ALBEMARLE CORP
Form 10-K
February 27, 2019
UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

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x 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
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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 001-12658
ALBEMARLE CORPORATION
(Exact name of registrant as specified in its charter)

VIRGINIA	54-1692118
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

4250 Congress Street, Suite 900
Charlotte, North Carolina 28209
(Address of principal executive offices) (Zip Code)
Registrant's telephone number, including area code: (980) 299-5700
Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
COMMON STOCK, $.01 Par Value	NEW YORK STOCK EXCHANGE

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes x No ¨
Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ¨ No x
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 at least the past 90 days. Yes x No ¨
Indicate by check mark whether the registrant has submitted electronically and posted on its Corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes x No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405) 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. x
Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer	x	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 x

The aggregate market value of the voting and non-voting common equity stock held by non-affiliates of the registrant was approximately $10.2 billion based on the last reported sale price of common stock on June 30, 2018, the last business day of the registrant's most recently completed second quarter.

Number of shares of common stock outstanding as of February 20, 2019: 105,753,864

Documents Incorporated by Reference

Portions of Albemarle Corporation's definitive Proxy Statement for its 2019 Annual Meeting of Shareholders to be filed with the U.S. Securities and Exchange Commission pursuant to Regulation 14A under the Securities Exchange Act of 1934, as amended, are incorporated by reference into Part III of this Form 10-K.

Albemarle
Corporation
and
Subsidiaries

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Year Ended December 31, 2018

Albemarle Corporation and Subsidiaries

PART I

Item 1. Business.

Albemarle Corporation was incorporated in Virginia in 1993. Our principal executive offices are located at 4250 Congress Street, Suite 900, Charlotte, North Carolina 28209. Unless the context otherwise indicates, the terms "Albemarle," "we," "us," "our" or "the Company" mean Albemarle Corporation and its consolidated subsidiaries.

We are a leading global developer, manufacturer and marketer of highly-engineered specialty chemicals that are designed to meet our customers' needs across a diverse range of end markets. The end markets we serve include energy storage, petroleum refining, consumer electronics, construction, automotive, lubricants, pharmaceuticals, crop protection and custom chemistry services. We believe that our commercial and geographic diversity, technical expertise, innovative capability, flexible, low-cost global manufacturing base, experienced management team and strategic focus on our core base technologies will enable us to maintain leading market positions in those areas of the specialty chemicals industry in which we operate.

We and our joint ventures currently operate 29 production and research and development ("R&D") facilities, as well as a number of administrative and sales offices, around the world. As of December 31, 2018, we served approximately 2,300 customers, none of which individually represents more than 10% of net sales of the Company, in approximately 100 countries. For information regarding our unconsolidated joint ventures see Note 10, "Investments," to our consolidated financial statements included in Part II, Item 8 of this report.

Business Segments

Effective January 1, 2018, the PCS product category merged with our former Refining Solutions reportable segment to form a global business focused on catalysts. As a result, our three reportable segments include Lithium, Bromine Specialties and Catalysts. Each segment has a dedicated team of sales, research and development, process engineering, manufacturing and sourcing, and business strategy personnel and has full accountability for improving execution through greater asset efficiency, market focus, agility and responsiveness. We expect this change to provide further clarity into the performance of each business. Financial results and discussion about our segments included in this Annual Report on Form 10-K are organized according to these categories except where noted.

For financial information regarding our reportable segments and geographic area information, see Note 24, "Segment and Geographic Area Information," to our consolidated financial statements included in Part II, Item 8 of this report.

Lithium Segment

Our Lithium business develops lithium materials for a wide range of industries and end markets. We are a low-cost producer of one of the most diverse product portfolios of lithium derivatives in the industry.

We develop and manufacture a broad range of basic lithium compounds, including lithium carbonate, lithium hydroxide, lithium chloride, and value-added lithium specialties and reagents, including butyllithium and lithium aluminum hydride. Lithium is a key component in products and processes used in a variety of applications and industries, which include lithium batteries used in consumer electronics and electric vehicles, high performance greases, thermoplastic elastomers for car tires, rubber soles and plastic bottles, catalysts for chemical reactions, organic synthesis processes in the areas of steroid chemistry and vitamins, various life science applications, as well as intermediates in the pharmaceutical industry, among other applications. We also develop and manufacture cesium products for the chemical and pharmaceutical industries, and zirconium, barium and titanium products for various pyrotechnical applications, including airbag initiators.

In addition to developing and supplying lithium compounds, we provide technical services, including the handling and use of reactive lithium products. We also offer our customers recycling services for lithium-containing by-products resulting from synthesis with organolithium products, lithium metal and other reagents. We plan to continue to focus on the development of new products and applications.

Competition

The global lithium market consists of producers primarily located in the Americas, Asia and Australia. Major competitors in lithium compounds include Livent Corporation, Sociedad Quimica y Minera de Chile S.A., Sichuan Tianqi Lithium, and Jiangxi Ganfeng Lithium. In the cesium and other specialty metal business, key competitors include Cabot Corporation and Sigma-Aldrich Corporation. Competition in the global lithium market is largely based on product quality, product diversity, reliability of supply and customer service.

Raw Materials and Significant Supply Contracts

We obtain lithium through solar evaporation of our ponds at the Salar de Atacama, in Chile, and in Silver Peak, Nevada. After we obtain the lithium brine from the Salar de Atacama, we process it into lithium carbonate and lithium chloride at a plant in nearby La Negra, Chile. The lithium brine from our Silver Peak site is processed into lithium carbonate at our plant in Silver Peak. Subsequently, in other locations in the United States (“U.S.”), Germany, France and Taiwan, we further process the materials into various derivatives, depending on the markets we serve. In addition, in December 2018, we purchased undeveloped land with access to a lithium resource in Antofalla, within the Catamarca Province of Argentina from Bolland Minera S.A. If necessary, we can also obtain lithium from other sources.

Our mineral rights with respect to the Salar de Atacama in Chile consist exclusively of our right to access lithium brine, covering an area of approximately 16,700 hectares, pursuant to a long-term contract with the Chilean government, originally entered into in January 1975 by one of our predecessors and subsequently amended and restated. The amended agreement provides us with sufficient lithium to produce over 80,000 metric tons annually of technical and battery grade lithium salts over the next 25 years at our expanding battery grade manufacturing facilities in La Negra, Chile. In addition, the amended agreement provides for commission payments to the Chilean government based on sales price/metric ton, our support of research and development in Chile in lithium applications and solar energy, and our support of local communities in Northern Chile. In March 2018, we received approval from Chilean Economic Development Agency (“CORFO”) to increase lithium production quota in Chile to as much as 145,000 metric tons of lithium carbonate equivalent annually through 2043, after developing an innovative technology that could lead to a sustainable increase in total lithium production in Chile without the need for additional brine pumping at the Salar de Atacama.

Our mineral rights in Silver Peak, Nevada consist of our right to access lithium brine pursuant to our permitted and certified senior water rights, a settlement agreement with the U.S. government, originally entered into in June 1991, and our patented and unpatented land claims. Pursuant to the 1991 agreement, our water rights and our land claims, we have rights to all lithium that we can remove economically from the Clayton Valley Basin in Nevada. We have been operating at the Silver Peak site since 1966. Our Silver Peak site covers a surface of approximately 15,301 acres, 10,826 acres of which we own through a subsidiary. The remaining acres are owned by the U.S. government from whom we lease the land pursuant to unpatented land claims that are renewed annually. Based on our 2018 production levels, we believe that the amount of lithium brine we can economically obtain from our Silver Peak, Nevada site pursuant to our rights could support the current levels of lithium carbonate production for approximately 20 years. Assuming certain operating conditions are satisfied, our annual lithium carbonate production capacity is estimated to be at least 6,000 metric tons at our Silver Peak facility. However, no assurance can be given that the indicated levels of production of lithium carbonate at either Silver Peak or La Negra will be realized.

We also obtain lithium through hard rock mining via our 49% interest in Windfield Holdings Pty. Ltd., which directly owns 100% of the equity of Talison Lithium Pty. Ltd., a company incorporated in Australia (“Talison”). Talison, through its wholly-owned subsidiaries, owns and operates a lithium mine in Greenbushes, Western Australia and mines lithium ore, which is then milled and processed to separate lithium concentrate from the rest of the ore. The ore is processed into battery-grade lithium carbonate and lithium hydroxide at our Jiangxi and Sichuan, China facilities. Talison currently sells the lithium concentrate to its shareholders. Talison has a leading position in two categories of lithium concentrates: (i) technical-grade lithium concentrates which have low iron content for use in the manufacture of glass, ceramics and heat-proof cookware; and (ii) a high-yielding chemical-grade lithium concentrate, used to produce lithium chemicals which form the basis for the manufacture of lithium-ion batteries for laptop computers, mobile phones, electric bicycles and electric vehicles. Assuming certain operating conditions are satisfied, the annual lithium carbonate equivalent production capacity at the Talison facility is estimated to be approximately 105,000 metric tons and will be approximately 190,000 metric tons upon completion of an expansion currently underway, with

commissioning expected in 2019. However, no assurance can be given that the indicated levels of production of lithium concentrate at Talison will be realized.
In December 2018, we entered into a definitive agreement to acquire a 50% interest in Mineral Resources Limited's Wodgina hard rock lithium mine project (“Wodgina Project”) and form a joint venture with Mineral Resources Limited to own and operate the Wodgina Project to produce spodumene concentrate and battery grade lithium hydroxide. Under this agreement, we would jointly fund, design, build and operate a battery grade lithium hydroxide plant in stages at Wodgina, located in the Pilbara region of Western Australia. This transaction is subject to regulatory approvals and other customary closing conditions, and is expected to close in the second half of 2019.
Bromine Specialties Segment
Our bromine and bromine-based business includes products used in fire safety solutions and other specialty chemicals applications. Our fire safety technology enables the use of plastics in high performance, high heat applications by enhancing the flame resistant properties of these materials. End market products that benefit from our fire safety technology include plastic

enclosures for consumer electronics, printed circuit boards, wire and cable products, electrical connectors, textiles and foam insulation. Our bromine-based business also includes specialty chemicals products such as elemental bromine, alkyl bromides, inorganic bromides, brominated powdered activated carbon and a number of bromine fine chemicals. These specialty products are used in chemical synthesis, oil and gas well drilling and completion fluids, mercury control, water purification, beef and poultry processing and various other industrial applications. Other specialty chemicals that we produce include tertiary amines for surfactants, biocides, and disinfectants and sanitizers. A number of customers of our bromine business operate in cyclical industries, including the consumer electronics and oil field industries. As a result, demand from our customers in such industries is also cyclical.

Competition

Our bromine business serves the markets in the Americas, Asia, Europe and the Middle East, each of which is highly competitive. Product performance and quality, price and contract terms are the primary factors in determining which qualified supplier is awarded a contract. Research and development, product and process improvements, specialized customer services, the ability to attract and retain skilled personnel and maintenance of a good safety record have also been important factors to compete effectively in the marketplace. Our most significant competitors are Lanxess AG and Israel Chemicals Ltd.

Raw Materials and Significant Supply Contracts

The bromine we use is sourced from two locations: Arkansas and the Dead Sea. Our bromine production operations in Arkansas are supported by an active brine rights leasing program. We estimate that, at current production levels, we will be able to produce bromine in Arkansas for decades. In addition, through our 50% interest in Jordan Bromine Company Limited (“JBC”), a consolidated joint venture with operations in Safi, Jordan, we source bromine from the Dead Sea, which is believed to have indefinite quantities of brine.

Catalysts Segment

Our three main product lines in this segment are (i) Clean Fuels Technologies (“CFT”), which is primarily composed of hydroprocessing catalysts (“HPC”) together with isomerization and akylation catalysts; (ii) fluidized catalytic cracking (“FCC”) catalysts and additives; and (iii) performance catalyst solutions (“PCS”), which is primarily composed of organometallics and curatives.

We offer a wide range of HPC products, which are applied throughout the refining industry. Their application enables the upgrading of oil fractions to clean fuels and other usable oil feedstocks and products by removing sulfur, nitrogen and other impurities from the feedstock. In addition, they improve product properties by adding hydrogen and in some cases improve the performance of downstream catalysts and processes. We continuously seek to add more value to refinery operations by offering HPC products that meet our customers’ requirements for profitability and performance in the very demanding refining market.

We provide our customers with customized FCC catalyst systems. FCC catalysts assist in the high yield cracking of refinery petroleum streams into derivative, higher-value products such as transportation fuels and petrochemical feedstocks like propylene. Our FCC additives are used to reduce emissions of sulfur dioxide and nitrogen oxide in FCC units and to increase liquefied petroleum gas olefins yield, such as propylene, and to boost octane in gasoline. Albemarle offers unique refinery catalysts to crack and treat the lightest to the heaviest feedstocks while meeting refinery yield and product needs.

Within our PCS product line, we manufacture organometallic co-catalysts (e.g., aluminum, magnesium and zinc alkyls) used in the manufacture of alpha-olefins (i.e., hexene, octene, decene), polyolefins (polyethylene and polypropylene) and electronics. Our curatives include a range of curing agents used in polyurethanes, epoxies and other engineered resins.

In 2018, the number of refineries world-wide was approximately 615. Over the long-term, we expect to see some smaller refineries shutting down and being replaced by larger scale and more complex refineries, with growth concentrated in the Middle East and Asia. Oil refining has again increased moderately compared to the previous year.

We estimate that there are currently approximately 565 FCC units being operated globally, each of which requires a constant supply of FCC catalysts. In addition, we estimate that there are approximately 3,200 HPC units being operated globally, or a capacity of approximately 46 million barrels per day, each of which typically requires replacement HPC catalysts once every one to four years.

On April 3, 2018, we completed the sale of the polyolefin catalysts and components portion of the PCS business (“Polyolefin Catalysts Divestiture”) to W.R. Grace & Co. for net cash proceeds of $413.6 million. The transaction included Albemarle’s Process Development Center located in Baton Rouge, Louisiana, and operations at the Yeosu, South Korea site. The sale did not include our organometallics or curatives portion of the PCS business. The Polyolefin Catalysts Divestiture reflects the Company’s commitment to investing in the future growth of its high priority businesses and returning capital to shareholders.

Competition

Our Catalysts segment serves the global market including the Americas, Asia, Europe and the Middle East, each of which is highly competitive. Competition in these markets is driven by a variety factors. Product performance and quality, price and contract terms, product and process improvements, specialized customer services, the ability to attract and retain skilled personnel, and the maintenance of a good safety record are the primary factors to compete effectively in the catalysts marketplace. In addition, through our research and development programs, we strive to differentiate our business by developing value-added products and products based on proprietary technologies.

Our major competitors in the CFT catalysts market include Criterion Catalysts and Technologies, Advanced Refining Technologies and Haldor Topsoe. Our major competitors in the FCC catalysts market include W.R. Grace & Co., BASF Corporation and China Petrochemical Corporation (Sinopec). In the PCS market, our major competitors include Nouryon, Lanxess AG and Lonza.

Raw Materials and Significant Supply Contracts

The major raw materials we use in our Catalysts operations include sodium silicate, sodium aluminate, kaolin, aluminum, ethylene, alpha-olefins, isobutylene, toluene and rare earths and metals, such as molybdenum, nickel and cobalt, most of which are readily available from numerous independent suppliers and are purchased or provided under contracts at prices we believe are competitive. The cost of raw materials is generally based on market prices, although we may use contracts with price caps or other tools, as appropriate, to mitigate price volatility.

