT (on a trailing four quarters basis) divided by the sum of net working capital, properties and equipment and certain other assets and liabilities.

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We define Adjusted Gross Margin (a non-GAAP financial measure) to be gross margin adjusted for pension-related costs included in cost of goods sold and the amortization of acquired inventory fair value adjustment.

We define Adjusted Earnings Per Share (EPS) (a non-GAAP financial measure) to be diluted EPS from continuing operations adjusted for costs related to legacy product, environmental and other claims; restructuring and repositioning expenses and asset impairments; pension costs other than service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits; income and expense items related to divested businesses, product lines, and certain other investments; gains and losses on sales of businesses, product lines and certain other investments; third-party acquisition-related costs and the amortization of acquired inventory fair value adjustment; certain other items that are not representative of underlying trends; certain discrete tax items; and income tax expense related to historical tax attributes.

We define Net Sales, constant currency (a non-GAAP financial measure) to be the period-over-period change in net sales calculated using the foreign currency exchange rates that were in effect during the previous comparable period. We use Adjusted EBIT as a performance measure in significant business decisions and in determining certain incentive compensation. We use Adjusted EBIT as a performance measure because it provides improved period-to-period comparability for decision making and compensation purposes, and because it better measures the ongoing earnings results of our strategic and operating decisions by excluding the earnings effects of our legacy product, environmental, and other claims; restructuring and repositioning activities; divested businesses; the effects of acquisitions; and certain other items that are not representative of underlying trends.

We use Adjusted EBITDA, Adjusted EBIT Return On Invested Capital, Adjusted Gross Margin, and Adjusted EPS as performance measures and may use these measures in determining certain incentive compensation. We use Adjusted EBIT Return On Invested Capital in making operating and investment decisions and in balancing the growth and profitability of our operations.

We use Net Sales, constant currency as a performance measure to compare current period financial performance to historical financial performance by excluding the impact of foreign currency exchange rate fluctuations that are not representative of underlying business trends and are largely outside of our control.

Adjusted EBIT, Adjusted EBITDA, Adjusted EBIT Return On Invested Capital, Adjusted Gross Margin, Adjusted EPS, and Net Sales, constant currency are non-GAAP financial measures; do not purport to represent income measures as defined under U.S. GAAP; and should not be used as alternatives to such measures as an indicator of our performance. These measures are provided to investors and others to improve the period-to-period comparability and peer-to-peer comparability of our financial results, and to ensure that investors understand the information we use to evaluate the performance of our businesses. They distinguish the operating results of Grace's current business base from the costs of Grace's legacy product, environmental and other claims; restructuring and repositioning activities; divested businesses; and certain other items. These measures may have material limitations due to the exclusion or inclusion of amounts that are included or excluded, respectively, in the most directly comparable measures calculated and presented in accordance with U.S. GAAP, and thus investors and others should review carefully the financial results calculated in accordance with U.S. GAAP.

Adjusted EBIT has material limitations as an operating performance measure because it excludes costs related to legacy product, environmental and other claims, and may exclude income and expenses from restructuring and repositioning activities and divested businesses, which historically have been material components of our net income. Adjusted EBITDA also has material limitations as an operating performance measure because it excludes the impact of depreciation and amortization expense. Our business is substantially dependent on the successful deployment of capital, and depreciation and amortization expense is a necessary element of our costs. We compensate for the limitations of these measurements by using these indicators together with net income as measured under U.S. GAAP to present a complete analysis of our results of operations. Adjusted EBIT and Adjusted EBITDA should be evaluated together with net income and net income attributable to Grace shareholders, measured under U.S. GAAP, for a complete understanding of our results of operations.

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Analysis of Operations (In millions, except per share amounts)	2018	2017	% Change	2016	% Change
Net sales:					
Catalysts Technologies	\$1,463.5	\$1,276.5	14.6 %	\$1,163.7	9.7 %
Materials Technologies	468.6	440.0	6.5 %	434.9	1.2 %
Total Grace net sales	\$1,932.1	\$1,716.5	12.6 %	\$1,598.6	7.4 %
Net sales by region:					
North America	\$581.7	\$486.0	19.7 %	\$490.7	(1.0)%
Europe Middle East Africa	752.2	667.7	12.7 %	647.8	3.1 %
Asia Pacific	481.5	459.8	4.7 %	348.9	31.8 %
Latin America	116.7	103.0	13.3 %	111.2	(7.4)%
Total net sales by region	\$1,932.1	\$1,716.5	12.6 %	\$1,598.6	7.4 %
Performance measures:					
Adjusted EBIT(A):					
Catalysts Technologies segment operating income	\$440.5	\$395.4	11.4 %	\$367.8	7.5 %
Materials Technologies segment operating income	105.6	100.6	5.0 %	104.0	(3.3)%
Corporate costs	(73.5)	(69.0)	(6.5)%	(59.4)	(16.2)%
Gain on termination and curtailment of postretirement plans related to current businesses	—	—	NM	0.2	NM
Certain pension costs(B)(C)	(15.9)	(13.0)	(22.3)%	(12.3)	(5.7)%
Adjusted EBIT	456.7	414.0	10.3 %	400.3	3.4 %
Costs related to legacy product, environmental and other claims, net	(84.6)	(30.8)		(35.4)	
Restructuring and repositioning expenses	(46.4)	(26.7)		(38.6)	
Pension MTM adjustment and other related costs, net(B)(C)	15.2	(51.1)		(60.3)	
Third-party acquisition-related costs	(7.3)	(2.9)		(2.5)	
Amortization of acquired inventory fair value adjustment	(6.9)	—		(8.0)	
Loss on early extinguishment of debt	(4.8)	—		(11.1)	
Income and expense items related to divested businesses	2.3	(2.3)		0.1	
Accounts receivable reserve—Venezuela	—	(10.0)		—	
Gain (loss) on sale of product line	—	—		1.7	
Gain on termination and curtailment of postretirement plans related to divested businesses	—	—		0.3	
Interest expense, net	(78.5)	(78.5)	— %	(80.5)	2.5 %
(Provision for) benefit from income taxes	(78.1)	(200.5)	61.0 %	(59.0)	NM
Income (loss) from continuing operations attributable to W. R. Grace & Co. shareholders	\$167.6	\$11.2	NM	\$107.0	(89.5)%
Diluted EPS from continuing operations	\$2.49	\$0.16	NM	\$1.52	(89.5)%
Adjusted EPS	\$4.14	\$3.40	21.8 %	\$3.10	9.7 %

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Analysis of Operations (In millions)	2018	2017	% Change	2016	% Change	
Adjusted performance measures:						
Gross Margin:						
Catalysts Technologies	41.7	% 40.8	% 0.9 pts	44.4	% (3.6) pts	
Materials Technologies	37.8	% 37.9	% (0.1) pts	39.6	% (1.7) pts	
Adjusted Gross Margin	40.7	% 40.1	% 0.6 pts	43.1	% (3.0) pts	
Amortization of acquired inventory fair value adjustment	(0.3))% —	% NM	(0.5))% NM	
Pension costs in cost of goods sold	(0.7))% (0.7))% 0.0 pts	(1.2))% 0.5 pts	
Total Grace	39.7	% 39.4	% 0.3 pts	41.4	% (2.0) pts	
Adjusted EBIT:						
Catalysts Technologies	\$440.5	\$395.4	11.4	% \$367.8	7.5	%
Materials Technologies	105.6	100.6	5.0	% 104.0	(3.3))%
Corporate, pension, and other	(89.4)	(82.0)	(9.0))% (71.5)	(14.7))%
Total Grace	456.7	414.0	10.3	% 400.3	3.4	%
Depreciation and amortization:						
Catalysts Technologies	\$81.7	\$87.1	(6.2))% \$77.4	12.5	%
Materials Technologies	15.5	19.6	(20.9))% 19.5	0.5	%
Corporate	3.6	4.8	(25.0))% 3.4	41.2	%
Total Grace	100.8	111.5	(9.6))% 100.3	11.2	%
Adjusted EBITDA:						
Catalysts Technologies	\$522.2	\$482.5	8.2	% \$445.2	8.4	%
Materials Technologies	121.1	120.2	0.7	% 123.5	(2.7))%
Corporate, pension, and other	(85.8)	(77.2)	(11.1))% (68.1)	(13.4))%
Total Grace	557.5	525.5	6.1	% 500.6	5.0	%
Adjusted EBIT margin:						
Catalysts Technologies	30.1	% 31.0	% (0.9) pts	31.6	% (0.6) pts	
Materials Technologies	22.5	% 22.9	% (0.4) pts	23.9	% (1.0) pts	
Total Grace	23.6	% 24.1	% (0.5) pts	25.0	% (0.9) pts	
Adjusted EBITDA margin:						
Catalysts Technologies	35.7	% 37.8	% (2.1) pts	38.3	% (0.5) pts	
Materials Technologies	25.8	% 27.3	% (1.5) pts	28.4	% (1.1) pts	
Total Grace	28.9	% 30.6	% (1.7) pts	31.3	% (0.7) pts	

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Analysis of Operations (In millions)	2018	2017	2016
Calculation of Adjusted EBIT Return On Invested Capital (trailing four quarters):			
Adjusted EBIT	\$456.7	\$414.0	\$400.3
Invested Capital:			
Trade accounts receivable	288.5	285.2	273.9
Inventories	281.1	230.9	228.0
Accounts payable	(248.6)	(210.3)	(195.4)
	321.0	305.8	306.5
Other current assets (excluding income taxes)	76.5	42.1	32.0
Properties and equipment, net	1,011.7	799.1	729.6
Goodwill	540.4	402.4	394.2
Technology and other intangible assets, net	356.5	255.4	269.1
Investment in unconsolidated affiliate	156.1	125.9	117.6
Other assets (excluding capitalized financing fees)	111.0	37.4	34.9
Other current liabilities (excluding income taxes, legacy environmental matters, accrued interest, and restructuring)	(189.8)	(158.6)	(144.4)
Other liabilities (excluding income taxes and legacy environmental matters)	(201.5)	(113.7)	(89.3)
Total invested capital	\$2,181.9	\$1,695.8	\$1,650.2
Adjusted EBIT Return On Invested Capital	20.9 %	24.4 %	24.3 %

Amounts may not add due to rounding.

NM—Not Meaningful

(A) Grace's segment operating income includes only Grace's share of income of consolidated and unconsolidated joint ventures.

(B) Certain pension costs include only ongoing costs recognized quarterly, which include service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits. Catalysts Technologies and Materials Technologies segment operating income and corporate costs do not include any amounts for pension expense. Other pension related costs including annual mark-to-market (MTM) adjustments and actuarial gains and losses are excluded from Adjusted EBIT. These amounts are not used by management to evaluate the performance of Grace's businesses and significantly affect the peer-to-peer and period-to-period comparability of our financial results. Mark-to-market adjustments and actuarial gains and losses relate primarily to changes in financial market values and actuarial assumptions and are not directly related to the operation of Grace's businesses.

(C) "Defined benefit pension expense" as measured under U.S. GAAP includes actuarial gains and losses and actual returns on assets. Adjusted EBIT includes expected returns on assets but excludes both actuarial gains and losses and actual returns on assets. The table below presents expected and actual returns on plan assets for U.S. and non-U.S. plans for the years ended December 31, 2018, 2017, and 2016.

(In millions)	2018		2017		2016	
	U.S. Plans	Non-U.S. Plans	U.S. Plans	Non-U.S. Plans	U.S. Plans	Non-U.S. Plans
Actual return on plan assets	\$(41.9)	\$(1.7)	\$112.7	\$ 1.6	\$95.6	\$(0.5)
Actual return on plan assets	(3.51)%	(8.01)%	11.20 %	8.62 %	9.65 %	(2.55)%
Expected return on plan assets	\$57.2	\$ 1.0	\$57.5	\$ 0.9	\$56.7	\$ 1.0
Expected return on plan assets	5.25 %	4.69 %	5.50 %	4.69 %	5.50 %	5.08 %

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Grace Overview

Following is an overview of our financial performance for the years ended December 31, 2018, 2017, and 2016.

Net Sales and Gross Margin

Sales were \$1,932.1 million, \$1,716.5 million, and \$1,598.6 million for the years ended December 31, 2018, 2017, and 2016. Gross margin was 39.7%, 39.4%, and 41.4% for the years ended December 31, 2018, 2017, and 2016.

Adjusted Gross Margin was 40.7%, 40.1%, and 43.1% for the years ended December 31, 2018, 2017, and 2016.

The following tables identify the year-over-year increase or decrease in sales attributable to changes in sales volume and/or mix, product price, and the impact of currency translation.

2018 as a Percentage Increase
(Decrease) from 2017

Net Sales Variance Analysis	Volume	Price	Currency Translation	Total
Catalysts Technologies	12.1%	1.6%	0.9%	14.6%
Materials Technologies	3.1%	1.6%	1.8%	6.5%
Net sales	9.8%	1.6%	1.2%	12.6%
By Region:				
North America	17.6%	2.1%	—%	19.7%
Europe Middle East Africa	6.8%	2.7%	3.2%	12.7%
Asia Pacific	4.0%	0.4%	0.3%	4.7%
Latin America	19.0%	(2.2)%	(3.5)%	13.3%

Sales for 2018 increased 12.6% overall compared with the prior year, up 11.4% on constant currency. Higher sales volumes in Catalysts Technologies were driven by the polyolefin catalysts acquisition and growth in the existing businesses across all regions except Asia. Sales volumes in Materials Technologies were up driven by growth in Europe, North America, and Latin America.

Gross margin increased 30 basis points to 39.7% from 39.4% for the prior year. Adjusted Gross Margin increased 60 basis points to 40.7% from 40.1% for the prior year. The increases were primarily due to lower depreciation expense, improved pricing, higher sales volumes, and favorable product and regional mix, partially offset by higher manufacturing costs including a 170 basis point impact related to higher raw materials and energy costs.

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Net Sales Variance Analysis	2017 as a Percentage Increase (Decrease) from 2016			
	Volume	Price	Currency Translation	Total
Catalysts Technologies	9.7 %	(0.3)%	0.3 %	9.7 %
Materials Technologies	0.3 %	(0.2)%	1.1 %	1.2 %
Net sales	7.2 %	(0.3)%	0.5 %	7.4 %
By Region:				
North America	(0.5)%	(0.5)%	— %	(1.0)%
Europe Middle East Africa	2.6 %	(0.6)%	1.1 %	3.1 %
Asia Pacific	31.3 %	0.6 %	(0.1)%	31.8 %
Latin America	(7.9)%	(0.2)%	0.7 %	(7.4)%

Sales for 2017 increased 7.4% overall compared with the prior year, up 6.9% on constant currency. Catalysts sales volumes increased primarily due to higher demand in Asia and the full-year benefit of the 2016 polyolefin catalysts acquisition, partially offset by lower demand in Latin America. Lower pricing in Catalysts Technologies was primarily due to customer mix. Sales in Materials Technologies increased, primarily driven by higher sales volumes and favorable currency translation. Higher sales volumes in the silicas business, primarily in Asia, were partially offset by the impact related to the exit of certain products lines in the 2016 first half and lower pharmaceutical fine chemicals sales in North America.

Gross margin decreased 200 basis points to 39.4% from 41.4% for the prior year. Adjusted Gross Margin decreased 300 basis points to 40.1% from 43.1% for the prior year. The decreases were primarily due to higher manufacturing costs, including 110 basis points related to higher raw materials costs, and product and regional mix.

Grace Income From Continuing Operations

Income from continuing operations was \$167.6 million for 2018 compared with \$11.2 million for the prior year. The increase was primarily due to the \$143.0 million provisional tax charge for the estimated impacts of the U.S. Tax Cuts and Jobs Act of 2017 (the "TCJA"), which was recorded in 2017. This was partially offset by higher restructuring and repositioning expenses and a higher provision for environmental remediation in 2018, which was primarily due to the \$70.0 million charge for the estimated costs of future remediation-related activities at the Libby, Montana, mine site (see Note 10 to the Consolidated Financial Statements).

Income from continuing operations was \$11.2 million for 2017 compared with \$107.0 million for the prior year. The decrease was primarily due to a higher provision for income taxes due to a \$143.0 million provisional charge for the estimated impacts of the TCJA (see Note 7 to the Consolidated Financial Statements) and an accounts receivable reserve for a customer in Venezuela, partially offset by higher segment operating income, lower restructuring and repositioning expenses, and a lower pension mark-to-market adjustment.

During the 2018 first quarter, we completed a study to evaluate the useful lives of our operating machinery and equipment, including a review of historical asset retirement data as well as review and analysis of relevant industry practices. As a result of this study, effective January 1, 2018, we revised the accounting useful lives of

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certain machinery and equipment, which was determined to be a change in accounting estimate and is being applied prospectively. As a result of this change in accounting estimate, depreciation expense with respect to such machinery and equipment was reduced by \$23.5 million, resulting in an increase to net income of \$18.0 million or \$0.27 per diluted share for the year ended December 31, 2018. Estimated useful lives for operating machinery and equipment, which previously ranged from 3 to 10 years, now range from 5 to 25 years.

Adjusted EBIT

Adjusted EBIT was \$456.7 million for 2018, an increase of 10.3% compared with the prior year primarily due to higher gross profit, higher income from our ART joint venture, and favorable currency translation, partially offset by business interruption insurance recoveries in the prior year that did not repeat in 2018 and higher operating expenses. Adjusted EBIT was \$414.0 million for 2017, an increase of 3.4% compared with the prior year primarily due to higher sales volumes and business interruption insurance recoveries for lost profits as a result of a customer outage. The increase was partially offset by higher manufacturing costs, unfavorable product and regional mix, and higher operating expenses.