Sales, Marketing and Distribution

We have an international strategic account program that uses cross-functional teams to serve large global customers. This program emphasizes creative strategies to improve and strengthen strategic customer relationships with emphasis on creating value for customers and promoting post-sale service. Complementing this program are regional Albemarle sales personnel around the world who serve numerous additional customers globally. We also utilize commissioned sales representatives and specialists in specific market areas.

Research and Development

We believe that in order to generate revenue growth, maintain our margins and remain competitive, we must continually invest in research and development, product and process improvements and specialized customer services. Our research and development efforts support each of our business segments. The objective of our research and development efforts is to develop innovative chemistries and technologies with applications relevant within targeted key markets through both process and new product development. Through research and development, we continue to seek increased margins by introducing value-added products and proprietary processes and innovative green chemistry technologies. Our green chemistry efforts focus on the development of products in a manner that minimizes waste and the use of raw materials and energy, avoids the use of toxic reagents and solvents and utilizes safe, environmentally friendly manufacturing processes. Green chemistry is encouraged with our researchers through periodic focus group discussions and special rewards and recognition for outstanding new green developments.

Intellectual Property

Our intellectual property, including our patents, licenses and trade names, is an important component of our business. As of December 31, 2018, we owned approximately 2,100 active patents and approximately 600 pending patent applications in key strategic markets worldwide. We also have acquired rights under patents and inventions of others through licenses, and we license certain patents and inventions to third parties.

Regulation

Our business is subject to a broad array of employee health and safety laws and regulations, including those under the Occupational Safety and Health Act ("OSHA"). We also are subject to similar state laws and regulations as well as local laws and regulations for our non-U.S. operations. We devote significant resources and have developed and implemented comprehensive programs to promote the health and safety of our employees and we maintain an active health, safety and environmental program. We finished 2018 with an OSHA occupational injury and illness incident rate of 0.58 for Albemarle employees and nested contractors, compared to 0.63 in 2017.

Our business and our customers are subject to significant requirements under the European Community Regulation for the Registration, Evaluation, Authorization and Restriction of Chemicals (“REACH”). REACH imposes obligations on European Union manufacturers and importers of chemicals and other products into the European Union to compile and file comprehensive reports, including testing data, on each chemical substance, and perform chemical safety assessments.

Additionally, substances of high concern, as defined under REACH, are subject to an authorization process. Authorization may result in restrictions in the use of products by application or even banning the product. REACH regulations impose significant additional responsibilities on chemical producers, importers, downstream users of chemical substances and preparations, and the entire supply chain. Our significant manufacturing presence and sales activities in the European Union require significant compliance costs and may result in increases in the costs of raw materials we purchase and the products we sell. Increases in the costs of our products could result in a decrease in their overall demand; additionally, customers may seek products that are not regulated by REACH, which could also result in a decrease in the demand of certain products subject to the REACH regulations.

In June 2016, modifications to the Toxic Substances Control Act ("TSCA") in the U.S. were signed into law, requiring chemicals to be assessed against a risk-based safety standard and calling for the elimination of unreasonable risks identified during risk evaluation. Other pending initiatives potentially will require toxicological testing and risk assessments of a wide variety of chemicals, including chemicals used or produced by us. These initiatives include the Voluntary Children's Chemical Evaluation Program, and High Production Volume Chemical Initiative in the U.S., as well as new initiatives in Asia and other regions. These assessments may result in heightened concerns about the chemicals involved and additional requirements being placed on the production, handling, labeling or use of the subject chemicals. Such concerns and additional requirements could also increase the cost incurred by our customers to use our chemical products and otherwise limit the use of these products, which could lead to a decrease in demand for these products.

Historically, there has been scrutiny of certain brominated flame retardants by regulatory authorities, legislative bodies and environmental interest groups in various countries. We manufacture a broad range of brominated flame retardant products, which are used in a variety of applications. Concern about the impact of some of our products on human health or the environment may lead to regulation or reaction in our markets independent of regulation.

Environmental Regulation

We are subject to numerous foreign, federal, state and local environmental laws and regulations, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes and the cleanup of contaminated properties. Ongoing compliance with such laws and regulations is an important consideration for us. Key aspects of our operations are subject to these laws and regulations. In addition, we incur substantial capital and operating costs in our efforts to comply with them.

We use and generate hazardous substances and wastes in our operations and may become subject to claims for personal injury and/or property damage relating to the release of such substances into the environment. In addition, some of our current properties are, or have been, used for industrial purposes, which could contain currently unknown contamination that could expose us to governmental requirements or claims relating to environmental remediation, personal injury and/or property damage. Liabilities associated with the investigation and cleanup of hazardous substances, as well as personal injury, property damages or natural resource damages arising from the release of, or exposure to, such hazardous substances, may be imposed in many situations without regard to violations of laws or regulations or other fault, and may also be imposed jointly and severally (so that a responsible party may be held liable for more than its share of the losses involved, or even the entire loss). Such liabilities also may be imposed on many different entities with a relationship to the hazardous substances at issue, including, for example, entities that formerly owned or operated the property affected by the hazardous substances and entities that arranged for the disposal of the hazardous substances at the affected property, as well as entities that currently own or operate such property. We are subject to such laws, including the federal Comprehensive Environmental Response, Compensation and Liability Act, commonly known as CERCLA or Superfund, in the U.S., and similar foreign and state laws. We may have liability as a potentially responsible party ("PRP") with respect to active off-site locations under CERCLA or state equivalents. We have sought to resolve our liability as a PRP at these sites through indemnification by third parties and settlements, which would provide for payment of our allocable share of remediation costs. Because the cleanup costs are estimates and are subject to revision as more information becomes available about the extent of remediation required, and in some cases we have asserted a defense to any liability, our estimates could change. Moreover, liability under CERCLA and equivalent state statutes may be joint and several, which could require us to pay in excess of our pro rata share of remediation costs. Our understanding of the financial strength of other PRPs has been considered, where appropriate, in estimating our liabilities. Accruals for these matters are included in the environmental reserve. Our management is actively involved in evaluating environmental matters and, based on information currently available to us, we have concluded that our outstanding environmental liabilities for unresolved waste sites currently known to us should not have a material effect on our operations.

See “Safety and Environmental Matters” in Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations for further details.

Climate Change

The growing concerns about climate change and the related increasingly stringent regulations may provide us with new or expanded business opportunities. We provide solutions to companies pursuing alternative fuel products and technologies (such as renewable fuels, gas-to-liquids and others), emission control technologies (including mercury emissions), alternative transportation vehicles and energy storage technologies and other similar solutions. As demand for, and legislation mandating or incentivizing the use of, alternative fuel technologies that limit or eliminate greenhouse gas emissions increase, we continue to monitor the market and offer solutions where we have appropriate technology and believe we are well positioned to take advantage of opportunities that may arise from such demand or legislation.

Recent Acquisitions, Joint Ventures and Divestitures

During recent years, we have devoted resources to acquisitions and joint ventures, including the subsequent integration of acquired businesses. These acquisitions and joint ventures have expanded our base business, provided our customers with a wider array of products and presented new alternatives for discovery through additional chemistries. In addition, we have pursued opportunities to divest businesses which do not fit our high priority business growth profile. Following is a summary of our significant acquisitions, joint ventures and divestitures over the last three years.

In December 2018, we entered into a definitive agreement to acquire a 50% interest in Mineral Resources Limited's Wodgina Project, located in the Pilbara region of Western Australia, and form a joint venture with Mineral Resources Limited to own and operate the Wodgina Project to produce spodumene concentrate and battery grade lithium hydroxide, for a purchase price of $1.15 billion. This transaction is subject to regulatory approvals and other customary closing conditions, and is expected to close in the second half of 2019.

On April 3, 2018, we completed the Polyolefin Catalysts Divestiture to W.R. Grace & Co. for net cash proceeds of approximately $413.6 million. The transaction includes Albemarle’s Product Development Center located in Baton Rouge, Louisiana, and operations at our Yeosu, South Korea site. The sale does not include the organometallics or curatives portion of the PCS business.

On December 31, 2016, we completed the acquisition of the lithium hydroxide and lithium carbonate conversion assets of Jiangxi Jiangli New Materials Science and Technology Co. Ltd. (“Jiangli New Materials”) for a purchase price of approximately $145 million. This includes manufacturing assets and supporting business functions located in both Jiangxi and Sichuan, China focused on the production of battery-grade lithium carbonate and lithium hydroxide. We believe this acquisition will enable us to supply premium lithium salts to an expanded global customer base while solidifying our leading position in the lithium industry.

On December 14, 2016, we completed the sale of the Chemetall Surface Treatment business to BASF SE for net cash proceeds of approximately $3.1 billion. The Chemetall Surface Treatment business was originally part of our previously reported 2015 acquisition of Rockwood Holdings, Inc. (“Rockwood”).

On January 4, 2016, we completed the sale of our metal sulfides business to Treibacher Industrie AG for net proceeds of approximately $137 million. Included in the transaction were sites in Vienna and Arnoldstein, Austria, and Tribotecc’s proprietary sulfide synthesis process. On February 1, 2016, we completed the sale of our minerals-based flame retardants and specialty chemicals business to Huber Engineered Materials, a division of J.M. Huber Corporation, for net proceeds of approximately $187 million. The transaction included Albemarle’s Martinswerk GmbH subsidiary and manufacturing facility located in Bergheim, Germany, and Albemarle’s 50% ownership interest in Magnifin Magnesiaprodukte GmbH, a joint-venture with Radex Heraklith Industriebeteiligung AG at Breitenau, Austria.

These transactions reflect our commitment to investing in future growth of our high priority businesses, maintaining leverage flexibility and returning capital to our shareholders.

Employees

As of December 31, 2018, we had approximately 5,900 employees, including employees of our consolidated joint ventures, of whom 2,800, or 48%, are employed in the U.S. and Latin America; 1,500, or 25%, are employed in Europe; 1,200, or 20%, are employed in Asia and 400, or 7%, are employed in the Middle East or other areas. Approximately 35% of these employees are represented by unions or works councils. We believe that we generally have a good relationship with our employees, and with those unions and works councils.

Albemarle Corporation and Subsidiaries

Available Information

Our website address is www.albemarle.com. We make available free of charge through our website our Annual Report 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 ("Exchange Act"), as well as beneficial ownership reports on Forms 3, 4 and 5 filed pursuant to Section 16 of the Exchange Act, as soon as reasonably practicable after such documents are electronically filed with, or furnished to, the Securities and Exchange Commission ("SEC"). 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. The SEC also maintains a website at www.sec.gov that contains reports, proxy statements and other information regarding SEC registrants, including Albemarle.

Our Corporate Governance Guidelines, Code of Conduct and the charters of the Audit and Finance, Health, Safety and Environment, Executive Compensation, and Nominating and Governance Committees of our Board of Directors are also available on our website and are available in print to any shareholder upon request by writing to Investor Relations, 4250 Congress Street, Suite 900, Charlotte, North Carolina 28209, or by calling (980) 299-5700.

Item 1A. Risk Factors.

You should consider carefully the following risks when reading the information, including the financial information, contained in this Annual Report on Form 10-K.

Risks Related to Our Business

Our substantial international operations subject us to risks of doing business in foreign countries, which could adversely affect our business, financial condition and results of operations.

We conduct a substantial portion of our business outside the U.S., with approximately 74% of our sales to foreign countries. We operate and/or sell our products to customers in approximately 100 countries. We currently have many production facilities, research and development and administrative facilities, as well as sales offices located outside the U.S., as detailed in Item 2. Properties. 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 international operations include the following:

- fluctuations in foreign currency exchange rates may affect product demand and may adversely affect the profitability in U.S. dollars of products and services we provide in international markets where payment for our products and services is made in the local currency;
- transportation and other shipping costs may increase, or transportation may be inhibited;
- increased cost or decreased availability of raw materials;
- changes in foreign laws and tax rates or U.S. laws and tax rates with respect to foreign income may unexpectedly increase the rate at which our income is taxed, impose new and additional taxes on remittances, repatriation or other payments by subsidiaries, or cause the loss of previously recorded tax benefits;
- foreign countries in which we do business may adopt other restrictions on foreign trade or investment, including currency exchange controls;
- trade sanctions by or against these countries could result in our losing access to customers and suppliers in those countries;
- unexpected adverse changes in foreign laws or regulatory requirements may occur;
- our agreements with counterparties in foreign countries may be difficult for us to enforce and related receivables may be difficult for us to collect;
- compliance with the variety of foreign laws and regulations may be unduly burdensome;
- compliance with anti-bribery and anti-corruption laws (such as the Foreign Corrupt Practices Act) as well as anti-money-laundering laws may be costly;

- unexpected adverse changes in export duties, quotas and tariffs and difficulties in obtaining export licenses may occur;
- general economic conditions in the countries in which we operate could have an adverse effect on our earnings from operations in those countries;
- our foreign operations may experience staffing difficulties and labor disputes;
- termination or substantial modification of international trade agreements may adversely affect our access to raw materials and to markets for our products outside the U.S.;

- foreign governments may nationalize or expropriate private enterprises;
- increased sovereign risk (such as default by or deterioration in the economies and credit worthiness of local governments) may occur; and
- political or economic repercussions from terrorist activities, including the possibility of hyperinflationary conditions and political instability, may occur in certain countries in which we do business.

In addition, certain of our joint ventures operate, and we have ongoing capital projects, in regions of the world such as the Middle East and South America, that are of high risk due to significant civil, political and security instability. Unanticipated events, such as geopolitical changes, could result in a write-down of our investment in the affected joint venture or a delay or cause cancellation of those capital projects, which could negatively impact our future growth and profitability. 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 and our joint ventures do business.

Furthermore, we are subject to rules and regulations related to anti-bribery and anti-trust prohibitions of the U.S. and other countries, as well as export controls and economic embargoes, violations of which may carry substantial penalties. For example, export control and economic embargo regulations limit the ability of our subsidiaries to market, sell, distribute or otherwise transfer their products or technology to prohibited countries or persons. Failure to comply with these regulations could subject our subsidiaries to fines, enforcement actions and/or have an adverse effect on our reputation and the value of our common stock.

Our inability to secure key raw materials, or to pass through increases in costs and expenses for other raw materials and energy, on a timely basis or at all, could have an adverse effect on the margins of our products and our results of operations.

The long-term profitability of our operations will, in part, depend on our ability to continue to economically obtain resources, including energy and raw materials. For example, our lithium and bromine businesses rely upon our continued ability to produce, or otherwise obtain, lithium and bromine of sufficient quality and in adequate amounts to meet our customers' demand. If we fail to secure and retain the rights to continue to access these key raw materials, we may have to restrict or suspend our operations that rely upon these key resources, which could harm our business, results of operations and financial condition. In addition, in some cases access to these raw materials by us and our competitors is subject to decisions or actions by governmental authorities, which could adversely impact us.

Furthermore, other raw material and energy costs account for a significant percentage of our total costs of products sold, even if they can be obtained on commercially reasonable terms. Our raw material and energy costs can be volatile and may increase significantly. Increases are primarily driven by tightening of market conditions and major increases in the pricing of key constituent materials for our products such as crude oil, chlorine and metals (including molybdenum and rare earths which are used in the refinery catalysts business). We generally attempt to pass through changes in the prices of raw materials and energy to our customers, but we may be unable to do so (or may be delayed in doing so). In addition, raising prices we charge to our customers in order to offset increases in the prices we pay for raw materials could cause us to suffer a loss of sales volumes. Our inability to efficiently and effectively pass through price increases, or inventory impacts resulting from price volatility, could adversely affect our margins.