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Adjusted EPS

The following table reconciles our Diluted EPS (GAAP) to our Adjusted EPS (non-GAAP):

	2018			
(In millions, except per share amounts)	Pre-Tax	Tax Effect	After-Tax	Per Share
Diluted Earnings Per Share (GAAP)				\$2.49
Costs related to legacy product, environmental and other claims, net	\$84.6	\$18.2	\$ 66.4	0.99
Restructuring and repositioning expenses	46.4	10.0	36.4	0.54
Pension MTM adjustment and other related costs, net(B)(C)	(15.2)	(3.4)	(11.8)	(0.18)
Third-party acquisition-related costs	7.3	1.6	5.7	0.08
Amortization of acquired inventory fair value adjustment	6.9	1.5	5.4	0.08
Loss on early extinguishment of debt	4.8	1.0	3.8	0.06
Income and expense items related to divested businesses	(2.3)	(0.5)	(1.8)	(0.03)
Income tax expense related to historical tax attributes(1)		(25.6)	25.6	0.38
Provisional charge related to the U.S. Tax Cuts and Jobs Act of 2017		17.1	(17.1)	(0.25)
Discrete tax items, including adjustments to uncertain tax positions		1.4	(1.4)	(0.02)
Adjusted EPS (non-GAAP)				\$4.14

Our historical tax attribute carryforwards (net operating losses and tax credits) unfavorably affect our tax expense (1) with respect to certain provisions of the TCJA. To normalize the effective tax rate, an adjustment is made to eliminate the tax expense impact associated with the historical tax attributes.

	2017			
(In millions, except per share amounts)	Pre-Tax	Tax Effect	After-Tax	Per Share
Diluted Earnings Per Share (GAAP)				\$0.16
Pension MTM adjustment and other related costs, net(B)(C)	\$51.1	\$17.4	\$ 33.7	0.49
Costs related to legacy product, environmental and other claims, net	30.8	11.4	19.4	0.28
Restructuring and repositioning expenses	26.7	8.9	17.8	0.26
Accounts receivable reserve-Venezuela	10.0	3.5	6.5	0.10
Third-party acquisition-related costs	2.9	1.1	1.8	0.03
Income and expense items related to divested businesses	2.3	0.8	1.5	0.02
Provisional charge related to the U.S. Tax Cuts and Jobs Act of 2017		(143.0)	143.0	2.10
Discrete tax items, including adjustments to uncertain tax positions		2.7	(2.7)	(0.04)
Adjusted EPS (non-GAAP)				\$3.40

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(In millions, except per share amounts)	2016			Per Share
	Pre-Tax	Tax Effect	After-Tax	
Diluted Earnings Per Share (GAAP)				\$1.52
Pension MTM adjustment and other related costs, net(B)(C)	\$60.3	\$19.8	\$40.5	0.57
Restructuring and repositioning expenses	38.6	11.6	27.0	0.38
Costs related to legacy product, environmental and other claims, net	35.4	13.2	22.2	0.31
Loss on early extinguishment of debt	11.1	4.1	7.0	0.10
Amortization of acquired inventory fair value adjustment	8.0	3.0	5.0	0.07
Third-party acquisition-related costs	2.5	0.7	1.8	0.03
(Gain) loss on sale of product line	(1.7)	(0.6)	(1.1)	(0.02)
Gain on termination and curtailment of postretirement plans related to divested businesses	(0.3)	(0.1)	(0.2)	—
Income and expense items related to divested businesses	(0.1)	—	(0.1)	—
Discrete tax items, including adjustments to uncertain tax positions		(9.8)	9.8	0.14
Adjusted EPS (non-GAAP)				\$3.10

Adjusted EBIT Return On Invested Capital

Adjusted EBIT Return On Invested Capital for 2018 was 20.9% on a trailing four quarters basis, a decrease compared with 2017 and 2016 on the same basis, due to the polyolefin catalysts acquisition. The acquisition, which was completed on April 3, 2018, increased invested capital at that date, while Adjusted EBIT includes only three quarters of income from the acquired business.

We manage our operations with the objective of maximizing sales, earnings and cash flow over time. Doing so requires that we successfully balance our growth, profitability and working capital and other investments to support sustainable, long-term financial performance. We use Adjusted EBIT Return On Invested Capital as a performance measure in evaluating operating results, in making operating and investment decisions, and in balancing the growth and profitability of our operations.

Grace Value Model

In March 2018, we introduced investors to the Grace Value Model (“GVM”), our framework for creating and delivering value to customers, investors, and employees. At the company level, we create value through our focused portfolio, strong strategic position, and disciplined capital allocation. At the business level, we create value through customer-driven innovation, commercial excellence, and operating excellence. Great talent, our high-performance culture, and integrated business management processes support all of our activities and are a source of competitive advantage.

The GVM framework also encompasses our multi-year initiatives to transform our manufacturing and business processes to extend our competitive advantages and improve our cost position. We expect to significantly improve our manufacturing performance, reduce our manufacturing costs, and improve our integrated business management capabilities. We also expect to invest significant capital in our manufacturing plants to

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accelerate growth and improve manufacturing performance. Our investments in commercial excellence are yielding positive results in account management, pipeline management and conversion, and pricing.

Segment Overview—Grace Catalysts Technologies

Following is an overview of the financial performance of Catalysts Technologies for the years ended December 31, 2018, 2017, and 2016.

Net Sales—Grace Catalysts Technologies

Sales were \$1,463.5 million for 2018, an increase of 14.6% compared with the prior year. The increase was due to higher sales volumes (+12.1%), improved pricing (+1.6%), and favorable currency translation (+0.9%). Higher sales were driven by the 2018 polyolefin catalysts acquisition (+6.8%) and growth in the existing businesses across all regions except Asia Pacific, driven by higher demand from new and existing customers and higher licensing revenues, improved pricing, and favorable currency translation as the U.S. dollar weakened against multiple currencies, especially the euro, compared with the prior year.

Sales were \$1,276.5 million for 2017, an increase of 9.7% compared with the prior year. The increase was due to higher sales volumes (+9.7%), and favorable currency translation (+0.3%), partially offset by lower pricing (-0.3%) primarily due to customer mix. Higher sales volumes were driven by higher demand, primarily in Asia Pacific, and the full-year benefit of the 2016 polyolefin catalysts acquisition. Specialty Catalysts sales volumes increased due to the 2016 polyolefin catalysts acquisition and organic growth in the existing businesses driven by higher demand in all markets. Refining Catalysts sales volumes increased primarily in Asia Pacific, due to demand for new products, bid business, and new customer acquisition. Sales volumes in Latin America decreased primarily due to a delay in contract renewals in the region and lower sales into Venezuela. Favorable currency translation affected both product groups as the U.S. dollar weakened against multiple currencies, especially the euro, compared with the prior year.

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Segment Operating Income (SOI) and Margin—Grace Catalysts Technologies

Gross profit was \$610.0 million for 2018, an increase of 17.0% compared with the prior year. Gross margin was 41.7% compared with 40.8% for the prior year. The increases were primarily due to lower depreciation expense, higher sales volumes, improved pricing, and favorable product and regional mix, partially offset by higher manufacturing costs including a 180 basis point impact related to higher raw materials and energy costs.

Segment operating income was \$440.5 million for 2018, an increase of 11.4% compared with the prior year, primarily due to higher gross profit, higher income from our ART joint venture, and favorable currency translation. The increase was partially offset by the absence of business interruption insurance recoveries that were included in the prior year and higher operating expenses. The ART joint venture contributed \$31.8 million to operating income, an increase of \$5.9 million from the prior-year period. Segment operating margin for 2018 decreased to 30.1%, a decline of 90 basis points compared with the prior year primarily due to the absence of business interruption insurance recoveries.

Gross profit was \$521.2 million for 2017, an increase of 0.9% compared with the prior year. Gross margin was 40.8% compared with 44.4% for the prior year. The decrease in gross margin was primarily due to higher manufacturing costs, including 130 basis points related to higher raw materials costs, and product and regional mix, including the effect of the customer outage and the full-year effect of the 2016 polyolefin catalysts acquisition.

Segment operating income was \$395.4 million for 2017, an increase of 7.5% compared with the prior year, primarily due to higher sales volumes and business interruption insurance recoveries, partially offset by higher manufacturing costs and product and regional mix. The ART joint venture contributed \$25.9 million to operating income, a decrease of \$3.9 million from the prior-year period, primarily due to a change in costs included in the partner service level agreements with ART. Segment operating margin for 2017 decreased to 31.0%, a decline of 60 basis points compared with the prior year.

In January 2017, a Catalysts Technologies customer experienced an explosion and fire resulting in an extended outage. We recognized a benefit of and received \$25.0 million in payments from our third-party insurer during 2017 under our business interruption insurance policy for a portion of profits lost as a result of the outage. The policy had a \$25.0 million limit for this event.

In the 2017 third quarter, we recorded a \$10.0 million charge to fully reserve for a trade receivable from a Venezuela-based customer related to increased economic uncertainty and the recent political unrest and sanctions. This charge has been excluded from Adjusted EBIT due to the nature of the situation.

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Segment Overview—Grace Materials Technologies

Following is an overview of the financial performance of Materials Technologies for the years ended December 31, 2018, 2017, and 2016.

Net Sales—Grace Materials Technologies

Sales were \$468.6 million for 2018, an increase of 6.5% compared with the prior year. The increase was due to higher sales volumes (+3.1%), favorable currency translation (+1.8%), and improved pricing (+1.6%). The increase in sales volumes was primarily driven by higher consumer/pharma and coatings sales in Europe, higher chemical process and coatings sales in North America, and higher sales across all product groups in Latin America. The remainder of the increase was driven by improved pricing across all regions and favorable currency translation as the U.S. dollar weakened against multiple currencies, especially the euro, compared with the prior year. Materials Technologies is our reportable segment most sensitive to changes in the euro.

Sales were \$440.0 million for 2017, an increase of 1.2% compared with the prior year. The increase was due to favorable currency translation (+1.1%) and higher sales volumes (+0.3%), partially offset by lower pricing (-0.2%). Higher sales volumes in the silicas business, primarily in Asia Pacific, were partially offset by the impact related to the exit of certain products lines in the 2016 first half and lower pharmaceutical fine chemicals sales in North America. Favorable currency translation was due to the U.S. dollar weakening against multiple currencies, especially the euro, compared with the prior year.

Segment Operating Income (SOI) and Margin—Grace Materials Technologies

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Gross profit was \$177.0 million for 2018, an increase of 6.1% compared with the prior year, primarily due to higher sales volumes and favorable product and regional mix, partially offset by higher manufacturing costs. Gross margin was 37.8% compared with 37.9% for the prior year. The decrease in gross margin was primarily due to higher manufacturing costs including a 120 basis point impact related to higher raw materials and energy costs, partially offset by favorable product and regional mix, improved pricing, and lower depreciation expense.

Segment operating income was \$105.6 million for 2018, an increase of 5.0% compared with the prior year, primarily due to higher gross profit, partially offset by higher operating expenses. Segment operating margin for 2018 decreased to 22.5%, a decline of 40 basis points compared with the prior year.

Gross profit was \$166.9 million for 2017, a decrease of 3.2% compared with the prior year, primarily due to the impact related to the exit of product lines in the 2016 first half and higher manufacturing costs. Gross margin was 37.9% compared with 39.6% for the prior year. The decrease in gross margin was primarily due to higher manufacturing costs, including 60 basis points related to higher raw materials costs.

Segment operating income was \$100.6 million for 2017, a decrease of 3.3% compared with the prior year, primarily due to higher manufacturing costs and higher operating expenses, partially offset by higher sales volumes and favorable currency translation. Segment operating margin for 2017 decreased to 22.9%, a decline of 100 basis points compared with the prior year.

Corporate Overview

Corporate costs include corporate functional costs and other corporate costs such as professional fees and insurance premiums. Corporate costs for 2018 increased 6.5% compared with the prior year, primarily due to higher incentive compensation expense.

Corporate costs for 2017 increased 16.2% compared with the prior year, primarily due to a favorable settlement of an insurance claim in 2016 and higher incentive compensation expense in 2017.

Restructuring and Repositioning Expenses

During 2018, we incurred \$14.0 million of restructuring expenses primarily related to the closure of two smaller manufacturing plants, the activities from which have been moved to larger, more cost-effective plants as part of our strategy to capture synergies from our recent Catalysts Technologies acquisitions. Restructuring expenses of \$11.5 million in 2017 primarily related to workforce reduction programs in our manufacturing, supply chain, finance and IT functions. Restructuring expenses of \$24.3 million in 2016 related to workforce reductions and the exit of certain non-strategic product lines in Materials Technologies. Substantially all costs related to the restructuring programs are expected to be paid by December 31, 2021, but could be paid earlier subject to negotiations around certain plant exit costs.

Repositioning expenses included in continuing operations for the years ended December 31, 2018, 2017, and 2016 were \$32.4 million, \$15.2 million, and \$14.3 million respectively. Expenses incurred in 2018 primarily include \$13.7 million of third-party costs related to a multi-year program to transform Grace's manufacturing and

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business processes to extend its competitive advantages and improve its cost position, \$11.7 million of severance and stock compensation costs related to employee separations, and write-offs of \$8.5 million of previously capitalized plant engineering costs as a result of terminating an expansion project no longer necessary due to the 2018 polyolefin catalysts acquisition (see Note 20 to the Consolidated Financial Statements). Expenses incurred in 2017 primarily related to third-party costs associated with productivity and transformation initiatives, as well as costs related to the Separation. Expenses incurred in 2016 primarily related to the Separation. Excluding asset write-offs and stock compensation costs, substantially all of these costs have been or are expected to be settled in cash by December 31, 2019.

The following table presents the major components of restructuring and repositioning expenses for the years ended December 31, 2018, 2017, and 2016.

(in millions)	Year Ended		
	December 31,		
	2018	2017	2016
Third-party costs of manufacturing and business transformation programs	\$13.7	\$8.2	\$—
Costs related to plant closures	13.4	0.6	—
Employee severance and accelerated stock compensation	12.3	13.5	16.1
Write-off of engineering costs	8.5	—	—
Costs related to the Separation	0.2	0.9	12.0
Write-off related to sale of product lines	—	—	6.6
Other	(1.7)	3.5	3.9
Total restructuring and repositioning expenses	\$46.4	\$26.7	\$38.6

Defined Benefit Pension Expense

Defined benefit pension expense includes costs under U.S. and non-U.S. defined benefit pension plans that provide benefits to business segment and corporate employees, as well as retirees and former employees of divested businesses where we retained these obligations.

Under mark-to-market accounting, our pension costs consist of two elements: 1) “certain pension costs”—ongoing costs recognized quarterly, which include service and interest costs, expected returns on plan assets, and amortization of prior service costs/credits; and 2) “pension mark-to-market adjustment and other related costs, net”—mark-to-market gains and losses recognized annually in the fourth quarter, or at an interim period should a significant event occur, resulting from changes in actuarial assumptions, such as discount rates and the difference between actual and expected returns on plan assets.

Certain pension costs were \$15.9 million, \$13.0 million and \$12.3 million for 2018, 2017 and 2016, respectively. The increases were primarily due to a decrease in discount rates.

Pension mark-to-market adjustment and other related costs, net were \$(15.2) million, \$51.1 million and \$60.3 million for 2018, 2017 and 2016, respectively. These costs are reported in “other (income) expense, net” in our Consolidated Financial Statements. The 2018 mark-to-market pension income of \$15.2 million was primarily due to the increase in discount rates used to value the projected benefit obligations of our plans from year-end 2017 to year-end 2018, partially offset by lower than expected return on assets. The 2017 mark-to-market pension expense of \$51.1 million was primarily due to the decrease in discount rates used to value the projected benefit obligations of our plans from year-end 2016 to year-end 2017, partially offset by higher than expected return on assets in the U.S. The 2016 mark-to-market pension expense of \$60.3 million was primarily due to the decrease in discount rates used to value the projected benefit obligations of our plans from year-end 2015 to year-end 2016, partially offset by higher than expected return on assets in the U.S.

Interest and Financing Expenses

Net interest and financing expenses were \$78.5 million for 2018, flat compared with 2017. Interest and financing expenses were \$78.5 million for 2017, a decrease of 2.5% compared with 2016, primarily due to voluntary prepayments of our term loans in February and March 2016, partially offset by higher interest expense due to borrowings on our floating rate term loans and revolving credit facility.

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Income Taxes

Income tax expense (benefit) for 2018, 2017 and 2016 was \$78.1 million, \$200.5 million and \$59.0 million, respectively, on income from continuing operations before income taxes of \$244.9 million, \$210.9 million and \$166.0 million in 2018, 2017 and 2016, respectively.

Our 2018 effective tax rate of 31.9% was higher than the 21% U.S. statutory rate. The higher rate was primarily caused by recognition of the GILTI tax that could not be offset with a corresponding GILTI deduction due to Grace utilizing NOLs in 2018. Once we have fully utilized our NOLs, we will be able to take advantage of the GILTI deduction that is currently limited due to NOL utilization. The geographic mix of income also contributed to the higher rate since the statutory rates in effect for our foreign subsidiaries exceed the 21% U.S. statutory rate.

Our 2017 effective tax rate includes \$143.0 million in charges related to the TCJA. The effective tax rate without the impact of the TCJA was 27.3%, lower than the 35% U.S. statutory rate, primarily due to the geographic mix of income and the R&D credit.

Our 2016 effective tax rate of 35.5% was slightly higher than the 35% U.S. statutory rate. The benefit from the geographic mix of income and stock compensation windfall was nearly fully offset by state income taxes and other permanent items.

See Note 7 to the Consolidated Financial Statements for additional information regarding income taxes.

Financial Condition, Liquidity, and Capital Resources

Following is an analysis of our financial condition, liquidity and capital resources at December 31, 2018.