Competition within our industry may place downward pressure on the prices and margins of our products and may adversely affect our businesses and results of operations.

We compete against a number of highly competitive global specialty chemical producers. Competition is based on several key criteria, including product performance and quality, product price, product availability and security of supply, and responsiveness of product development in cooperation with customers and customer service. Some of our competitors are larger than we are and may have greater financial resources. These competitors may also be able to maintain significantly greater operating and financial flexibility. As a result, these competitors may be better able to withstand changes in conditions within our industry. Competitors' pricing decisions could compel us to decrease our prices, which could negatively affect our margins and profitability. Our ability to maintain or increase our profitability is, and will continue to be, dependent upon our ability to offset decreases in the prices and margins of our products by improving production efficiency and volume and other productivity enhancements, shifting to production of higher margin chemical products and improving existing products through innovation and research and development. If we are unable to do so or to otherwise maintain our competitive position, we could lose market share to our competitors. In addition, Albemarle's brands, product image and trademarks represent the unique product identity of each of our products and are important symbols of the Company's reputation. Accordingly, the performance of our business could be adversely affected by any marketing and promotional materials used by our competitors that make adverse claims, whether with or without merit, against our Company or its products, imply or assert immoral or improper conduct by us, or are otherwise disparaging of our Company or its products. Further, our own actions could hurt such brands, product image and trademarks if our products underperform or we otherwise draw negative publicity.

Our research and development efforts may not succeed in addressing changes in our customers' needs, and our competitors may develop more effective or successful products.

Our industries and the end markets into which we sell our products experience technological change and product improvement. Manufacturers periodically introduce new products or require new technological capacity to develop customized products. Our future growth depends on our ability to gauge the direction of the commercial and technological progress in all key end markets in which we sell our products and upon our ability to fund and successfully develop, manufacture and market products in such changing end markets. As a result, we must commit substantial resources each year to research and development. There is no assurance that we will be able to continue to identify, develop, market and, in certain cases, secure regulatory approval for, innovative products in a timely manner or at all, as may be required to replace or enhance existing products, and any such inability could have a material adverse effect on our profit margins and our competitive position.

In addition, our customers use our specialty chemicals for a broad range of applications. Changes in our customers' products or processes may enable our customers to reduce consumption of the specialty chemicals that we produce or make our specialty chemicals unnecessary. Customers may also find alternative materials or processes that do not require our products. Should a customer decide to use a different material due to price, performance or other considerations, we may not be able to supply a product that meets the customer's new requirements. Consequently, it is important that we develop new products to replace the sales of products that mature and decline in use. Our business, results of operations, cash flows and margins could be materially adversely affected if we are unable to manage successfully the maturation of our existing products and the introduction of new products.

Despite our efforts, we may not be successful in developing new products and/or technology, either alone or with third parties, or licensing intellectual property rights from third parties on a commercially competitive basis. Our new products may not be accepted by our customers or may fail to receive regulatory approval. Moreover, new products may have lower margins than the products they replace. Furthermore, ongoing investments in research and development for the future do not yield an immediate beneficial impact on our operating results and therefore could result in higher costs without a proportional increase in revenues.

Adverse conditions in the economy, and volatility and disruption of financial markets can negatively impact our customers, suppliers and other business partners and therefore have a material adverse effect on our business and results of operations.

A global, regional or localized economic downturn may reduce customer demand or inhibit our ability to produce our products, negatively impacting our operating results. Our business and operating results have been and will continue to be sensitive to the many challenges that can affect national, regional and global economies, including economic downturns (including credit market tightness, which can impact our liquidity as well as that of our customers, suppliers and other business partners), declining consumer and business confidence, fluctuating commodity prices and volatile exchange rates. Our customers may experience deterioration of their businesses, cash flow shortages and difficulty obtaining financing, leading them to delay or cancel plans to purchase products, and they may not be able to fulfill their obligations in a timely fashion. Further, suppliers and other business partners may experience similar conditions, which could impact their ability to fulfill their obligations to us. Also, it could be difficult to find replacements for business partners without incurring significant delays or cost increases.

Downturns in our customers' industries could adversely affect our sales and profitability.

Downturns in the businesses that use our specialty chemicals may adversely affect our sales. Many of our customers are in industries, including the electronics, building and construction, oilfield and automotive industries, which are cyclical in nature, or which are subject to secular market downturns. Historically, cyclical or secular industry downturns have resulted in diminished demand for our products, excess manufacturing capacity and lower average selling prices, and we may experience similar problems in the future. A decline in our customers' industries may have a material adverse effect on our sales and profitability.

Our results are subject to fluctuation because of irregularities in the demand for our HPC catalysts and certain of our agrichemicals.

Our HPC catalysts are used by petroleum refiners in their processing units to reduce the quantity of sulfur and other impurities in petroleum products. The effectiveness of HPC catalysts diminishes with use, requiring the HPC catalysts to be replaced, on average, once every one to four years. The sales of our HPC catalysts, therefore, are largely dependent on the useful life cycle of the HPC catalysts in the processing units and may vary materially by quarter. In addition, the timing and profitability of HPC catalysts sales can have a significant impact on revenue and profit in any one quarter. Sales of our agrichemicals are also subject to fluctuation as demand varies depending on climate and other environmental conditions, which may prevent or reduce farming for extended periods. In addition, crop pricing and the timing of when farms alternate from one crop to another crop in a particular year can also alter sales of agrichemicals.

Regulation, or the threat of regulation, of some of our products could have an adverse effect on our sales and profitability.

We manufacture or market a number of products that are or have been the subject of attention by regulatory authorities and environmental interest groups. For example, over the past decade, there has been increasing scrutiny of certain brominated flame retardants by regulatory authorities, legislative bodies and environmental interest groups in various countries. We manufacture a broad range of brominated flame retardant products, which are used in a variety of applications to protect people, property and the environment from injury and damage caused by fire. Concern about the impact of some of our products on human health or the environment may lead to regulation, or reaction in our markets independent of regulation, that could reduce or eliminate markets for such products.

Agencies in the European Union (“E.U.”) continue to evaluate the risks to human health and the environment associated with certain brominated flame retardants such as tetrabromobisphenol A and decabromodiphenylethane, both of which we manufacture. Additional government regulations, including limitations or bans on the use of brominated flame retardants, could result in a decline in our net sales of brominated flame retardants and have an adverse effect on our sales and profitability. In addition, the threat of additional regulation or concern about the impact of brominated flame retardants on human health or the environment could lead to a negative reaction in our markets that could reduce or eliminate our markets for these products, which could have an adverse effect on our sales and profitability.

Our business and our customers are subject to significant requirements under REACH, which imposes obligations on E.U. manufacturers and importers of chemicals and other products into the E.U. to compile and file comprehensive reports, including testing data, on each chemical substance, and perform chemical safety assessments. Additionally, substances of high concern, as defined under REACH, are subject to an authorization process, which may result in restrictions in the use of products by application or even banning the product. REACH regulations impose significant additional burdens on chemical producers, importers, downstream users of chemical substances and preparations, and the entire supply chain. See “Regulation” in Item 1. Business. Our significant manufacturing presence and sales activities in the E.U. requires significant compliance costs and may result in increases in the costs of raw materials we purchase and the products we sell. Increases in the costs of our products could result in a decrease in their overall demand; additionally, customers may seek products that are not regulated by REACH, which could also result in a decrease in the demand of certain products subject to the REACH regulations.

In June 2016, modifications to the TSCA in the U.S. were signed into law, requiring chemicals to be assessed against a risk-based safety standard and for the elimination of unreasonable risks identified during risk evaluation. Other pending initiatives potentially will require toxicological testing and risk assessments of a wide variety of chemicals, including chemicals used or produced by us. These initiatives include the Voluntary Children's Chemical Evaluation Program, and High Production Volume Chemical Initiative in the U.S., as well as new initiatives in Asia and other regions. These assessments may result in heightened concerns about the chemicals involved and additional requirements being placed on the production, handling, labeling or use of the subject chemicals. Such concerns and additional requirements could also increase the cost incurred by our customers to use our chemical products and otherwise limit the use of these products, which could lead to a decrease in demand for these products. Such a decrease in demand would likely have an adverse impact on our business and results of operations.

We could be subject to damages based on claims brought against us by our customers or lose customers as a result of the failure of our products to meet certain quality specifications.

Our products provide important performance attributes to our customers' products. If a product fails to perform in a manner consistent with quality specifications or has a shorter useful life than guaranteed, a customer of ours could seek the replacement of the product or damages for costs incurred as a result of the product failing to perform as guaranteed. These risks apply to our refinery catalysts in particular because, in certain instances, we sell our refinery catalysts under agreements that contain limited performance and life cycle guarantees. Also, because many of our products are integrated into our customers' products, we may be requested to participate in, or fund in whole or in part the costs of, a product recall conducted by a customer. For example, some of our businesses supply products to customers in the automotive industry. In the event one of these customers conducts a product recall that it believes is related to one of our products, we may be asked to participate in, or fund in whole or in part, such a recall.

Our customers often require our subsidiaries to represent that our products conform to certain product specifications provided by our customers. Any failure to comply with such specifications could result in claims or legal action against us.

A successful claim or series of claims against us could have a material adverse effect on our financial condition and results of operations and could result in our loss of one or more customers.

Our business is subject to hazards common to chemical and natural resource extraction businesses, any of which could injure our employees or other persons, damage our facilities or other properties, interrupt our production and adversely affect our reputation and results of operations.

Our business is subject to hazards common to chemical manufacturing, storage, handling and transportation, as well as natural resource extraction, including explosions, fires, severe weather, natural disasters, mechanical failure, unscheduled downtime, transportation interruptions, remediation, chemical spills, discharges or releases of toxic or hazardous substances or gases and other risks. These hazards can cause personal injury and loss of life to our employees and other persons, severe damage to, or destruction of, property and equipment and environmental contamination. In addition, the occurrence of disruptions, shutdowns or other material operating problems at our facilities due to any of these hazards may diminish our ability to meet our output goals. Accordingly, these hazards and their consequences could adversely affect our reputation and have a material adverse effect on our operations as a whole, including our results of operations and cash flows, both during and after the period of operational difficulties.

Our business could be adversely affected by environmental, health and safety laws and regulations.

The nature of our business, including historical operations at our current and former facilities, exposes us to risks of liability under environmental laws and regulations due to the production, storage, use, transportation and sale of materials that can cause contamination or personal injury if released into the environment. In the jurisdictions in which we operate, we are subject to numerous U.S. and non-U.S. national, federal, state and local environmental, health and safety laws and regulations, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes and the cleanup of contaminated properties. We currently use, and in the past have used, hazardous substances at many of our facilities, and we have in the past been, and may in the future be, subject to claims relating to exposure to hazardous materials. We also have generated, and continue to generate, hazardous wastes at a number of our facilities. Some of our facilities also have lengthy histories of manufacturing or other activities that may have resulted in site contamination. Liabilities associated with the investigation and cleanup of hazardous substances, as well as personal injury, property damages or natural resource damages arising from the release of, or exposure to, such hazardous substances, may be imposed in many situations without regard to violations of laws or regulations or other fault, and may also be imposed jointly and severally (so that a responsible party may be held liable for more than its share of the losses involved, or even the entire loss). Such liabilities may also be imposed on many different entities, including, for example, current and prior property owners or operators, as well as entities that arranged for the disposal of the hazardous substances. Such liabilities may be material and can be difficult to identify or quantify.

Further, some of the raw materials we handle are subject to government regulation. These regulations affect the manufacturing processes, handling, uses and applications of our products. In addition, our production facilities and a number of our distribution centers require numerous operating permits. Due to the nature of these requirements and changes in our operations, our operations may exceed limits under permits or we may not have the proper permits to conduct our operations. Ongoing compliance with such laws, regulations and permits is an important consideration for us and we incur substantial capital and operating costs in our compliance efforts.

Compliance with environmental laws generally increases the costs of manufacturing, registration/approval requirements, transportation and storage of raw materials and finished products, and storage and disposal of wastes, and could have a material adverse effect on our results of operations. We may incur substantial costs, including fines, damages, criminal or civil sanctions and remediation costs, or experience interruptions in our operations, for violations arising under these laws or permit requirements. Additional information may arise in the future concerning the nature or extent of our liability with respect to identified sites, and additional sites may be identified for which we are alleged to be liable, that could cause us to materially increase our environmental accrual or the upper range of the costs we believe we could reasonably incur for such matters. Furthermore, environmental laws are subject to change and have become increasingly stringent in recent years. We expect this trend to continue and to require materially increased capital expenditures and operating and compliance costs.

We may be subject to indemnity claims and liable for other payments relating to properties or businesses we have divested.

In connection with the sale of certain properties and businesses, we have agreed to indemnify the purchasers of such properties for certain types of matters, such as certain breaches of representations and warranties, taxes and certain environmental matters. With respect to environmental matters, the discovery of contamination arising from properties that we have divested may expose us to indemnity obligations under the sale agreements with the buyers of such properties or cleanup obligations and other damages under applicable environmental laws. We may not have insurance coverage for such indemnity obligations or cash flows to make such indemnity or other payments. Further, we cannot predict the nature of and the amount of any indemnity or other obligations we may have to the applicable purchaser. Such payments may be costly and may adversely affect our financial condition and results of operations.

At several of our properties where hazardous substances are known to exist (including some sites where hazardous substances are being investigated or remediated), we believe we are entitled to contractual indemnification from one or more former owners or operators; however, in the event we make a claim, the indemnifier may disagree with us regarding, or not have the financial capacity to fulfill, its indemnity obligation. If our contractual indemnity is not upheld or effective, our accrual and/or our costs for the investigation and cleanup of hazardous substances could increase materially.

We could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act and similar foreign anti-corruption laws.

The U.S. Foreign Corrupt Practices Act (the "FCPA") and similar foreign anti-corruption laws in other jurisdictions around the world generally prohibit companies and their intermediaries from making improper payments or providing anything of value to non-U.S. government officials for the purpose of obtaining or retaining business or securing an unfair advantage. We operate in some parts of the world that have experienced governmental corruption to some degree, and, in certain circumstances, strict compliance with anti-bribery laws may conflict with local customs and practices. Although we have established formal policies or procedures for prohibiting or monitoring this conduct, we cannot assure you that our employees or other agents will not engage in such conduct for which we might be held responsible. In the event that we believe or have reason to believe that our employees, agents or distributors have or may have violated applicable anti-corruption laws, including the FCPA, we may be required to investigate or have outside counsel investigate the relevant facts and circumstances, which can be expensive and require significant time and attention from senior management. If we are found to be liable for violations of the FCPA or other applicable anti-corruption laws (either due to our own acts or our inadvertence, or due to the acts or inadvertence of others, including employees of our joint ventures), we could suffer from civil and criminal penalties or other sanctions, which could have a material adverse effect on our business and results of operations.

As previously reported in 2018, following receipt of information regarding potential improper payments being made by third party sales representatives of our Refining Solutions business, within our Catalysts segment, we promptly retained outside counsel and forensic accountants to investigate potential violations of the Company's Code of Conduct, the FCPA, and other potentially applicable laws. Based on this internal investigation, we have voluntarily self-reported potential issues relating to the use of third party sales representatives in our Refining Solutions business, within our Catalysts segment, to the U.S. Department of Justice ("DOJ"), the SEC, and Dutch Public Prosecutor ("DPP"), and are cooperating with the DOJ, the SEC, and the DPP in their review of these matters. In connection with our internal investigation, we have implemented, and are continuing to implement, appropriate remedial measures.

At this time, we are unable to predict the duration, scope, result or related costs associated with the investigations by the DOJ, the SEC, or DPP. We also are unable to predict what, if any, action may be taken by the DOJ, the SEC, or DPP, or what penalties or remedial actions they may seek. Any determination that our operations or activities are not in compliance with existing laws or regulations could result in the imposition of fines, penalties, disgorgement, equitable relief, or other losses.

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

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

can result in penalties or sanctions that could also adversely impact our operating results and financial condition.
Our inability to protect our intellectual property rights could have a material adverse effect on our business, financial condition and results of operations.
Protection of our proprietary processes, methods and compounds and other technology is important to our business. We generally rely on patent, trade secret, trademark and copyright laws of the U.S. and certain other countries in which our products are produced or sold, as well as licenses and nondisclosure and confidentiality agreements, to protect our intellectual property rights. The patent, trade secret, trademark and copyright laws of some countries, or their enforcement, may not protect our intellectual property rights to the same extent as the laws of the U.S. Failure to protect our intellectual property rights may result in the loss of valuable proprietary technologies. Additionally, some of our technologies are not covered by any patent or

patent application and, even if a patent application has been filed, it may not result in an issued patent. If patents are issued to us, those patents may not provide meaningful protection against competitors or against competitive technologies. We cannot assure you that our intellectual property rights will not be challenged, invalidated, circumvented or rendered unenforceable.

We also conduct research and development activities with third parties and license certain intellectual property rights from third parties and we plan to continue to do so in the future. We endeavor to license or otherwise obtain intellectual property rights on terms favorable to us. However, we may not be able to license or otherwise obtain intellectual property rights on such terms or at all. Our inability to license or otherwise obtain such intellectual property rights could have a material adverse effect on our ability to create a competitive advantage and create innovative solutions for our customers, which will adversely affect our net sales and our relationships with our customers.

We could face patent infringement claims from our competitors or others alleging that our processes or products infringe on their proprietary technologies. 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 partially or completely, pay to use the technology of others, stop using certain technologies or stop producing the infringing product entirely. Even if we ultimately prevail in an infringement suit, the existence of the suit could prompt customers to switch to products that are not the subject of infringement suits. We may not prevail in intellectual property litigation and such litigation may result in significant legal costs or otherwise impede our ability to produce and distribute key products.

We also rely upon unpatented proprietary manufacturing expertise, continuing technological innovation and other trade secrets to develop and maintain our competitive position. While we generally enter into confidentiality agreements with our employees and third parties to protect our intellectual property, we cannot assure you that our confidentiality agreements will not be breached, that they will provide meaningful protection for our trade secrets and proprietary manufacturing expertise or that adequate remedies will be available in the event of an unauthorized use or disclosure of our trade secrets or manufacturing expertise. In addition, our trade secrets and know-how may be improperly obtained by other means, such as a breach of our information technologies security systems or direct theft.

Our inability to acquire or develop additional reserves that are economically viable could have a material adverse effect on our future profitability.

Our lithium reserves will, without more, decline as we continue to extract these raw materials. Accordingly, our future profitability depends upon our ability to acquire additional lithium reserves that are economically viable to replace the reserves we will extract. Exploration and development of lithium resources are highly speculative in nature. Exploration projects involve many risks, require substantial expenditures and may not result in the discovery of sufficient additional resources that can be extracted profitably. Once a site with potential resources is discovered, it may take several years of development until production is possible, during which time the economic viability of production may change. Substantial expenditures are required to establish recoverable proven and probable reserves and to construct extraction and production facilities. As a result, there is no assurance that current or future exploration programs will be successful and there is a risk that depletion of reserves will not be offset by discoveries or acquisitions.

We utilize feasibility studies to estimate the anticipated economic returns of an exploration project. The actual project profitability or economic feasibility may differ from such estimates as a result of factors such as, but not limited to, changes in volumes, grades and characteristics of resources to be mined and processed; changes in labor costs or availability of adequate and skilled labor force; the quality of the data on which engineering assumptions were made; adverse geotechnical conditions; availability, supply and cost of water and power; fluctuations in inflation and currency exchange rates; delays in obtaining environmental or other government permits or approvals or changes in the laws and regulations related to our operations or project development; changes in royalty agreements, laws and/or regulations around royalties and other taxes; and weather or severe climate impacts.

For our existing operations, we utilize geological and metallurgical assumptions, financial projections and price estimates. These estimates are periodically updated to reflect changes in our operations, including modifications to our proven and probable reserves and mineralized material, revisions to environmental obligations, changes in legislation and/or social, political or economic environment, and other significant events associated with natural resource extraction operations. There are numerous uncertainties inherent in estimating quantities and qualities of lithium and costs to extract recoverable reserves, including many factors beyond our control, that could cause results to differ materially from expected financial and operating results or result in future impairment charges.

There is risk to the growth of lithium markets.

Our lithium business is significantly dependent on the development and adoption of new applications for lithium power and the growth in demand for plug-in hybrid electric vehicles and battery electric vehicles. To the extent that such development, adoption and growth do not occur in the volume and/or manner that we contemplate, the long-term growth in the markets for lithium products may be adversely affected, which would have a material adverse effect on our business, financial condition and operating results.

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

Attempts to gain unauthorized access to our information technology systems become more sophisticated over time. These attempts, which might be related to industrial or other espionage, include covertly introducing malware to our computers and networks and impersonating authorized users, among others. We seek to detect and investigate all security incidents and to prevent their recurrence, but in some cases we might be unaware of an incident or its magnitude and effects. The theft, unauthorized use or publication of our intellectual property and/or confidential business information could harm our competitive position, reduce the value of our investment in research and development and other strategic initiatives or otherwise adversely affect our business. To the extent that any cybersecurity breach results in inappropriate disclosure of our customers' or licensees' confidential information, we may incur liability as a result. The devotion of additional resources to the security of our information technology systems in the future could significantly increase the cost of doing business or otherwise adversely impact our financial results.

In addition, risks associated with information technology systems failures or network disruptions, including risks associated with upgrading our systems or in successfully integrating information technology and other systems in connection with the integration of businesses we acquire, could disrupt our operations by impeding our processing of transactions, financial reporting and our ability to protect our customer or company information, which could adversely affect our business and results of operations.

The occurrence or threat of extraordinary events, including domestic and international terrorist attacks, may disrupt our operations and decrease demand for our products.

Chemical-related assets may be at greater risk of future terrorist attacks than other possible targets in the U.S. and around the world. As a result, we are subject to existing federal rules and regulations (and may be subject to additional legislation or regulations in the future) that impose site security requirements on chemical manufacturing facilities, which increase our overhead expenses.

We are also subject to federal regulations that have heightened security requirements for the transportation of hazardous chemicals in the U.S. We believe we have met these requirements but additional federal and local regulations that limit the distribution of hazardous materials are being considered. We ship and receive materials that are classified as hazardous. Bans on movement of hazardous materials through cities, like Washington, D.C., could affect the efficiency of our logistical operations. Broader restrictions on hazardous material movements could lead to additional investment to produce hazardous raw materials and change where and what products we manufacture.

The Chemical Facility Anti-Terrorism Standards program ("CFATS Program"), which is administered by the Department of Homeland Security ("DHS"), identifies and regulates chemical facilities to ensure that they have security measures in place to reduce the risks associated with potential terrorist attacks on chemical plants located in the U.S. In December 2014, the Protecting and Securing Chemical Facilities from Terrorist Attacks Act of 2014 ("CFATS Act") was enacted. The CFATS Act reauthorizes the CFATS Program for four years. DHS has released an interim final rule under the CFATS Program that imposes comprehensive federal security regulations for high-risk chemical facilities in possession of specified quantities of chemicals of interest. This rule establishes risk-based performance standards for the security of the U.S.'s chemical facilities. It requires covered chemical facilities to prepare Security Vulnerability Assessments, which identify facility security vulnerabilities, and to develop and implement Site Security

Plans, which include measures that satisfy the identified risk-based performance standards. We cannot determine with certainty the costs associated with any security measures that DHS may require.

The occurrence of extraordinary events, including future terrorist attacks and the outbreak or escalation of hostilities, cannot be predicted, and their occurrence can be expected to continue to negatively affect the economy in general, and the markets for our products in particular. The resulting damage from a direct attack on our assets, or assets used by us, could include loss of life and property damage. In addition, available insurance coverage may not be sufficient to cover all of the damage incurred or, if available, may be prohibitively expensive.

Natural disasters and weather-related matters could impact our results of operations.

Historically, major hurricanes have caused significant disruption to the operations on the U.S. Gulf Coast for many of our customers and our suppliers of certain raw materials, which had an adverse impact on volume and cost for some of our products. Our operations in Chile could be subject to significant rain events and earthquakes. If similar weather-related matters or other natural disasters occur in the future, they could negatively affect the results of operations at our sites in the affected regions as well as have adverse impacts on the global economy.

Our insurance may not fully cover all potential exposures.

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

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

Growing concerns about climate change may result in the imposition of additional regulations or restrictions to which we may become subject. Climate changes include changes in rainfall and in storm patterns and intensities, water shortages, significantly changing sea levels and increasing atmospheric and water temperatures, among others. For example, there have been concerns regarding the declining water level of the Dead Sea, from which our joint venture, JBC, produces bromine. A number of governments or governmental bodies have introduced or are contemplating regulatory changes in response to climate change, including regulating greenhouse gas emissions. Potentially, additional U.S. federal regulation will be forthcoming with respect to greenhouse gas emissions (including carbon dioxide) and/or “cap and trade” legislation that could impact our operations. In addition, we have operations in the E.U., Brazil, China, Japan, Jordan, Saudi Arabia, Singapore and the United Arab Emirates, which have implemented measures to achieve objectives under the Kyoto Protocol, an international agreement linked to the United Nations Framework Convention on Climate Change (“UNFCC”), which set binding targets for reducing greenhouse gas emissions.

The outcome of new legislation or regulation in the U.S. and other jurisdictions in which we operate may result in new or additional requirements, additional charges to fund energy efficiency activities, and fees or restrictions on certain activities. While certain climate change initiatives may result in new business opportunities for us in the area of alternative fuel technologies and emissions control, compliance with these initiatives may also result in additional costs to us, including, among other things, increased production costs, additional taxes, reduced emission allowances or additional restrictions on production or operations. Any adopted future climate change regulations could also negatively impact our ability to compete with companies situated in areas not subject to such limitations. Even without such regulation, increased public awareness and adverse publicity about potential impacts on climate change emanating from us or our industry could harm us. We may not be able to recover the cost of compliance with new or more stringent laws and regulations, which could adversely affect our business and negatively impact our growth. Furthermore, the potential impact of climate change and related regulation on our customers is highly uncertain and there can be no assurance that it will not have an adverse effect on our financial condition and results of operations.

Economic conditions and regulatory changes relating to the United Kingdom’s withdrawal from the European Union could adversely impact our business.

Following a referendum in 2016, voters in the United Kingdom ("U.K.") approved that country's exit from the E.U., a process often referred to as "Brexit." Subsequently, in March 2017, the U.K. invoked Article 50 of the Lisbon Treaty, which provides a two-year time period through March 2019 for the U.K. and the remaining E.U. countries to negotiate a withdrawal agreement. The future effects of Brexit will depend on any agreements the U.K. makes to retain access to the E.U. or other markets either during a transitional period or more permanently. Given the lack of comparable precedent and the uncertainty around the terms upon which the U.K. will leave the E.U., it is unclear what financial, trade and legal implications Brexit would have and how such withdrawal would affect our Company. We derive a significant portion of our revenues from sales outside the U.S., including 16% from E.U. countries. The consequences of Brexit, together with what may be protracted negotiations around the terms of Brexit (including the possibility of a so-called "Hard Brexit," where no formal agreement is made between the E.U. and U.K. prior to the U.K.'s exit from the E.U.), could introduce significant uncertainties into global financial markets, including volatility in foreign currencies, and adversely impact the markets in which we and our customers operate. Although we are not experiencing any immediate adverse impact on our financial condition as a result of Brexit, adverse consequences such as deterioration in economic conditions, volatility in currency exchange rates or adverse changes in regulation could have a negative impact on our future operations, operating results and financial condition. All of these potential consequences could be further magnified if additional countries were to exit the E.U.

If we are unable to retain key personnel or attract new skilled personnel, it could have an adverse effect on our business.

Our success depends on our ability to attract and retain key personnel, including our management team. In light of the specialized and technical nature of our business, our performance is dependent on the continued service of, and on our ability to attract and retain, qualified management, scientific, technical, marketing and support personnel. Competition for such personnel is intense, and we may be unable to continue to attract or retain such personnel. In addition, because of our reliance on our senior management team, the unanticipated departure of any key member of our management team could have an adverse effect on our business. Our future success depends, in part, on our ability to identify and develop or recruit talent to succeed our senior management and other key positions throughout the organization. If we fail to identify and develop or recruit successors, we are at risk of being harmed by the departures of these key employees. Effective succession planning is also important to our long-term success. Failure to ensure effective transfer of knowledge and smooth transitions involving key employees could hinder our strategic planning and execution.

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

As of December 31, 2018, we had approximately 5,900 employees, including employees of our consolidated joint ventures. Approximately 35% of these employees are represented by unions or works councils. 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 of the U.S. Such employment rights require us to work collaboratively with the legal representatives of those employees to effect any changes to labor arrangements. For example, most of our employees in Europe are represented by works councils that must approve any changes in conditions of employment, including salaries and benefits and staff changes, and may impede efforts to restructure our workforce. Although we believe that we have a good working relationship with our employees, a strike, work stoppage, slowdown or significant dispute with our employees could result in a significant disruption of our operations or higher labor costs.

Our joint ventures may not operate according to their business plans if our partners fail to fulfill their obligations, which may adversely affect our results of operations and may force us to dedicate additional resources to these joint ventures.

We currently participate in a number of joint ventures and may enter into additional joint ventures in the future. The nature of a joint venture requires us to share control with unaffiliated third parties. If our joint venture partners do not fulfill their obligations, the affected joint venture may not be able to operate according to its business plan. In that case, our results of operations may be adversely affected and we may be required to materially change the level of our commitment to the joint venture. Also, differences in views among joint venture participants may result in delayed decisions or failures to agree on major issues. If these differences cause the joint ventures to deviate from their business plans, our results of operations could be adversely affected.

Risks Related to Our Financial Condition

Our required capital expenditures can be complex, may experience delays or other difficulties, and the costs may exceed our estimates.

Our capital expenditures generally consist of expenditures to maintain and improve existing equipment, facilities and properties, and substantial investments in new or expanded equipment, facilities and properties. Execution of these capital expenditures can be complex, and commencement of production requires start-up, commission and certification of product quality by our customers, which may impact the expected output and timing of sales of product from such facilities. Construction of large chemical operations is subject to numerous risks and uncertainties, including, among others, the ability to complete a project on a timely basis and in accordance with the estimated budget for such project and our ability to estimate future demand for our products. In addition, our returns on these capital expenditures may not meet our expectations.