Our principal uses of cash are generally capital investments and acquisitions; working capital investments; compensation paid to employees, including contributions to our defined benefit pension plans and defined contribution plans; the repayment of debt and interest payments thereon; and the return of cash to shareholders through repurchase of shares and dividends.

On February 8, 2017, we announced that the Board of Directors had authorized a share repurchase program of up to \$250 million. Under this program, during 2018 we repurchased 1,171,141 shares of Company common stock for \$80.0 million. As of December 31, 2018, \$138.9 million remained under the current authorization.

We paid cash dividends of \$64.6 million during 2018. On February 8, 2018, we announced that the Board of Directors had approved an increase in the annual dividend rate, from \$0.84 to \$0.96 per share of Company common stock, effective with the dividend paid March 22, 2018. On February 7, 2019, we announced that the Board of Directors had approved a further increase to \$1.08 per share of Company common stock.

We believe that the cash we expect to generate during 2019 and thereafter, together with other available liquidity and capital resources, are sufficient to finance our operations, growth strategy, share repurchase program and expected dividend payments, and meet our debt and pension obligations.

On April 3, 2018, we entered into the Credit Agreement, which provides for new secured credit facilities, consisting of:

- (a) a \$950 million term loan due in 2025, with interest at LIBOR +175 basis points, and
- (b) a \$400 million revolving credit facility due in 2023, with interest at LIBOR +175 basis points.

We used the proceeds from the term loan to repay in full the outstanding borrowings of \$507.0 million under our 2014 credit agreement, to fund the 2018 polyolefin catalysts acquisition for \$418.0 million, and to make a voluntary \$50.0 million accelerated contribution to our U.S. qualified pension plans. See Note 5 to the Consolidated Financial Statements for additional information related to the Credit Agreement.

Cash Resources and Available Credit Facilities

At December 31, 2018, we had available liquidity of \$606.7 million, consisting of \$200.5 million in cash and cash equivalents (\$100.5 million in the U.S.), \$367.6 million available under our revolving credit facility, and \$38.6 million of available liquidity under various non-U.S. credit facilities. The \$400 million revolving credit facility includes a \$100 million sublimit for letters of credit.

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Our non-U.S. credit facilities are extended to various subsidiaries that use them primarily to issue bank guarantees supporting trade activity and to provide working capital during occasional cash shortfalls. We generally renew these credit facilities as they expire.

The following table summarizes our non-U.S. credit facilities as of December 31, 2018:

(In millions)	Maximum Borrowing Amount	Available Liquidity	Expiration Date
China	\$ 22.9	\$ 20.6	April 3, 2023
Other countries	28.4	18.0	Various through 2023, as well as open-ended
Total	\$ 51.3	\$ 38.6	

Analysis of Cash Flows

The following table summarizes our cash flows for the years ended December 31, 2018, 2017, and 2016:

(In millions)	Year Ended December 31,		
	2018	2017	2016
Net cash provided by (used for) operating activities from continuing operations	\$342.0	\$319.2	\$267.5
Net cash provided by (used for) investing activities from continuing operations	(618.5)	(129.2)	(344.4)
Net cash provided by (used for) financing activities from continuing operations	316.5	(134.8)	(60.2)
Effect of currency exchange rate changes on cash and cash equivalents	(2.5)	7.7	(3.0)
Increase (decrease) in cash and cash equivalents from continuing operations	37.5	62.9	(140.1)
Increase (decrease) in cash and cash equivalents from discontinued operations	—	—	44.8
Net increase (decrease) in cash and cash equivalents	37.5	62.9	(95.3)
Less: cash and cash equivalents of discontinued operations	—	—	(143.4)
Cash and cash equivalents, beginning of period	163.5	100.6	339.3
Cash and cash equivalents, end of period	\$201.0	\$163.5	\$100.6

Net cash provided by operating activities in 2018 was \$342.0 million compared with \$319.2 million in the prior year.

The year-over-year change in cash flow was primarily due to higher income from continuing operations and the timing of advance payments from customers in 2018, and a 2017 payment of \$30 million to satisfy a deferred payment obligation to the asbestos property damage trust required under the joint plan of reorganization, partially offset by a \$50.0 million accelerated contribution to the U.S. defined benefit pension plans, higher net cash paid for income taxes, and the prior-year dividend received from ART that did not repeat in 2018.

Net cash provided by operating activities in 2017 was \$319.2 million compared with \$267.5 million in the prior year.

The year-over-year change in cash flow was primarily due to higher income from continuing operations before income taxes and lower net cash paid for income taxes, partially offset by a 2017 payment of \$30 million to satisfy a deferred payment obligation to the asbestos property damage trust required under the joint plan of reorganization.

Net cash used for investing activities in 2018 was \$618.5 million compared with \$129.2 million in the prior year and \$344.4 million in 2016. Net cash used for investing activities primarily includes the net cash paid for capital expenditures and businesses acquired. Our capital expenditures include investments in new capacity, improved productivity, information technology, and maintenance of our manufacturing and office facilities. We expect our capital expenditures in 2019 to be in the range of \$200 million to \$210 million and have entered into commitments related to a portion of those expenditures. We expect to fund our capital expenditures from net cash provided by operating activities.

In 2018, we completed the purchase of the polyolefin catalysts business of Albemarle Corporation for \$418.0 million, and in 2016, we completed the purchase of the BASF polyolefin catalysts business for \$246.5 million. The 2016 acquisition cost was partially offset by \$11.3 million in proceeds from the sale of assets.

Net cash provided by financing activities in 2018 was \$316.5 million compared with cash used of \$134.8 million in 2017 and \$60.2 million in 2016. In 2018, we entered into a new Credit Agreement and used a portion of

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the proceeds to repay in full the borrowings outstanding under our 2014 credit agreement. Cash paid for repurchases of common stock in 2018 was \$80.0 million, compared with \$65.0 million in 2017 and \$195.1 million in 2016. We paid cash dividends of \$64.6 million in 2018, compared with \$57.3 million in 2017 and \$36.0 million in 2016. In 2016, we received a \$750 million distribution of cash from GCP, of which we used \$600 million to pay down our euro and U.S. dollar term loans in the first quarter.

Debt and Other Contractual Obligations

Total debt outstanding at December 31, 2018, was \$1,983.3 million. Set forth below are our contractual obligations as of December 31, 2018:

(In millions)	Payments Due by Period				
	Total	Less than 1 Year	2-3 Years	4-5 Years	More Than 5 Years
Debt	\$1,983.3	\$22.3	\$731.7	\$31.6	\$1,197.7
Expected interest payments on debt(1)	452.5	96.3	181.6	114.2	60.4
Operating lease obligations	32.5	8.3	9.6	3.2	11.4
Operating commitments(2)	256.8	166.6	86.9	3.3	—
Pension funding requirements per ERISA(3)	5.5	0.1	0.6	4.8	—
Pension funding requirements for non-U.S. pension plans(4)	46.5	8.8	18.3	19.4	—
Total Contractual Obligations	\$2,777.1	\$302.4	\$1,028.7	\$176.5	\$1,269.5

(1) Amounts are based on current interest rates as of December 31, 2018, for principal debt outstanding as of December 31, 2018. Actual interest payments may vary based on any interest rate swaps in effect.

(2) Amounts do not include open purchase commitments, which are routine in nature and normally settle within 90 days, or obligations to employees under annual or long-term incentive programs.

(3) Based on the U.S. qualified pension plans' status as of December 31, 2018, minimum funding requirements under ERISA have been estimated for the next five years. Amounts in subsequent years or additional payments have not yet been determined.

(4) Based on the non-U.S. pension plans' status as of December 31, 2018, funding requirements have been estimated for the next five years. Amounts in subsequent years have not yet been determined.

See Note 10 to the Consolidated Financial Statements for a discussion of Financial Assurances.

Employee Benefit Plans

See Note 8 to the Consolidated Financial Statements for further discussion of Pension Plans and Other Retirement Plans.

Defined Contribution Retirement Plan

We sponsor a defined contribution retirement plan for our employees in the United States. This plan is qualified under section 401(k) of the U.S. tax code. Currently, we contribute an amount equal to 100% of employee contributions, up to 6% of an individual employee's salary or wages. Our costs related to this benefit plan were \$12.6 million, \$11.5 million and \$11.1 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Defined Benefit Pension Plans

We sponsor defined benefit pension plans for our employees in the U.S., Canada, Germany, and a number of other countries, and fund government-sponsored programs in other countries where we operate. Certain of our defined benefit pension plans are advance-funded and others are pay-as-you-go. The advance-funded plans are administered by trustees who receive direction related to the management of plan assets and arrange to have obligations paid when due. Our most significant advance-funded plans cover current and former salaried employees in the U.S. and employees covered by collective bargaining agreements at certain of our U.S. facilities. Our U.S. advance-funded plans are qualified under the U.S. tax code.