Future capital expenditures may be significantly higher, depending on the investment requirements of each of our business lines, and may also vary substantially if we are required to undertake actions to compete with new technologies in our industry. We may not have the capital necessary to undertake these capital investments. If we are unable to do so, we may not be able to effectively compete in some of our markets.

We will need a significant amount of cash to service our indebtedness and our ability to generate cash depends on many factors beyond our control.

Our ability to generate sufficient cash flow from operations or use existing cash balances to make scheduled payments on our debt depends on a range of economic, competitive and business factors, many of which are outside our control. Our business may not generate sufficient cash flow from operations to service our debt obligations. If we are unable to service our debt obligations, we may need to refinance all or a portion of our indebtedness on or before maturity, reduce or delay capital expenditures, sell assets or raise additional equity. We may not be able to refinance any of our indebtedness, sell assets or raise additional equity on commercially reasonable terms or at all, which could cause us to default on our obligations and impair our liquidity. Our inability to generate sufficient cash flow or use existing cash balances to satisfy our debt obligations, or to refinance our obligations on commercially reasonable terms, could have a material adverse effect on our business and financial condition.

Restrictive covenants in our debt instruments may adversely affect our business.

Our senior credit facilities and the indentures governing our senior notes contain select restrictive covenants. These covenants provide constraints on our financial flexibility. The failure to comply with these or other covenants governing other indebtedness, including indebtedness incurred in the future, could result in an event of default, which, if not cured or waived, could have a material adverse effect on our business, financial condition and results of operations, including cross-defaults to other debt facilities. See “Financial Condition and Liquidity—Long-Term Debt” in Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations.

Changes in credit ratings issued by nationally recognized statistical rating organizations could adversely affect our cost of financing, the market price of our securities and our debt service obligations.

Credit rating agencies rate our debt securities on factors that include our operating results, actions that we take, their view of the general outlook for our industry and their view of the general outlook for the economy. Actions taken by the rating agencies can include maintaining, upgrading or downgrading the current rating or placing us on a watch list for possible future downgrades. Downgrading the credit rating of our debt securities or placing us on a watch list for possible future downgrades would likely increase our cost of future financing, limit our access to the capital markets and have an adverse effect on the market price of our securities.

Borrowings under a portion of our debt facilities bear interest at floating rates, and are subject to adjustment based on the ratings of our senior unsecured long-term debt. The downgrading of any of our ratings or an increase in any of the benchmark interest rates would result in an increase of the interest expense on our variable rate borrowings.

We are exposed to fluctuations in currency exchange rates, which may adversely affect our operating results and net income.

We conduct our business and incur costs in the local currency of most of the countries in which we operate. Changes in exchange rates between foreign currencies and the U.S. Dollar will affect the recorded levels of our assets, liabilities, net sales, cost of goods sold and operating margins and could result in exchange losses. The primary currencies to which we have exposure are the E.U. Euro, Japanese Yen, Chinese Renminbi, South Korean Won, Australian Dollar, Chilean Peso and Taiwan Dollar. Exchange rates between these currencies and the U.S. Dollar in recent years have fluctuated significantly and may do so in the future. With respect to our potential exposure to foreign currency fluctuations and devaluations, for the year ended December 31, 2018, approximately 32% of our net sales were denominated in currencies other than the U.S. Dollar. Significant changes in these foreign currencies relative to the U.S. Dollar could also have an adverse effect on our ability to meet interest and principal payments on any foreign currency-denominated debt outstanding. In addition to currency translation risks, we incur currency transaction risks whenever one of our operating subsidiaries or joint ventures enters into either a purchase or a sales transaction using a different currency from its functional currency. Our operating results and net income may be affected by any volatility in currency exchange rates and our ability to manage effectively our currency transaction and translation risks.

Changes in, or the interpretation of, tax legislation or rates throughout the world could materially impact our results.
Our effective tax rate and related tax balance sheet attributes could be impacted by changes in tax legislation throughout the world. Currently, the majority of our net sales are generated from customers located outside the U.S., and a substantial portion of our assets and employees are located outside of the U.S.
We have not accrued income taxes or foreign withholding taxes on undistributed earnings for most non-U.S. subsidiaries, because those earnings are intended to be indefinitely reinvested in the operations of those subsidiaries. Certain tax proposals

with respect to such earnings could substantially increase our tax expense, which would substantially reduce our income and have a material adverse effect on our results of operations and cash flows from operating activities.

Our future effective tax rates could be affected by changes in the mix of earnings in countries with differing statutory tax rates, expirations of tax holidays or rulings, changes in the assessment regarding the realization of the valuation of deferred tax assets, or changes in tax laws and regulations or their interpretation. Recent developments, including the European Commission's investigations on illegal state aid, the Organisation for Economic Co-operation and Development ("OECD") project on Base Erosion and Profit Shifting and the enacted U.S tax reform legislation commonly referred to as the U.S. Tax Cuts and Jobs Act ("TCJA") during the fourth quarter of 2017 may result in changes to long-standing tax principles, which could adversely affect our effective tax rates or result in higher cash tax liabilities.

We are subject to the regular examination of our income tax returns by various tax authorities. Examinations in material jurisdictions or changes in laws, rules, regulations or interpretations by local taxing authorities could result in impacts to tax years open under statute or to foreign operating structures currently in place. We regularly assess the likelihood of adverse outcomes resulting from these examinations or changes in laws, rules, regulations or interpretations to determine the adequacy of our provision for taxes. It is possible the outcomes from these examinations will have a material adverse effect on our financial condition and operating results.

We may be subject to increased tax exposure resulting from Rockwood pre-acquisition periods.

Under the terms of certain purchase agreements, third party sellers have agreed to substantially indemnify us for tax liabilities pertaining to Rockwood's periods prior to its acquisition by us. These indemnity obligations will continue generally until the applicable statutes of limitations expire. To the extent that such companies fail to indemnify or satisfy their obligations, or if any amount is not covered by the terms of the indemnity, our earnings could be negatively impacted in future periods through increased tax expense.

Future events may impact our deferred tax asset position and U.S. deferred federal income taxes on undistributed earnings of international affiliates that are considered to be indefinitely reinvested.

We evaluate our ability to utilize deferred tax assets and our need for valuation allowances based on available evidence. This process involves significant management judgment about assumptions that are subject to change from period to period based on changes in tax laws or variances between future projected operating performance and actual results. We are required to establish a valuation allowance for deferred tax assets if we determine, based on available evidence at the time the determination is made, that it is more likely than not that some portion or all of the deferred tax assets will not be utilized. In making this determination, we evaluate all positive and negative evidence as of the end of each reporting period. Future adjustments (either increases or decreases), to the deferred tax asset valuation allowance are determined based upon changes in the expected realization of the net deferred tax assets. The utilization of our deferred tax assets ultimately depends on the existence of sufficient taxable income in either the carry-back or carry-forward periods under the applicable tax law. Due to significant estimates used to establish the valuation allowance and the potential for changes in facts and circumstances, it is reasonably possible that we will be required to record adjustments to the valuation allowance in future reporting periods. Changes to the valuation allowance or the amount of deferred tax liabilities could have a materially adverse effect on our business, financial condition and results of operations. Further, should we change our assertion regarding the permanent reinvestment of the undistributed earnings in foreign operations, a deferred tax liability may need to be established.

Our business and financial results may be adversely affected by various legal and regulatory proceedings.

We are involved from time to time in legal and regulatory proceedings, which may be material in the future. The outcome of proceedings, lawsuits and claims may differ from our expectations, leading us to change estimates of liabilities and related insurance receivables.

Legal and regulatory proceedings, whether with or without merit, and associated internal investigations, may be time-consuming and expensive to prosecute, defend or conduct, may divert management's attention and other resources, inhibit our ability to sell our products, result in adverse judgments for damages, injunctive relief, penalties and fines, and otherwise negatively affect our business.

Because a significant portion of our operations is conducted through our subsidiaries and joint ventures, our ability to service our debt may be dependent on our receipt of distributions or other payments from our subsidiaries and joint ventures.

A significant portion of our operations is conducted through our subsidiaries and joint ventures. As a result, our ability to service our debt may be partially dependent on the earnings of our subsidiaries and joint ventures and the payment of those earnings to us in the form of dividends, loans or advances and through repayment of loans or advances from us. Payments to us by our subsidiaries and joint ventures are contingent upon our subsidiaries' or joint ventures' earnings and other business considerations and may be subject to statutory or contractual restrictions. In addition, there may be significant tax and other legal restrictions on the ability of our non-U.S. subsidiaries or joint ventures to remit money to us.

Although our pension plans currently meet minimum funding requirements, events could occur that would require us to make significant contributions to the plans and reduce the cash available for our business.

We have several defined benefit pension plans around the world, including in the U.S., U.K., Germany, Belgium and Japan. We are required to make cash contributions to our pension plans to the extent necessary to comply with minimum funding requirements imposed by the various countries' benefit and tax laws. The amount of any such required contributions will be determined annually based on an actuarial valuation of the plans as performed by the plans' actuaries.

In previous years, we have made voluntary contributions to our U.S. qualified defined benefit pension plans. We anticipate approximately $7.0 million of required cash contributions during 2019 for our defined benefit pension plans. Additional voluntary pension contributions in and after 2019 may vary depending on factors such as asset returns, interest rates, and legislative changes. The amounts we may elect or be required to contribute to our pension plans in the future may increase significantly. These contributions could be substantial and would reduce the cash available for our business.

Further, an economic downturn or recession or market disruption in the capital and credit markets may adversely impact the value of our pension plan assets, our results of operations, our statement of changes in stockholders' equity and our liquidity. Our funding obligations could change significantly based on the investment performance of the pension plan assets and changes in actuarial assumptions for local statutory funding valuations. Any deterioration of the capital markets or returns available in such markets may negatively impact our pension plan assets and increase our funding obligations for one or more of these plans and negatively impact our liquidity. We cannot predict the impact of this or any further market disruption on our pension funding obligations.

We may not be able to consummate future acquisitions or integrate acquisitions into our business, which could result in unanticipated expenses and losses.

We believe that our customers are increasingly looking for strong, long-term relationships with a few key suppliers that help them improve product performance, reduce costs, and support new product development. To satisfy these growing customer requirements, our competitors have been consolidating within product lines through mergers and acquisitions.

As part of our business growth strategy, we have acquired businesses and entered into joint ventures in the past and intend to pursue acquisitions and joint venture opportunities in the future. Our ability to implement this component of our growth strategy will be limited by our ability to identify appropriate acquisition or joint venture candidates and our financial resources, including available cash and borrowing capacity. The expense incurred in consummating acquisitions or entering into joint ventures, the time it takes to integrate an acquisition or our failure to integrate businesses successfully, could result in unanticipated expenses and losses. Furthermore, we may not be able to realize any of the anticipated benefits from acquisitions or joint ventures.

The process of integrating acquired operations into our existing operations may result in unforeseen operating difficulties and may require significant financial resources that would otherwise be available for the ongoing development or expansion of existing operations. Some of the risks associated with the integration of acquisitions include:

- potential disruption of our ongoing business and distraction of management;
- unforeseen claims and liabilities, including unexpected environmental exposures;
- unforeseen adjustments, charges and write-offs;

- problems enforcing the indemnification obligations of sellers of businesses or joint venture partners for claims and liabilities;
- unexpected losses of customers of, or suppliers to, the acquired business;
- difficulty in conforming the acquired businesses' standards, processes, procedures and controls with our operations;
- in the case of foreign acquisitions, the need to integrate operations across different cultures and languages and to address the particular economic, currency, political and regulatory risks associated with specific countries;
- variability in financial information arising from the implementation of purchase price accounting;
- inability to coordinate new product and process development;

- loss of senior managers and other critical personnel and problems with new labor unions and cultural challenges associated with integrating employees from the acquired company into our organization; and
- challenges arising from the increased scope, geographic diversity and complexity of our operations.

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

We have historically expanded our business primarily through acquisitions. A part of our business strategy is to continue to grow through acquisitions that complement our existing technologies and accelerate our growth. Our credit facilities have limited financial maintenance covenants. In addition, the indenture and other agreements governing our senior notes do not limit our ability to incur additional indebtedness in connection with acquisitions or otherwise. As a result, we may incur substantial additional indebtedness in connection with acquisitions.

Any such additional indebtedness and the related debt service obligations could have important consequences and risks for us, including:

- reducing flexibility in planning for, or reacting to, changes in our businesses, the competitive environment and the industries in which we operate, and to technological and other changes;
- lowering credit ratings;
- reducing access to capital and increasing borrowing costs generally or for any additional indebtedness to finance future operating and capital expenses and for general corporate purposes;
- reducing funds available for operations, capital expenditures, share repurchases, dividends and other activities; and
- creating competitive disadvantages relative to other companies with lower debt levels.

If our goodwill, intangible assets or long-lived assets become impaired, we may be required to record a significant charge to earnings.

Under U.S. Generally Accepted Accounting Principles ("GAAP"), we review our intangible assets and long-lived assets for impairment when events or changes in circumstances indicate the carrying value may not be recoverable. Goodwill is tested for impairment on October 31 of each year, or more frequently if required. Factors that may be considered a change in circumstances, indicating that the carrying value of our goodwill, intangible assets or long-lived assets may not be recoverable, include, but are not limited to, a decline in our stock price and market capitalization, reduced future cash flow estimates, and slower growth rates in our industry. We may be required to record a significant charge in our financial statements during the period in which any impairment of our goodwill, intangible assets or long-lived assets is determined, negatively impacting our results of operations and financial condition.

Item 1B. Unresolved Staff Comments.

NONE

Item 2. Properties.

We operate globally, with our principal executive offices located in Charlotte, NC, our corporate office located in Baton Rouge, LA and regional shared services offices located in Budapest, Hungary and Dalian, China. All of these properties are leased. We and our affiliates also operate regional sales and administrative offices in various locations throughout the world, which are generally leased.

We believe that our production facilities, research and development facilities, and sales and administrative offices are generally well maintained, effectively used and are adequate to operate our business. During 2018, the Company's manufacturing plants operated at approximately 78% capacity, in the aggregate.