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The following table presents the funded status of our underfunded and unfunded pension plans:

(In millions)	Underfunded		Unfunded	
	Pension Plans(1)		Pension Plans(2)	
	2018	2017	2018	2017
Projected benefit obligation	\$920.3	\$1,241.8	\$380.0	\$406.9
Fair value of plan assets	852.5	1,131.3	—	—
Funded status (PBO basis)	\$(67.8)	\$(110.5)	\$(380.0)	\$(406.9)

(1) Plans intended to be advance-funded.

(2) Plans intended to be pay-as-you-go.

Underfunded plans include a group of advance-funded plans that are underfunded on a PBO basis by a total of \$67.8 million as of December 31, 2018. Additionally, we have several plans that are funded on a pay-as-you-go basis, and therefore, the entire PBO of \$380.0 million at December 31, 2018, is unfunded. The combined balance of the underfunded and unfunded plans was \$447.8 million as of December 31, 2018, and is presented as a liability on the Consolidated Balance Sheets as follows: \$14.7 million in “other current liabilities” and \$433.1 million included in “underfunded and unfunded defined benefit pension plans.”

At the December 31, 2018, measurement date for the U.S. advance-funded plans, the PBO was approximately \$930 million as measured under U.S. GAAP. The PBO is measured as the present value (using a 4.22% weighted average discount rate as of December 31, 2018) of vested and non-vested benefits earned from employee service to date, based upon current services and estimated future pay increases for active employees. Of the participants in the U.S. advance-funded plans, approximately 78% are retired or former employees or employees of our former businesses, which shortens the duration of the PBO. Assets available to fund the PBO for the U.S. advance-funded plans at December 31, 2018, were approximately \$871 million, or approximately \$59 million less than the measured obligation.

The following table presents the components of cash contributions for the advance-funded and pay-as-you-go plans:

(In millions)	2018	2017	2016
U.S. advance-funded plans	\$50.0	\$2.1	\$—
U.S. pay-as-you-go plans	6.9	7.5	7.5
Non-U.S. advance-funded plans	1.9	1.1	1.3
Non-U.S. pay-as-you-go plans	7.7	7.1	7.1
Total Cash Contributions	\$66.5	\$17.8	\$15.9

We intend to fund non-U.S. pension plans based upon applicable legal requirements and actuarial and trustee recommendations. We contributed \$9.6 million to these plans in 2018.

Other Contingencies

See Note 10 to the Consolidated Financial Statements for a discussion of our other contingent matters.

Inflation

We recognize that inflationary pressures may have an adverse effect on us through higher asset replacement costs and higher raw materials and other operating costs. We experienced raw materials cost inflation during the 2017 second half and throughout 2018 and expect to see continued inflation in 2019 but at a lower rate than in 2018. We try to minimize these impacts through effective control of operating expenses, productivity improvements, and hedging purchases of certain raw materials, as well as price increases on our products.

Critical Accounting Estimates

The preparation of financial statements in conformity with U.S. GAAP requires that we make estimates and assumptions affecting the assets and liabilities reported at the date of the Consolidated Financial Statements, and

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the revenues and expenses reported for the periods presented. We believe that our accounting estimates are appropriate and the related balances are reasonable; however, actual amounts could differ from the original estimates, requiring adjustments in future periods. Changes in estimates are recorded in the period in which the change is identified. Our accounting policies are described in Note 1 to the Consolidated Financial Statements. Critical accounting estimates are described in this section.

An accounting estimate is considered critical if the estimate requires management to make assumptions and judgments about matters that were highly uncertain at the time the estimate was made, if different estimates reasonably could have been used, or if changes in the estimate are reasonably likely to occur from period to period that could have a material impact on our financial condition or results of operations. As part of our quarterly disclosure controls and procedures, management has discussed the development, selection and disclosure of the critical accounting estimates with the Audit Committee of the Board of Directors.

Contingent Liabilities

We have recorded a liability for the resolution of contingencies related to asbestos property damage, environmental remediation, and litigation. We record a liability if we have determined that a loss is probable and we are able to reasonably estimate the amount of the loss or have another reasonable basis for recording a liability. We have determined that each of the contingencies discussed below involves an accounting judgment that is material to our Consolidated Financial Statements.

Legacy Product Liabilities

We emerged from an asbestos-related Chapter 11 bankruptcy on February 3, 2014, as discussed in Note 10 to the Consolidated Financial Statements. Under the plan of reorganization, all pending and future asbestos-related claims are channeled for resolution to either the PI Trust or the PD Trust. The trusts are the sole recourse for holders of asbestos-related claims. The channeling injunctions issued by the bankruptcy court prohibit holders of asbestos-related claims from asserting such claims directly against us.

We have satisfied all of our financial obligations to the PI Trust. We have contingent financial obligations remaining to the PD Trust. With respect to property damage claims related to ZAI PD Claims, the PD Trust was funded with \$34.4 million on the Effective Date and \$30 million on February 3, 2017. We are also obligated to make up to 10 contingent deferred payments of \$8 million per year to the PD Trust in respect of ZAI PD Claims during the 20-year period beginning on the fifth anniversary of the Effective Date, with each such payment due only if the assets of the PD Trust in respect of ZAI PD Claims fall below \$10 million during the preceding year. As of December 31, 2018, we have evaluated the activity in the PD Trust with respect to ZAI PD Claims and other trust expenses.

Through December 31, 2018, the PD Trust has paid approximately \$15 million in ZAI PD Claims, approximately \$6 million in operating and education expenses, and approximately \$15 million in one-time attorneys' fees. The PD Trust balance was approximately \$30 million as of December 31, 2018. We expect ZAI PD Claims payments to decline over time but have limited information to estimate the amount and timing of future claims payments. It is reasonably possible that one or more contingent deferred payments will be made in the future. We estimate the present value of reasonably possible future payments to range between \$0 million and \$20 million. We have not accrued for any contingent deferred payments as we do not believe that payment is probable. We will continue to evaluate new information as it becomes available and will revise our estimate of the amount and timing of future claims payments and any contingent deferred payments at that time. We are not obligated to make additional payments to the PD Trust in respect of ZAI PD Claims beyond the payments described above. We have satisfied all of our financial obligations with respect to Canadian ZAI PD Claims.

With respect to Other PD Claims, claims unresolved as of the Effective Date are to be litigated in the bankruptcy court and any future claims are to be litigated in a federal district court, in each case pursuant to procedures approved by the bankruptcy court. To the extent any such Other PD Claims are determined to be allowed claims, they are to be paid in cash by the PD Trust. We are obligated to make a payment to the PD Trust every six months in the amount of any Other PD Claims allowed during the preceding six months plus interest (if applicable) and the amount of PD Trust expenses for the preceding six months. We have not paid any Other PD Claims since emergence. Annual expenses have been approximately \$0.2 million per year. The aggregate amount to be paid under the PD Obligation is not

capped, and we may be obligated to make additional payments to the PD Trust in respect of the PD Obligation. We have accrued for those unresolved Other PD Claims that we

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believe are probable and estimable. We have not accrued for other unresolved or unasserted Other PD Claims as we do not believe that payment is probable.

All payments to the PD Trust required after the Effective Date are secured by our obligation to issue 77,372,257 shares of Company common stock to the PD Trust in the event of default, subject to customary anti-dilution provisions.

Environmental Remediation

We are obligated under applicable law to remediate certain properties related to our business or former businesses. At some sites we outsource all or a portion of the remediation to third parties, and at others we perform the required remediation ourselves. Our environmental remediation obligation has a significant impact on our Consolidated Financial Statements. See disclosure in this Report in Item 1 (Business—Environment, Health and Safety Matters) and in Note 10 to the Consolidated Financial Statements for a discussion of our environmental remediation liabilities.

At sites where third parties conduct remediation, we estimate our obligations from information available to us through such third parties, including actual costs incurred, expected future costs and time to completion. At sites where we conduct remediation, we use available information, work with regulatory authorities to define compliance requirements, and then estimate the cost required to meet those requirements. We base our estimates on our historical knowledge and engineering assessments specific to conditions at each site, and we update our estimates as necessary. Our estimates can fluctuate significantly due to the extended duration of some remediation projects. The accuracy of our estimates is dependent on the validity of assumptions regarding regulatory approaches and such matters as labor rates, indirect costs and capital costs, which are each difficult to forecast over extended periods. It is not practicable to estimate the impact on our Consolidated Financial Statements of using other reasonably possible assumptions. Future changes in estimates, if required, may lead to material adjustments to our Consolidated Financial Statements, and the ultimate resolution of these obligations could have a material impact on our liquidity and capital resources.

We purchased a vermiculite mine in Libby, Montana, in 1963 and operated it until 1990. Vermiculite concentrate from the Libby mine was used in the manufacture of attic insulation and other products. Some of the vermiculite ore contained naturally occurring asbestos. We are engaged with the EPA and other federal, state and local governmental agencies in a remedial investigation and feasibility study of the Libby mine and the surrounding area, known as OU3. The RI/FS will determine the specific areas within OU3 requiring remediation and will identify possible remedial action alternatives. Possible remedial actions within OU3 are wide-ranging, from institutional controls such as land use restrictions, to more active measures involving soil removal, containment projects, or other protective measures. As part of the RI/FS process, we contracted an engineering and consulting firm to develop a range of possible remedial alternatives and associated cost estimates for OU3. Based on this work, we recorded a pre-tax charge of \$70.0 million in the 2018 third quarter for the estimated costs of remediation of OU3. We believe that this amount should provide for a protective remedy meeting the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act.