Set forth below is information regarding our significant production facilities operated by us and our affiliates:

Location	Business Segment	Principal Use	Owned/Leased
Amsterdam, the Netherlands	Catalysts	Production of refinery catalysts, research and product development activities	Owned

Baton Rouge, Louisiana	Bromine Specialties	Research and product development activities, and production of flame retardants	Leased

Albemarle Corporation and Subsidiaries

Location	Business Segment	Principal Use	Owned/Leased
Bitterfeld, Germany	Catalysts	Refinery catalyst regeneration, rejuvenation, and sulfiding	Owned by Eurecat S.A., a joint venture owned 50% by each of Axens Group and us
Greenbushes, Australia	Lithium	Production of lithium spodumene minerals and lithium concentrate	Owned by Windfield Holdings Pty Ltd, a joint venture in which we own 49%, and Sichuan Tianqi Lithium Industries Inc. which owns the remaining interest
Jubail, Saudi Arabia	Catalysts	Manufacturing and marketing of organometallics	Owned by Saudi Organometallic Chemicals Company LLC, a joint venture owned 50% by each of Saudi Specialty Chemicals Company (a SABIC affiliate) and us
Kings Mountain, North Carolina	Lithium	Production of technical and battery grade lithium hydroxide, lithium salts and battery grade lithium metal products	Owned
La Negra, Chile	Lithium	Production of lithium carbonate and lithium chloride	Owned
Langelsheim, Germany	Lithium	Production of butyllithium, lithium chloride, specialty products, lithium hydrides, cesium and special metals	Owned
Louvain-la-Neuve, Belgium	Lithium; Bromine Specialties; Catalysts; All Other	Regional offices and research and customer technical service activities	Owned
La Voulte, France	Catalysts	Refinery catalysts regeneration and treatment, research and development activities	Owned by Eurecat S.A., a joint venture owned 50% by each of Axens Group and us
Magnolia, Arkansas	Bromine Specialties	Production of flame retardants, bromine, inorganic bromides, agricultural intermediates and tertiary amines	Owned
McAlester, Oklahoma	Catalysts	Refinery catalyst regeneration, rejuvenation, pre-reclaim burn off,	Owned by Eurecat S.A., a joint venture owned 50% by each of Axens Group

		as well as specialty zeolites and additives marketing activities	and us
Meishan, China	Lithium	Production of lithium carbonate and lithium hydroxide	Owned
Mobile, Alabama	Catalysts	Production of tin stabilizers	Owned by PMC Group, Inc. which operates the plant for Stannica LLC, a joint venture owned 50% by each of PMC Group Inc. and us
New Johnsonville, Tennessee	Lithium	Production of specialty products	Owned
Niihama, Japan	Catalysts	Production of refinery catalysts	Leased by Nippon Ketjen Company Limited, a joint venture owned 50% by each of Sumitomo Metal Mining Company Limited and us
Pasadena, Texas	Catalysts; All Other	Production of aluminum alkyls, alkenyl succinic anhydride, orthoalkylated anilines, and other specialty chemicals	Owned
Pasadena, Texas	Catalysts	Production of refinery catalysts, research and development activities	Owned

Albemarle Corporation and Subsidiaries

Location	Business Segment	Principal Use	Owned/Leased
Pasadena, Texas	Catalysts	Refinery catalysts regeneration services	Owned by Eurecat U.S. Incorporated, a joint venture in which we own a 57.5% interest and a consortium of entities in various proportions owns the remaining interest
Safi, Jordan	Bromine Specialties	Production of bromine and derivatives and flame retardants	Owned and leased by JBC, a joint venture owned 50% by each of Arab Potash Company Limited and us
Salar de Atacama, Chile	Lithium	Production of lithium brine and potash	Owned; however ownership will revert to the Chilean government once we have sold all remaining amounts under our contract with the Chilean government pursuant to which we obtain lithium brine in Chile
Santa Cruz, Brazil	Catalysts	Production of catalysts, research and product development activities	Owned by Fábrica Carioca de Catalisadores S.A, a joint venture owned 50% by each of Petrobras Química S.A.—PETROQUISA and us
Silver Peak, Nevada	Lithium	Production of lithium brine and lithium carbonate	Owned
South Haven, Michigan	All Other	Production of custom fine chemistry products including pharmaceutical actives	Owned
Taichung, Taiwan	Lithium	Production of butyllithium	Owned
Takaishi City, Osaka, Japan	Catalysts	Production of aluminum alkyls	Owned by Nippon Aluminum Alkys, a joint venture owned 50% by each of Mitsui Chemicals, Inc. and us
Twinsburg, Ohio	Bromine Specialties	Production of bromine-activated carbon	Leased
Tyrone, Pennsylvania	All Other	Production of custom fine chemistry products, agricultural intermediates, performance polymer products and research and development activities	Owned
Xinyu, China	Lithium	Production of lithium carbonate and lithium hydroxide	Owned

Item 3. Legal Proceedings.

We are involved in litigation incidental to our business and are a party to a number of legal actions and claims, various governmental proceedings and private civil lawsuits, including, but not limited to, those related to environmental and hazardous material exposure matters, product liability, and breach of contract. Some of the legal proceedings include claims for compensatory as well as punitive damages. While the final outcome of these matters cannot be predicted with certainty, considering, among other things, the legal defenses available and liabilities that have been recorded along with applicable insurance, it is currently the opinion of management that none of these pending items will have a material adverse effect on our financial condition, results of operations or liquidity.

As previously reported in 2018, following receipt of information regarding potential improper payments being made by third party sales representatives of our Refining Solutions business, within our Catalysts segment, we promptly retained outside counsel and forensic accountants to investigate potential violations of the Company's Code of Conduct, the FCPA, and other potentially applicable laws. Based on this internal investigation, we have voluntarily self-reported potential issues relating to the use of third party sales representatives in our Refining Solutions business, within our Catalysts segment, to the DOJ, the SEC, and DPP, and are cooperating with the DOJ, the SEC, and DPP in their review of these matters. In connection with our internal investigation, we have implemented, and are continuing to implement, appropriate remedial measures.

At this time, we are unable to predict the duration, scope, result or related costs associated with the investigations by the DOJ, the SEC, or DPP. We also are unable to predict what, if any, action may be taken by the DOJ, the SEC or DPP, or what penalties or remedial actions they may seek to impose. Any determination that our operations or activities are not in compliance with existing laws or regulations could result in the imposition of fines, penalties, disgorgement, equitable relief, or other losses. We do not believe, however, that any such fines, penalties, disgorgement, equitable relief or other losses would have a material adverse effect on our financial condition or liquidity.

An unexpected adverse resolution of one or more of these items, however, could have a material adverse effect on our financial condition, results of operations or liquidity in that particular period.

Item 4. Mine Safety Disclosures.

Not applicable.

Executive Officers of the Registrant.

The names, ages and biographies of our executive officers, as of February 20, 2019, are set forth below. The term of office of each officer is until the meeting of the Board of Directors following the next annual shareholders' meeting (May 7, 2019).

Name	Age	Position
Luther C. Kissam IV	54	Chairman, President and Chief Executive Officer
Karen G. Narwold	59	Executive Vice President, Chief Administrative Officer, Corporate Secretary
Scott A. Tozier	53	Executive Vice President, Chief Financial Officer
Donald J. LaBauve, Jr.	52	Vice President, Corporate Controller, Chief Accounting Officer

Luther C. Kissam IV was elected as Chairman of the Board of Directors in November 2016. Mr. Kissam was first elected to our Board of Directors effective November 2011. He was elected as Chief Executive Officer effective September 2011 and as our President effective May 2013. Previously, Mr. Kissam served as President from March 2010 until March 2012, Executive Vice President, Manufacturing, Law and HS&E from May 2009 until March 2010, and as Senior Vice President, Manufacturing and Law and Corporate Secretary from January 2008 until May 2009. Mr. Kissam joined us in October 2003 and served as Vice President, General Counsel and Corporate Secretary from that time until December 2005, when he was promoted to Senior Vice President, General Counsel and Corporate Secretary. Before joining us, Mr. Kissam served as Vice President, General Counsel and Secretary of Merisant Company (manufacturer and marketer of sweetener and consumer food products), having previously served as Associate General Counsel of Monsanto Company (provider of agricultural products and solutions). Mr. Kissam serves on the Advisory Committee of the Specialty Products Division at DowDupont since June 2018.

Karen G. Narwold joined us in September of 2010 and currently serves as Executive Vice President, Chief Administrative Officer, General Counsel and Corporate Secretary. Ms. Narwold has over 25 years of legal, management and business experience with global industrial and chemical companies. After five years in private practice, she served as Vice President, General Counsel, Human Resources and Secretary of GrafTech International Ltd., a global graphite and carbon manufacturer and former subsidiary of Union Carbide. She then served as Vice President and Strategic Counsel of Barzel Industries, a North American steel processor and distributor. Ms. Narwold resigned from Barzel in November 2009, after Barzel reached an agreement to sell substantially all of its assets in a planned transaction that was consummated in a sale pursuant to Section 363 of the U.S. Bankruptcy Code. Prior to joining Albemarle, Ms. Narwold served as Special Counsel with Kelley Drye & Warren LLP and with Symmetry Advisors where she worked in the areas of strategic, financial and capital structure planning and restructuring for public and private companies. Ms. Narwold was appointed as a member of the Board of Directors of Ingevity Corporation on February 20, 2019.

Scott A. Tozier was elected as our Executive Vice President and Chief Financial Officer effective January 2011. Mr. Tozier also served as our Chief Accounting Officer from January 2013 until February 2014. Mr. Tozier has over 25 years of diversified international financial management experience. Following four years of assurance services with the international firm Ernst & Young, LLP, Mr. Tozier joined Honeywell International, Inc., where his 16 year career spanned senior financial positions in the U.S., Australia and Europe. His roles of increasing responsibilities included management of financial planning, analysis and reporting, global credit and treasury services and Chief Financial Officer of Honeywell's Transportation Systems, Turbo Technologies and Building Solutions divisions. Most recently, Mr. Tozier served as Vice President of Finance, Operations and Transformation of Honeywell International, Inc. Mr. Tozier has served as a member of the board of directors of Garrett Motion Inc. since October 2018.

Donald J. LaBauve Jr. was elected Vice President, Corporate Controller effective February 2013, and Chief Accounting Officer effective February 2014, after having previously served as Vice President, Finance - Business Operations since April

2009. Mr. LaBauve served as Chief Financial Officer, Fine Chemistry from April 2007 until April 2009, and prior to that time held the role of Controller, Polymer Solutions from January 2006 through March 2007. Since joining the Company in 1990, Mr. LaBauve has held various staff and leadership positions of increasing responsibility within the finance function, including an assignment to our European headquarters in Belgium in April 2000, where he held the regional finance leadership role from July 2002 through June 2005.

PART II

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

Our common stock trades on the New York Stock Exchange ("NYSE") under the symbol "ALB." There were 105,753,864 shares of common stock held by 2,444 shareholders of record as of February 20, 2019. On February 26, 2019, we declared a dividend of $0.3675 per share of common stock, payable April 1, 2019. We expect to continue to declare and pay dividends to our shareholders in the future, however, dividends are declared solely at the discretion of our Board of Directors and there is no guarantee that the Board of Directors will continue to declare dividends in the future.

The following table summarizes our repurchases of equity securities for the three-month period ended December 31, 2018:

Period	Total Number of Shares Repurchased	Average Price Paid Per Share	Total Number of Shares Repurchased as Part of Publicly Announced Plans or Programs[(a)]	Maximum Number of Shares that May Yet Be Repurchased Under the Plans or Programs
October 1, 2018 to October 31, 2018	—	$ —	—	7,993,299
November 1, 2018 to November 30, 2018	—	—	—	7,993,299
December 1, 2018 to December 31, 2018[(b)]	597,036	96.83	597,036	7,396,263
Total	597,036		597,036	

(a) Our stock repurchase plan, which was authorized by our Board of Directors, permits the Company to repurchase up to a maximum of 15,000,000 shares. The stock repurchase plan will expire when we have repurchased all shares authorized for repurchase thereunder, unless the stock repurchase plan is earlier terminated by action of our Board of Directors or further shares are authorized for repurchase.

(b) In the third quarter of 2018, we paid $250 million under the accelerated share repurchase ("ASR") agreement. Under the terms of the agreement, in December 2018, the ASR agreement was completed and we received and retired a final settlement of 597,036 shares. The Average Price Paid Per Share was calculated using the daily Rule 10b-18 volume-weighted average prices of our common stock over the term of the ASR agreement, less an agreed discount. See Note 5, "Earnings Per Share," to our consolidated financial statements included in Part II, Item 8 of this report.

Stock Performance Graph

The graph below shows the cumulative total shareholder return assuming the investment of $100 in our common stock on December 31, 2013 and the reinvestment of all dividends thereafter. The information contained in the graph below is furnished and therefore not to be considered "filed" with the SEC, and is not incorporated by reference into any document that incorporates this Annual Report on Form 10-K by reference.

Albemarle
Corporation
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Subsidiaries

Item 6. Selected Financial Data.
The information for the five years ended December 31, 2018, is contained in the “Five-Year Summary” included in Part IV, Item 15, Exhibit 99.1 and incorporated herein by reference.

Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations.
Forward-looking Statements
Some of the information presented in this Annual Report on Form 10-K, including the documents incorporated by reference, may constitute forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Such forward-looking statements are based on our current expectations, which are in turn based on assumptions that we believe are reasonable based on our current knowledge of our business and operations. We have used words such as “anticipate,” “believe,” “could,” “estimate,” “expect,” “intend,” “may,” “should,” “would,” “will” and vari
words and similar expressions to identify such forward-looking statements.
These forward-looking statements are not guarantees of future performance and involve certain risks, uncertainties and assumptions, which are difficult to predict and many of which are beyond our control. There can be no assurance that our actual results will not differ materially from the results and expectations expressed or implied in the forward-looking statements. Factors that could cause actual results to differ materially from the outlook expressed or implied in any forward-looking statement include, without limitation, information related to:
- changes in economic and business conditions;
- changes in financial and operating performance of our major customers and industries and markets served by us;
- the timing of orders received from customers;
- the gain or loss of significant customers;
- competition from other manufacturers;
- changes in the demand for our products or the end-user markets in which our products are sold;
- limitations or prohibitions on the manufacture and sale of our products;
- availability of raw materials;
- increases in the cost of raw materials and energy, and our ability to pass through such increases to our customers;
- changes in our markets in general;

- fluctuations in foreign currencies;
- changes in laws and government regulation impacting our operations or our products;
- the occurrence of regulatory actions, proceedings, claims or litigation;
- the occurrence of cyber-security breaches, terrorist attacks, industrial accidents, natural disasters or climate change;
- hazards associated with chemicals manufacturing;
- the inability to maintain current levels of product or premises liability insurance or the denial of such coverage;
- political unrest affecting the global economy, including adverse effects from terrorism or hostilities;
- political instability affecting our manufacturing operations or joint ventures;
- changes in accounting standards;
- the inability to achieve results from our global manufacturing cost reduction initiatives as well as our ongoing continuous improvement and rationalization programs;
- changes in the jurisdictional mix of our earnings and changes in tax laws and rates;
- changes in monetary policies, inflation or interest rates that may impact our ability to raise capital or increase our cost of funds, impact the performance of our pension fund investments and increase our pension expense and funding obligations;
- volatility and uncertainties in the debt and equity markets;
- technology or intellectual property infringement, including through cyber-security breaches, and other innovation risks;
- decisions we may make in the future;
- the ability to successfully execute, operate and integrate acquisitions and divestitures; and
- the other factors detailed from time to time in the reports we file with the SEC.

We assume no obligation to provide revisions to any forward-looking statements should circumstances change, except as otherwise required by securities and other applicable laws. The following discussion should be read together with our consolidated financial statements and related notes included in this Annual Report on Form 10-K.

The following is a discussion and analysis of our results of operations for the years ended December 31, 2018, 2017 and 2016. A discussion of our consolidated financial condition and sources of additional capital is included under a separate heading “Financial Condition and Liquidity” on page 49.

Overview

We are a leading global developer, manufacturer and marketer of highly-engineered specialty chemicals that are designed to meet our customers’ needs across a diverse range of end markets. The end markets we serve include energy storage, petroleum refining, consumer electronics, construction, automotive, lubricants, pharmaceuticals, crop protection and custom chemistry services. We believe that our commercial and geographic diversity, technical expertise, innovative capability, flexible, low-cost global manufacturing base, experienced management team and strategic focus on our core base technologies will enable us to maintain leading market positions in those areas of the specialty chemicals industry in which we operate.