The estimated costs of remediation are preliminary and consist of several components, each of which may vary significantly as the remedial alternatives are further developed. It is reasonably possible that the ultimate costs of remediation could range between \$30 million and \$170 million. Grace is working closely with the EPA, and the ultimate remedy will be determined by the EPA after the RI/FS is finalized. Such remedy will be set forth in a Record of Decision (“ROD”) that is expected to be issued by the EPA during or after 2020. Costs associated with the more active remedial alternatives would be expected to be incurred over a decade or more. We will reevaluate our estimated liability as remedial alternatives evolve based on further work by the engineering and consulting firm and discussions with the EPA as the RI/FS process moves toward a ROD. Depending on the remedial alternatives that the EPA selects in the ROD, the total cost of remediating OU3 may exceed our current estimate by material amounts.

The EPA is also investigating or remediating formerly owned or operated sites that processed Libby vermiculite into finished products. We are cooperating with the EPA on these investigation and remediation activities and have recorded a liability to the extent that our review has indicated that a probable liability has been

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incurred and the cost is estimable. These liabilities cover the estimated cost of investigations and, to the extent an assessment has indicated that remediation is necessary, the estimable cost of response actions. Response actions typically involve soil excavation and removal, and replacement with clean fill. The EPA may commence additional investigations in the future at other sites that processed Libby vermiculite, but we do not believe, based on our knowledge of prior and current operations and site conditions, that liability for remediation at such other sites is probable.

Our current estimates of our environmental remediation obligations do not include the costs related to any additional EPA claims, which may be material but are not currently estimable. It is possible that our ultimate liability for environmental remediation will exceed our current estimates by material amounts.

Other Legacy Liabilities

As part of the process for renewing our permit for a dam on the Libby mine site, which expires in March 2019, the Montana Department of Natural Resources and Conservation is expected to require us to replace the dam spillway, which is deteriorating, with a new spillway. We constructed the dam in 1971 to prevent vermiculite ore tailings from moving into nearby creeks and rivers. Based on information provided by third-party consultants, the cost of the new spillway is estimated to be between \$40 million and \$45 million. We expect to record a liability for this project at the time the permit renewal is approved. We anticipate that approval of the renewal of such permit will occur in the first quarter of 2019. Construction of the new spillway is expected to take three to four years.

Litigation

We are subject to legal proceedings and claims arising out of the normal course of business. To estimate the cost to resolve our legal obligations, we review the facts of each matter to determine the merits of the case and the corresponding probability of a loss. If we determine that a loss is probable, we determine if there is sufficient information to make a reasonable estimate of the loss amount. Our estimates regarding the outcome of our legal proceedings and claims involve substantial uncertainties that could cause our actual losses to differ materially from our estimates. In estimating the likely outcome of a legal proceeding, we consider the nature of the specific claim (or unasserted claim), our experience with similar claims, the jurisdiction in which the proceeding is filed, court rulings, the status of any settlement negotiations, the likelihood of resolution through settlement or alternative dispute resolution, the proceeding's current status and other relevant information and events. We adjust our recorded liability for litigation contingencies as necessary to reflect our current evaluation of these and other factors.

Goodwill and Intangible Assets

We account for business combinations under the acquisition method of accounting, which requires us to allocate the purchase price to the tangible and identifiable intangible assets and liabilities acquired based on their estimated fair values at the acquisition date in accordance with ASC 805 "Business Combinations." The excess of the purchase price over the fair values of these identifiable assets and liabilities is recorded to goodwill. The assessment of fair value requires management to make significant estimates, including future expected revenues, earnings, and cash flows; expected useful lives; and attrition and discount rates. The allocation of the purchase price may be adjusted during the measurement period, which may not exceed one year after the acquisition date.

We review our finite-lived tangible and intangible assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be fully recoverable. We have no indefinite-lived intangible assets. There were no impairment charges recorded in any of the periods presented.

We review our goodwill for impairment on an annual basis at October 31 and whenever events or a change in circumstances indicate that the carrying amount may not be fully recoverable. We have identified our operating segments as reporting units for goodwill impairment testing. Our Catalysts Technologies reportable segment has two reporting units for goodwill impairment testing, which are our Refining Technologies and Specialty Catalysts operating segments. Our Materials Technologies operating segment represents a single reporting unit for goodwill impairment testing.

We performed a quantitative analysis as of October 31, 2018, and concluded that the estimated fair value of all of our reporting units substantially exceeded their carrying values.

Table of Contents**Pension Expenses and Liabilities**

We sponsor defined benefit pension plans for our employees in the United States and a number of other countries, including Canada and Germany, and fund government-sponsored programs in other countries where we operate. See Note 8 to the Consolidated Financial Statements for a detailed discussion of our pension plans.

In order to estimate our pension expenses and liabilities we evaluate the range of possible assumptions to be used in the calculation of pension expenses and liabilities. We select the assumptions that we believe to be most indicative of factors such as participant demographics, past experiences and market indices, and provide the assumptions to independent actuaries. These assumptions are updated annually and primarily include factors such as discount rates, expected return on plan assets, mortality rates, retirement rates, and rate of compensation increase. The independent actuaries review our assumptions for reasonableness, and use the assumptions to calculate our estimated liability and future pension expense. We review the actuarial reports for reasonableness and adjust our expenses, assets and liabilities to reflect the amounts calculated in the actuarial reports.

The two key assumptions used in determining our pension benefit obligations and pension expense are the discount rate and expected return on plan assets. Our most significant pension assets and pension liabilities relate to U.S. pension plans.

The assumed discount rate for pension plans reflects the market rates for high-quality corporate bonds currently available and is subject to change based on changes in overall market interest rates. For the U.S. pension plans, the assumed weighted average discount rate was selected in consultation with our independent actuaries, based on a yield curve constructed from a portfolio of high quality bonds for which the timing and amount of cash outflows approximate the estimated payouts of the plan.

We selected the expected return on plan assets for the U.S. qualified pension plans for 2018 in consultation with our independent actuaries, using an expected return model. The model determines the weighted average return for an investment portfolio based on the target asset allocation and expected future returns for each asset class, which were developed using a building block approach based on observable inflation, available interest rate information, current market characteristics, and historical results.

The following table reflects the sensitivity of 2019 pre-tax expense (excluding the effects of the annual mark-to-market adjustment) and our year-end projected benefit obligation, or PBO, to a change in the discount rate and expected rate of return on plan assets assumptions for the U.S. pension plans:

Change in Assumption (In millions)	Effect	
	on 2019 Pre-Tax Pension Expense	Effect on December 31, 2018 PBO
25 basis point decrease in discount rate	\$ (1)	\$ 27
25 basis point increase in discount rate	1	(26)
25 basis point decrease in expected return on plan assets	2	—
25 basis point increase in expected return on plan assets	(2)	—

Income Taxes

Our effective tax rate is primarily determined based on our pre-tax income and the statutory income tax rates in the jurisdictions in which we operate. The effective tax rate also reflects the tax impacts of items treated differently for tax purposes than for financial reporting purposes. Some of these differences are permanent, such as expenses that are not deductible in our tax returns, and some differences are temporary, reversing over time, such as depreciation expense. These temporary differences create deferred income tax assets and liabilities. Deferred income tax assets are also recorded for NOL and federal tax credit carryforwards.

Deferred income tax assets and liabilities are recognized by applying enacted tax rates to temporary differences that exist as of the balance sheet date. We reduce the carrying amounts of deferred tax assets by a valuation allowance if, based on the available evidence, it is more likely than not that such assets will not be realized. The need to establish valuation allowances for deferred tax assets is assessed quarterly. In assessing the requirement for, and amount of, a

valuation allowance in accordance with the more likely than not standard, we give appropriate consideration to all positive and negative evidence related to the realization of the deferred

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tax assets. This assessment considers, among other matters, the nature, frequency and severity of current and cumulative losses, forecasts of future profitability and foreign source income (“FSI”), the duration of statutory carryforward periods, and our experience with operating loss and tax credit carryforward expirations. A history of cumulative losses is a significant piece of negative evidence used in our assessment. If a history of cumulative losses is incurred for a tax jurisdiction, forecasts of future profitability are not used as positive evidence related to the realization of the deferred tax assets in the assessment.

As further described in Note 7 to the Consolidated Financial Statements, our Consolidated Balance Sheet as of December 31, 2018, includes net deferred income tax assets of \$518.5 million. Included in this amount are deferred U.S. federal income tax assets representing federal tax credit carryforwards of \$291.0 million, federal NOL carryforwards of \$44.3 million, state NOL deferred income tax assets of \$52.9 million, and foreign NOL deferred tax assets of \$5.7 million. We have established valuation allowances in the amount of \$19.9 million, consisting of \$6.6 million for state NOL carryforwards, \$4.2 million for foreign deferred tax assets, primarily foreign operating loss carryforwards, and 5.2 million for federal tax credits.