Secular trends favorably impacting demand within the end markets that we serve combined with our diverse product portfolio, broad geographic presence and customer-focused solutions will continue to be key drivers of our future earnings growth. We continue to build upon our existing green solutions portfolio and our ongoing mission to provide innovative, yet commercially viable, clean energy products and services to the marketplace. We believe our disciplined cost reduction efforts and ongoing productivity improvements, among other factors, position us well to take advantage of strengthening economic conditions as they occur, while softening the negative impact of the current challenging global economic environment.

2018 Highlights

- In the first quarter, we increased our quarterly dividend for the 24th consecutive year, to $0.335 per share.

- We received approval from CORFO for an increase in our lithium quota to sustainably increase lithium production in Chile to as much as 145,000 metric tons of lithium carbonate equivalent annually through 2043.
- On April 3, 2018, we completed the Polyolefin Catalysts Divestiture to W.R. Grace & Co. for net cash proceeds of approximately $413.6 million and recorded a gain of $210.4 million before income taxes related to the sale of this business.

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Albemarle Corporation and Subsidiaries

- In June 2018, we entered into a revolving, unsecured credit agreement that provides for borrowings of up to $1.0 billion and matures on June 21, 2023 (the “2018 Credit Agreement”) to replace our existing revolving, unsecured credit agreement.
- We announced our exclusive collaboration with DuPont as the primary hydroprocessing catalyst manufacturer for the DuPont™ IsoTherming® hydroprocessing technology, making clean fuels production more cost efficient for refiners. IsoTherming® is an innovative hydroprocessing technology that can lower capital and operational costs.
- We launched XPLORE™, a new platform for the clean transportation fuels market. The XPLORE catalyst platform is the result of breakthrough research in hyrdroprocessing catalyst technology allowing refineries to produce clean transportation fuels in a more efficient way. The new PULSAR family, with KF 787 PULSAR™ as its first grade product, is a cutting-edge, premium catalyst line, designed for the production of clean diesel.
- We entered into two separate $250 million ASR agreements in May and August 2018, respectively. We completed these ASR agreements in September and December 2018, respectively, receiving and retiring a total of 5,262,654 shares.
- We successfully completed the commissioning of our La Negra facility in Chile (“La Negra II”), which has a nameplate capacity of 20,000 metric tons of lithium carbonate. Upon completion of the ramp-up of La Negra II, the total capacity of our facilities in La Negra, Chile will be 44,000 metric tons.
- We completed pre-commissioning activities related to our new facility in Xinyu, China and began start-up activities. This expansion will result in an additional 20,000 metric tons of lithium hydroxide, bringing total site capacity to 30,000 metric tons, with significant volumes expected from the new unit in 2019.
- We entered into a definitive agreement to acquire a 50% interest in Mineral Resources Limited's Wodgina Project in Western Australia and form a joint venture with Mineral Resources Limited to own and operate the Wodgina Project to produce spodumene concentrate and battery grade lithium hydroxide, for a purchase price of $1.15 billion. The joint venture will ultimately construct a battery grade lithium hydroxide plant at the resource site. This transaction is subject to regulatory approvals and other customary closing conditions, and is expected to close in the second half of 2019.
- We received the required environmental approvals from Australian federal and state government for the Company’s proposed Kemerton lithium hydroxide conversion site in Western Australia. This plant will have an initial capacity of 60,000 metric tons of lithium hydroxide with an ability to expand to 100,000 metric tons over time. The commissioning of this site is expected to start in stages during the course of 2021.
- In December 2018, we exercised an $18 million option to purchase undeveloped land with access to a lithium resource in Antofalla, within the Catamarca Province of Argentina from Bolland Minera S.A. We believe this asset could be certified as the largest lithium resource in Argentina.
- We achieved earnings of $693.6 million during 2018 as compared to $54.9 million for 2017. Cash flows from operations in 2018 were $546.2 million. Earnings for 2018 included a $169.9 million after-tax gain from the Polyolefin Catalysts Divestiture, while earnings for 2017 were negatively impacted by the $366.9 million net income tax expense resulting from the enactment of the TCJA. In addition, earnings for 2018 includes pension and other postretirement benefit (“OPEB”) actuarial losses of $10.6 million after income taxes, compared to pension and OPEB actuarial gains of $7.3 million after income taxes in 2017.

Outlook

The current global business environment presents a diverse set of opportunities and challenges in the markets we serve. In particular, the market for lithium battery and energy storage continues to accelerate, providing the opportunity to continue to develop high quality and innovative products while managing the high cost of expanding capacity. The other markets we serve continue to present various opportunities for value and growth as we have positioned ourselves to manage the impact on our business of changing global conditions, such as slow and uneven global growth, currency exchange volatility, crude oil price fluctuation, a dynamic pricing environment, an ever-changing landscape in electronics, the continuous need for cutting edge catalysts and technology by our refinery customers and increasingly stringent environmental standards. Amidst these dynamics, we believe our business fundamentals are sound and that we are strategically well-positioned as we remain focused on increasing sales volumes, optimizing and improving the value of our portfolio primarily through pricing and product development, managing costs and delivering value to our customers and shareholders. We believe that our businesses remain well-positioned to capitalize on new business opportunities and long-term trends driving growth within our end markets and to respond quickly to changes in economic conditions in these markets.

Lithium: We expect a similar rate of growth in 2019 as in 2018 in Lithium, led by continued strong demand in battery-grade applications, price improvement and increased conversion capacity.

On a longer term basis, we believe that demand for lithium will continue to grow as new lithium applications advance and the use of plug-in hybrid electric vehicles and full battery electric vehicles increases. This demand for lithium is supported against a favorable backdrop of steadily declining lithium ion battery costs, increasing battery performance and an increasingly favorable global public policy toward acceptance of e-mobility/renewable energy usage. Our long-term outlook is also bolstered by our successful negotiation of long-term supply agreements with our key strategic customers, reflecting our standing as a preferred global lithium partner, highlighted by our scale, access to geographically diverse, low-cost resource base and long-term focus on execution.

Bromine Specialties: We expect to see continued growth in net sales and profitability in 2019, due to healthy demand and pricing for our flame retardants and other derivatives. However, with sustained low oil prices, we expect stable, albeit low, drilling completion fluid demand throughout the year. While it is possible oil prices could continue to rebound some in 2019, the short-term impact will be to increase raw material costs. Offshore well completions lag oil pricing, so any benefit in completion fluid volumes would likely extend throughout the year.

On a longer term basis, we continue to believe that improving global standards of living, widespread digitization, increasing demand for data management capacity and the potential for increasingly stringent fire safety regulations in developing markets are likely to drive continued demand for fire safety products. Absent an increase in regulatory pressure on offshore drilling, we would expect this business to follow a long-term growth trajectory once oil prices recover from recent levels as we expect that deep water drilling will continue to increase around the world. We are focused on profitably growing our globally competitive bromine and derivatives production network to serve all major bromine consuming products and markets. We believe the global supply/demand gap could tighten as demand for existing and possible new uses of bromine expands over time. The combination of solid, long-term business fundamentals, with our strong cost position, product innovations and effective management of raw material costs will enable us to manage our business through end market challenges and to capitalize on opportunities that are expected with favorable market trends in select end markets.

Catalysts: We expect to see continued headwinds from rising raw material costs in both our CFT and FCC businesses, similar to 2018.

On a longer term basis, we believe increased global demand for transportation fuels, new refinery start-ups and ongoing adoption of cleaner fuels will be the primary drivers of growth in our Catalysts business. We believe delivering superior end-use performance continues to be the most effective way to create sustainable value in the refinery catalysts industry. We believe our technologies continue to provide significant performance and financial benefits to refiners challenged to meet tighter regulations around the world, including those managing new contaminants present in North America tight oil, and those in the Middle East and Asia seeking to use heavier feedstock while pushing for higher propylene yields. Longer term, we believe that the global crude supply will get heavier and more sour, a trend that bodes well for our catalysts portfolio. With superior technology and production capacities, and expected growth in end market demand, we believe that Catalysts remains well-positioned for the future. In PCS, we expect growth in our organometallic business due to growing global demand for plastics driven by rising standards of living and infrastructure spending.

On April 3, 2018, we completed the Polyolefin Catalysts Divestiture to W.R. Grace & Co. for net cash proceeds of approximately $413.6 million.

All Other: The fine chemistry services business will continue to be reported outside the Company’s reportable segments as it does not fit in the Company’s core businesses. We expect the near future to be impacted by a challenging agriculture industry environment and the timing of customer orders in pharmaceuticals. We continue to work to reinvigorate the pipeline of new products and services to these markets.

Corporate: We continue to focus on cash generation, working capital management and process efficiencies. We expect our global effective tax rate for 2019 to be between 23% and 24%; however, our rate will vary based on the locales in which income is actually earned and remains subject to potential volatility from changing legislation in the U.S., including the TCJA, and other tax jurisdictions.

In the first quarter of 2019, we increased our quarterly dividend rate to $0.3675 per share. During 2018, we received and retired approximately 5.3 million shares of our common stock under our share repurchase program and ASR agreements, and we may periodically repurchase shares in the future on an opportunistic basis as approved by our share repurchase program.

Actuarial gains and losses related to our defined benefit pension and OPEB plan obligations are reflected in Corporate as a component of non-operating pension and OPEB plan costs under mark-to-market accounting. Results for the year ended

December 31, 2018 include an actuarial loss of $14.0 million ($10.6 million after income taxes), as compared to a gain of $11.4 million ($7.3 million after income taxes) for the year ended December 31, 2017.
We remain committed to evaluating the merits of any opportunities that may arise for acquisitions or other business development activities that will complement our business footprint. Additional information regarding our products, markets and financial performance is provided at our web site, www.albemarle.com. Our web site is not a part of this document nor is it incorporated herein by reference.

Results of Operations
The following data and discussion provides an analysis of certain significant factors affecting our results of operations during the periods included in the accompanying consolidated statements of income.

Albemarle Corporation and Subsidiaries

Selected Financial Data	Year Ended December 31,			Percentage Change	
	2018	2017	2016	2018 vs. 2017	2017 vs. 2016
	(In thousands, except percentages and per share amounts)				
NET SALES	$3,374,950	$3,071,976	$2,677,203	10 %	15 %
Cost of goods sold	2,157,694	1,965,700	1,706,897	10 %	15 %
GROSS PROFIT	1,217,256	1,106,276	970,306	10 %	14 %
GROSS PROFIT MARGIN	36.1 %	36.0 %	36.2 %		
Selling, general and administrative expenses	446,090	450,286	353,765	(1)%	27 %
Research and development expenses	70,054	84,330	80,475	(17)%	5 %
Gain on sales of businesses, net	(210,428)	—	(122,298)	*	(100)%
Acquisition and integration related costs	—	—	57,384	— %	(100)%
OPERATING PROFIT	911,540	571,660	600,980	59 %	(5)%
OPERATING PROFIT MARGIN	27.0 %	18.6 %	22.4 %		
Interest and financing expenses	(52,405)	(115,350)	(65,181)	(55)%	77 %
Other expenses, net	(64,434)	(9,512)	(20,535)	577 %	(54)%
INCOME FROM CONTINUING OPERATIONS BEFORE INCOME TAXES AND EQUITY IN NET INCOME OF UNCONSOLIDATED INVESTMENTS	794,701	446,798	515,264	78 %	(13)%
Income tax expense	144,826	431,817	96,263	(66)%	349 %
Effective tax rate	18.2 %	96.6 %	18.7 %		
INCOME FROM CONTINUING OPERATIONS BEFORE EQUITY IN NET INCOME OF UNCONSOLIDATED INVESTMENTS	649,875	14,981	419,001	*	(96)%
Equity in net income of unconsolidated investments (net of tax)	89,264	84,487	59,637	6 %	42 %
NET INCOME FROM CONTINUING OPERATIONS	739,139	99,468	478,638	643 %	(79)%
Income from discontinued operations (net of tax)	—	—	202,131	— %	(100)%
NET INCOME	739,139	99,468	680,769	643 %	(85)%
Net income attributable to noncontrolling interests	(45,577)	(44,618)	(37,094)	2 %	20 %
NET INCOME ATTRIBUTABLE TO ALBEMARLE CORPORATION	$693,562	$54,850	$643,675	*	(91)%
NET INCOME FROM CONTINUING OPERATIONS AS A PERCENTAGE OF NET SALES	21.9 %	3.2 %	17.9 %		
Basic earnings per share:					
Continuing operations	$6.40	$0.49	$3.93	*	(88)%
Discontinued operations	—	—	1.80	— %	(100)%
	$6.40	$0.49	$5.73	*	(91)%
Diluted earnings per share:					
Continuing operations	$6.34	$0.49	$3.90	*	(87)%
Discontinued operations	—	—	1.78	— %	(100)%
	$6.34	$0.49	$5.68	*	(91)%

* Percentage calculation is not meaningful.

Comparison of 2018 to 2017

Net Sales

For the year ended December 31, 2018, we recorded net sales of $3.37 billion, a 10% increase compared to net sales of $3.07 billion for the corresponding period of 2017. Net sales increased, including in all three reportable segments, due to $210.6 million of higher volumes, $141.0 million of favorable pricing impacts and $30.6 million of favorable currency exchange. This was partially offset by $78.9 million of net sales from the Polyolefin Catalysts Divestiture.

Gross Profit

For the year ended December 31, 2018, our gross profit increased $111.0 million, or 10%, compared to the corresponding period of 2017. Cost of goods sold for the year ended December 31, 2018 included a decrease of $13.4 million in acquisition, integration and restructuring related costs from various significant projects compared to the corresponding period in 2017, and $8.8 million related to non-routine labor and compensation related costs in Chile that are outside normal compensation arrangements. In addition, Gross profit for the year ended December 31, 2017 included a $23.1 million charge related to the markup of inventory purchased as part of the acquisition of Jiangli New Materials and $30.4 million of gross profit from the Polyolefin Catalysts Divestiture. In addition, gross profit increased $19.6 million in Catalysts and Bromine Specialties due to the year over year impact of hurricane Harvey, which includes a partial insurance claim reimbursement of $4.2 million in 2018. Excluding the impact of these items, gross profit increased by $93.9 million, or 8.3%, due to $141.0 million in favorable pricing impacts and approximately $77 million of higher volumes, more than offsetting higher material and utility costs of approximately $60 million and price-related royalties of approximately $30 million. Additionally higher production costs and the negative impact of currency exchange on material and production costs in foreign locations resulted in approximately $30 million in offsets. Overall, these factors contributed to a gross profit margin for the years ended December 31, 2018 and 2017 of 36.1% and 36.0%, respectively.

Selling, General and Administrative Expenses

For the year ended December 31, 2018, our selling, general and administrative (“SG&A”) expenses decreased $4.2 million, or 1%, from the year ended December 31, 2017. SG&A expenses for the year ended December 31, 2018 included $16.2 million of charitable contributions beyond the Company’s ordinary, recurring charitable contributions, a decrease in restructuring and other costs related to several locations of $4.7 million and $3.9 million less acquisition and integration related costs for various significant projects. The remaining decrease was primarily due to lower compensation related costs, particularly incentive compensation, and professional fees. As a percentage of net sales, SG&A expenses were 13.2% in 2018, compared to 14.7% in 2017.