In order to fully utilize our U.S. federal tax credits before they expire from 2021 to 2028, we will need to generate income of approximately \$1.4 billion. We estimate that we will need to generate future U.S. taxable income of approximately \$232 million before 2035 to fully utilize the federal NOLs. We will need to generate approximately \$1.9 billion for state income tax purposes during the respective realization periods (ranging from 2018 to 2035) in order to fully realize the state NOLs.

Inherent in determining our effective tax rate are judgments regarding business plans and expectations about future operations. These judgments include the amount and geographic mix of future taxable income, the amount of FSI, limitations on the usage of NOL carryforwards, the impact of ongoing or potential tax audits, and other future tax consequences.

The federal tax credit carryforwards arose primarily as a result of the payment of intercompany dividends from our foreign affiliates, from the mandatory repatriation under the TCJA, and from research and development credits. The federal and state NOLs arose primarily as a result of the amounts paid as a result of our bankruptcy proceedings. Our ability to utilize deferred tax assets may be impacted by certain future events, such as changes in tax legislation or insufficient future taxable income or FSI prior to expiration of certain deferred tax assets.

We recognize the tax benefits of an uncertain tax position if those benefits are more likely than not to be sustained based on existing tax law. Additionally, we establish a reserve for tax positions that are more likely than not to be sustained based on existing tax law, but uncertain in the ultimate benefit to be sustained upon examination by the relevant taxing authorities. Unrecognized tax benefits are subsequently recognized at the time the more likely than not recognition threshold is met, the tax matter is effectively settled or the statute of limitations for the relevant taxing authority to examine and challenge the tax position has expired, whichever is earlier.

Recent Accounting Pronouncements

See Note 1 to the Consolidated Financial Statements for a discussion of recent accounting pronouncements and their effect on us.

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W. R. GRACE & CO. AND SUBSIDIARIES

FINANCIAL STATEMENT SCHEDULE II—VALUATION AND QUALIFYING ACCOUNTS AND RESERVES

(In millions)

For the Year Ended December 31, 2018

Description	Balance at beginning of period	Additions charged to costs and expenses	Deductions	Other, net(1)	Balance at end of period
Valuation and qualifying accounts deducted from assets:					
Allowances for notes and accounts receivable	\$ 12.0	\$ —	—	\$ —	—\$ 12.0
Valuation allowance for deferred tax assets(2)	12.0	10.7	(2.8)	—	19.9
Reserves:					
Reserves for environmental remediation(3)	70.3	73.8	(17.7)	—	126.4
Reserves for retained obligations of divested businesses	12.8	1.0	(1.6)	—	12.2

For the Year Ended December 31, 2017

Description	Balance at beginning of period	Additions charged to costs and expenses	Deductions	Other, net(1)	Balance at end of period
Valuation and qualifying accounts deducted from assets:					
Allowances for notes and accounts receivable(4)	\$ 2.8	\$ 10.6	\$ (1.3)	\$(0.1)	\$ 12.0
Valuation allowance for deferred tax assets(5)	31.4	0.3	(19.7)	—	12.0
Reserves:					
Reserves for environmental remediation	66.3	24.4	(20.4)	—	70.3
Reserves for retained obligations of divested businesses	11.7	1.5	(0.4)	—	12.8

For the Year Ended December 31, 2016

Description	Balance at beginning of period	Additions charged to costs and expenses	Deductions	Other, net(1)	Balance at end of period
Valuation and qualifying accounts deducted from assets:					
Allowances for notes and accounts receivable	\$ 1.4	\$ 2.4	\$ (1.1)	\$ 0.1	\$ 2.8
Valuation allowance for deferred tax assets(6)	8.4	11.6	(9.1)	20.5	31.4
Reserves:					
Reserves for environmental remediation	55.2	29.2	(18.1)	—	66.3
Reserves for retained obligations of divested businesses	13.5	—	(1.8)	—	11.7

(1) Effects of currency translation and, in 2016, the Separation.

(2) The valuation allowance increased \$7.9 million from December 31, 2017, to December 31, 2018. The increase was primarily due to expected foreign tax credit utilization.

(3) The increase was primarily related to a pre-tax charge of \$70.0 million for the estimated costs of future remediation-related activities at the former vermiculite mine site in Libby, Montana.

The allowance for accounts receivable increased primarily due to a \$10.0 million charge to fully reserve for a trade
(4) receivable from a Venezuela-based customer related to increased economic uncertainty and the recent political unrest and sanctions.

(5) The valuation allowance decreased \$19.4 million from December 31, 2016, to December 31, 2017. The decrease was primarily due to the effects of U.S. tax reform.

The valuation allowance increased \$23.0 million from December 31, 2015, to December 31, 2016. The increase
(6) was primarily due to the adoption of ASU 2016-09 as well as the ability to utilize NOL carryforwards as a result of the Separation.

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EXHIBIT 31(i).1

CERTIFICATION OF PERIODIC REPORT UNDER SECTION 302 OF
THE SARBANES-OXLEY ACT OF 2002

I, Hudson La Force, certify that:

1. I have reviewed this annual report on Form 10-K of W. R. Grace & Co.;

Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a
2. material fact necessary to make the statements made, in light of the circumstances under which such statements
were made, not misleading with respect to the period covered by this report;

Based on my knowledge, the financial statements, and other financial information included in this report, fairly
3. present in all material respects the financial condition, results of operations and cash flows of the registrant as of,
and for, the periods presented in this report;

The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls
4. and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial
reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed
(a) under our supervision, to ensure that material information relating to the registrant, including its consolidated
subsidiaries, is made known to us by others within those entities, particularly during the period in which this report
is being prepared;

designed such internal control over financial reporting, or caused such internal control over financial reporting to
(b) be designed under our supervision, 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;

evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our
(c) conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered
by this report based on such evaluation; and

disclosed in this report any change in the registrant's internal control over financial reporting that occurred during
(d) the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that
has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial
reporting; and

The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal
5. control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of
directors (or persons performing the equivalent functions):

all significant deficiencies and material weaknesses in the design or operation of internal control over financial
(a) reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and
report financial information; and

(b) any fraud, whether or not material, that involves management or other employees who have a significant role in the
registrant's internal control over financial reporting.

Date: February 28, 2019

/s/ HUDSON LA FORCE

Hudson La Force

President and Chief Executive Officer

(Principal Executive Officer)

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EXHIBIT 31(i).2

CERTIFICATION OF PERIODIC REPORT UNDER SECTION 302 OF
THE SARBANES-OXLEY ACT OF 2002

I, Hudson La Force, certify that:

1. I have reviewed this annual report on Form 10-K of W. R. Grace & Co.;

Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a
2. material fact necessary to make the statements made, in light of the circumstances under which such statements
were made, not misleading with respect to the period covered by this report;

Based on my knowledge, the financial statements, and other financial information included in this report, fairly
3. present in all material respects the financial condition, results of operations and cash flows of the registrant as of,
and for, the periods presented in this report;

The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls
4. and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial
reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed
(a) under our supervision, to ensure that material information relating to the registrant, including its consolidated
subsidiaries, is made known to us by others within those entities, particularly during the period in which this report
is being prepared;

designed such internal control over financial reporting, or caused such internal control over financial reporting to
(b) be designed under our supervision, 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;

evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our
(c) conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered
by this report based on such evaluation; and

disclosed in this report any change in the registrant's internal control over financial reporting that occurred during
(d) the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that
has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial
reporting; and

The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal
5. control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of
directors (or persons performing the equivalent functions):

all significant deficiencies and material weaknesses in the design or operation of internal control over financial
(a) reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and
report financial information; and

(b) any fraud, whether or not material, that involves management or other employees who have a significant role in the
registrant's internal control over financial reporting.

Date: February 28, 2019

/s/ HUDSON LA FORCE

Hudson La Force

President and Chief Executive Officer

(Acting Principal Financial Officer)

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EXHIBIT 32

CERTIFICATION UNDER SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 (18 U.S.C. Section 1350), the undersigned certifies that (1) this Annual Report of W. R. Grace & Co. (the “Company”) on Form 10-K for the period ended December 31, 2018, as filed with the Securities and Exchange Commission on the date hereof (this “Report”), fully complies with the requirements of Sections 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, and (2) the information contained in this Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ HUDSON LA FORCE

Hudson La Force

President and Chief Executive Officer

(Principal Executive Officer)

/s/ HUDSON LA FORCE

Hudson La Force

President and Chief Executive Officer

(Acting Principal Financial Officer)

Date: February 28, 2019

A signed original of this written statement required by Section 906 has been provided to the Company and will be retained by the Company and furnished to the Securities and Exchange Commission or its staff upon request.