Research and Development Expenses

For the year ended December 31, 2018, our R&D expenses decreased $14.3 million, or 17%, from the year ended December 31, 2017. Included in R&D expenses for the year ended December 31, 2017 are $5.7 million of restructuring costs related to our Lithium sites in Germany. The remaining decrease was primarily due to $4.5 million of R&D expenses related to the Polyolefin Catalysts Divestiture. As a percentage of net sales, R&D expenses were 2.1% in 2018, compared to 2.7% in 2017.

Gain on Sales of Businesses, Net

The year ended December 31, 2018 included a gain before income taxes of $210.4 million related to the Polyolefin Catalysts Divestiture, which we completed in the second quarter of 2018.

Interest and Financing Expenses

Interest and financing expenses for the year ended December 31, 2018 decreased $62.9 million to $52.4 million from the corresponding 2017 period, due mainly to a loss on early extinguishment of debt of $52.8 million in 2017 relating to the tender premiums, fees, unamortized discounts and unamortized deferred financing costs from the repayment of the 3.00% Senior notes in full, €307.0 million of the 1.875% Senior notes and $174.7 million of the 4.50% Senior notes. The remaining difference is primarily related to the impact of higher capitalized interest from increased capital expenditures in 2018.

Other Expenses, Net

Other expenses, net, for the year ended December 31, 2018 was $64.4 million compared to $9.5 million for the corresponding 2017 period. Other expenses, net for 2018 included approximately $5.3 million of pension and OPEB costs (including mark-to-market actuarial losses of $14.0 million) as compared to $16.1 million of pension and OPEB benefits (including mark-to-market actuarial gains of $11.4 million) in 2017. In addition, during the year ended December 31, 2018, we incurred $27.0 million of legal expenses related to products that Albemarle no longer manufactures and a previously disposed business, $19.7 million to increase an indemnification liability related to the settlement of an ongoing audit of a previously disposed business in Germany and $15.6 million of environmental charges related to a site formerly owned by Albemarle, partially offset by a $2.1 million gain in the fair value of our investment in private equity securities. During the year ended December 31, 2017, we recorded a $28.7 million reserve recorded against a note receivable in one of our European entities no longer deemed probable of collection, $11.0 million of charges related to previously disposed properties or businesses, partially offset by a $10.6 million gain related to the reversal of liabilities recorded as part of purchase accounting from a previous acquisition, a $6.2 million gain related to the acquisition of the 50% interest of an equity investment and $1.1 million related to a reversal of a liability associated with the previous disposal of a property. The remaining change was primarily due to a decrease in foreign exchange losses totaling $0.6 million and a decrease in interest income.

The mark-to-market actuarial loss in 2018 is primarily attributable to a lower return on pension plan assets in 2018 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was (4.55)% versus an expected return of 6.73%. The mark-to-market actuarial loss in 2018 was partially offset by an increase in the weighted-average discount rate to 4.59% from 4.03% for our U.S. pension plans and to 2.15% from 1.94% for our foreign pension plans to reflect market conditions as of the December 31, 2018 measurement date.

The mark-to-market actuarial gain in 2017 is primarily attributable to a higher return on pension plan assets in 2017 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 14.31% versus an expected return of 6.73%. The mark-to-market actuarial gain in 2017 was partially offset by a decrease in the weighted-average discount rate to 4.03% from 4.43% for our U.S. pension plans and to 1.94% from 2.00% for our foreign pension plans to reflect market conditions as of the December 31, 2017 measurement date.

Income Tax Expense

The effective income tax rate for 2018 was 18.2% compared to 96.6% for 2017. Our effective income tax rate for 2018 was primarily affected by a tax benefit of $42.3 million related to the refinement of the one-time transition tax during the period defined by Staff Accounting Bulletin No. 118 (“SAB 118”). In addition, our effective income tax rate was impacted by the mix of earnings in countries with differing statutory rates.

Our effective income tax rate for 2017 was primarily affected by the enactment of the TCJA in December 2017. During 2017, provisional tax effects of the TCJA were recorded in connection with the one-time transition tax expense of $429.2 million, partially offset by the remeasurement of deferred tax assets and liabilities due to a decrease in corporate tax rate from 35% to 21% of $62.3 million tax benefit. Exclusive of the enactment of the TCJA, the Company’s effective tax rate differs from the U.S. Federal statutory income tax rate due to the impact of earnings from outside the U.S., mainly attributable to our share of the income of our JBC joint venture, a Free Zones company under the laws of the Hashemite Kingdom of Jordan. In addition, income tax expense for the year ended December 31, 2017, included foreign rate changes of $16.2 million and a $5.1 million out-of-period adjustment due to changes in our deferred tax liabilities for basis differences in Chilean fixed assets, partially offset by a $10.9 million benefit from the release of valuation allowances due to a foreign restructuring plan that was initiated during the second quarter of 2017 and a $8.8 million benefit from excess tax benefits realized from stock-based compensation arrangements.

See Note 20, “Income Taxes” to our consolidated financial statements included in Part II, Item 8 of this report for a reconciliation of the U.S. Federal statutory income tax rate to our effective rate for 2018 and 2017.

Equity in Net Income of Unconsolidated Investments

Equity in net income of unconsolidated investments was $89.3 million for the year ended December 31, 2018 compared to $84.5 million in the same period last year. This increase of $4.8 million was primarily due to higher equity income reported by our Lithium segment joint venture, Windfield Holdings Pty. Ltd., partially offset by a decrease in equity income in our Catalysts segment.

Net Income Attributable to Noncontrolling Interests

For the year ended December 31, 2018, net income attributable to noncontrolling interests was $45.6 million compared to $44.6 million in the same period of 2017. This increase of $1.0 million was primarily due to an increase in consolidated income related to our JBC joint venture from higher sales volumes in the current year.

Net Income Attributable to Albemarle Corporation

Net income attributable to Albemarle Corporation increased to $693.6 million for the year ended December 31, 2018, from $54.9 million for the corresponding period of 2017. The increase is primarily due to the net impact to income tax expense of $366.9 million as a result of the enactment of the TCJA and a $52.8 million loss on early extinguishment of debt related to the repayment of senior notes recorded in 2017, as well as the after-tax gain of $169.9 million related to the Polyolefin Catalysts Divestiture in 2018. In addition, the increase was driven by favorable pricing impacts of $141.0 million and increased sales volumes in all reportable segments, reduced acquisition and integration, and restructuring and other costs in 2018. This was partially offset by $27.0 million of legal expenses related to products that Albemarle no longer manufactures and a previously disposed business, $16.2 million of charitable contributions beyond the Company's ordinary, recurring charitable contributions, $15.6 million related to environmental charges related to a site formerly owned by Albemarle recorded in 2018 and a $6.2 million gain related to the acquisition of the 50% interest of an equity investment in 2017.

Other Comprehensive (Loss) Income, Net of Tax

Total other comprehensive loss, after income taxes, was $125.2 million in 2018 compared to $187.6 million in 2017. This change is primarily due to changes in foreign currency translations. We translate our foreign subsidiary financial statements from their local currencies to U.S. Dollars. In 2018, other comprehensive loss from foreign currency translation adjustments was $150.3 million, mainly as a result of unfavorable movements in the Euro of approximately $114 million, the Chinese Renminbi of approximately $14 million, the Brazilian Real of approximately $12 million, the Korean Won of approximately $5 million and a net unfavorable variance in various other currencies totaling approximately $5 million. Also included in total other comprehensive loss for 2018 is a gain of $25.8 million in connection with the revaluation of our Euro-based 1.875% Senior notes which have been designated as a hedge of our net investment in foreign operations. In 2017, other comprehensive income from foreign currency translation adjustments was $227.4 million, mainly as a result of favorable movements in the Euro of approximately $192 million, the Korean Won of approximately $16 million, the Chinese Renminbi of approximately $13 million and the Taiwan Dollar of approximately $4 million. Also included in total other comprehensive income for 2017 is a loss of $41.8 million in connection with the revaluation of our Euro-based 1.875% Senior notes which have been designated as a hedge of our net investment in foreign operations.

Segment Information Overview. We have identified three reportable segments according to the nature and economic characteristics of our products as well as the manner in which the information is used internally by the Company's chief operating decision maker to evaluate performance and make resource allocation decisions. Our reportable business segments consist of: (1) Lithium, (2) Bromine Specialties and (3) Catalysts.

Summarized financial information concerning our reportable segments is shown in the following tables. Results for 2017 have been recast to reflect the change in segments previously noted. The "All Other" category includes only the fine chemistry services business, that does not fit into any of our core businesses.

The Corporate category is not considered to be a segment and includes corporate-related items not allocated to the operating segments. Pension and OPEB service cost (which represents the benefits earned by active employees during the period) and amortization of prior service cost or benefit are allocated to the reportable segments, All Other, and Corporate, whereas the remaining components of pension and OPEB benefits cost or credit ("Non-operating pension and OPEB items") are included in Corporate. Segment data includes intersegment transfers of raw materials at cost and allocations for certain corporate costs.

The Company's chief operating decision maker uses adjusted EBITDA (as defined below) to assess the ongoing performance of the Company's business segments and to allocate resources. The Company defines adjusted EBITDA as earnings before interest, taxes, depreciation and amortization, as adjusted on a consistent basis for certain non-recurring or unusual items in a balanced manner and on a segment basis. These non-recurring or unusual items may include acquisition and integration related costs, utilization of inventory markup, gains or losses on sales of businesses, restructuring charges, facility divestiture charges, non-operating pension and OPEB items and other significant non-recurring items. In addition, management uses adjusted EBITDA for business planning purposes and as a significant component in the calculation of performance-based compensation for management and other employees. The Company has reported adjusted EBITDA because management believes it provides transparency to investors and enables period-to-period comparability of financial performance. Adjusted EBITDA is a financial measure that is not required by, or presented in accordance with, U.S. GAAP. Adjusted EBITDA should not be considered as an alternative to Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP, or any other financial measure reported in accordance with U.S. GAAP.

Albemarle Corporation and Subsidiaries

	Year Ended December 31,				Percentage Change
	2018	%	2017	%	2018 vs. 2017
	(In thousands, except percentages)				
Net sales:					
Lithium	$1,228,171	36.4 %	$1,018,885	33.2 %	21 %
Bromine Specialties	917,880	27.2 %	855,143	27.8 %	7 %
Catalysts	1,101,554	32.6 %	1,067,572	34.7 %	3 %
All Other	127,186	3.8 %	128,914	4.2 %	(1)%
Corporate	159	— %	1,462	0.1 %	(89)%
Total net sales	$3,374,950	100.0 %	$3,071,976	100.0 %	10 %
Adjusted EBITDA:					
Lithium	$530,773	52.7 %	$446,652	50.4 %	19 %
Bromine Specialties	288,116	28.6 %	258,901	29.2 %	11 %
Catalysts	284,307	28.3 %	283,883	32.1 %	— %
All Other	14,091	1.4 %	13,878	1.6 %	2 %
Corporate	(110,623)	(11.0)%	(117,834)	(13.3)%	(6)%
Total adjusted EBITDA	$1,006,664	100.0 %	$885,480	100.0 %	14 %

Albemarle Corporation and Subsidiaries

See below for a reconciliation of adjusted EBITDA, the non-GAAP financial measure, from Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP, (in thousands):

	Lithium	Bromine Specialties	Catalysts	Reportable Segments Total	All Other	Corporate	Consolidated Total
2018							
Net income (loss) attributable to Albemarle Corporation	$428,212	$ 246,509	$445,604	$1,120,325	$6,018	$(432,781)	$693,562
Depreciation and amortization	95,193	41,607	49,131	185,931	8,073	6,694	200,698
Restructuring and other[(a)]	—	—	—	—	—	3,838	3,838
Gain on sale of business[(b)]	—	—	(210,428)	(210,428)	—	—	(210,428)
Acquisition and integration related costs[(c)]	—	—	—	—	—	19,377	19,377
Interest and financing expenses	—	—	—	—	—	52,405	52,405
Income tax expense	—	—	—	—	—	144,826	144,826
Non-operating pension and OPEB items	—	—	—	—	—	5,285	5,285
Legal accrual[(d)]	—	—	—	—	—	27,027	27,027
Environmental accrual[(e)]	—	—	—	—	—	15,597	15,597
Albemarle Foundation contribution[(f)]	—	—	—	—	—	15,000	15,000
Indemnification adjustments[(g)]	—	—	—	—	—	25,240	25,240
Other[(h)]	7,368	—	—	7,368	—	6,869	14,237
Adjusted EBITDA	$530,773	$ 288,116	$284,307	$1,103,196	$14,091	$(110,623)	$1,006,664
2017							
Net income (loss) attributable to Albemarle Corporation	$342,992	$ 218,839	$230,665	$792,496	$5,521	$(743,167)	$54,850
Depreciation and amortization	87,879	40,062	54,468	182,409	8,357	6,162	196,928
Utilization of inventory markup[(i)]	23,095	—	—	23,095	—	—	23,095
Restructuring and other[(j)]	—	—	—	—	—	17,056	17,056
Gain on acquisition[(k)]	(6,221)	—	—	(6,221)	—	—	(6,221)
Acquisition and integration related costs[(c)]	—	—	—	—	—	33,954	33,954
Interest and financing expenses[(l)]	—	—	—	—	—	115,350	115,350
Income tax expense	—	—	—	—	—	431,817	431,817
Non-operating pension and OPEB items	—	—	—	—	—	(16,125)	(16,125)
Note receivable reserve[(m)]	—	—	—	—	—	28,730	28,730
Other[(n)]	(1,093)	—	(1,250)	(2,343)	—	8,389	6,046
Adjusted EBITDA	$446,652	$ 258,901	$283,883	$989,436	$13,878	$(117,834)	$885,480

(a) Expected severance payments as part of a business reorganization plan, $0.1 million recorded in Cost of goods sold and $3.7 million recorded in Selling, general and administrative expenses. These severance payments have been made during the year ended December 31, 2018.

(b) See “Gain on Sale of Businesses, Net” on page 33 for a description of this gain.

(c) Included amounts for the years ended December 31, 2018 and 2017 recorded in (1) Cost of goods sold of $3.7 million and $14.3 million, respectively; and (2) Selling, general and administrative expenses of $15.7 million and $19.6 million, respectively, relating to various significant projects.

(d) Included in Other expenses, net is a $16.2 million expense resulting from a jury rendered verdict against Albemarle related to certain business concluded under a 2014 sales agreement for products that Albemarle no longer manufactures and a $10.8 million expense resulting from a settlement of a legal matter related to guarantees from a previously disposed business.

(e) Increase in environmental reserve to indemnify the buyer of a formerly owned site recorded in Other expenses, net. As defined in the agreement of sale, this indemnification has a set cutoff date in 2024, at which point we will no longer be required to provide financial coverage.

(f) Included in Selling, general and administrative expenses is a charitable contribution, using a portion of the proceeds received from the Polyolefin Catalysts Divestiture, to the Albemarle Foundation, a non-profit organization that sponsors grants, health and social projects, educational initiatives, disaster relief, matching gift programs, scholarships and other charitable initiatives in locations where our employees live and operate. This contribution is in addition to the ordinary annual contribution made to the Albemarle Foundation by the

Company, and is significant in size and nature in that it is intended to provide more long-term benefits in the communities where we live and operate.

(g) Included in Other expenses, net is $19.7 million related to the proposed settlement of an ongoing audit of a previously disposed business in Germany, and $5.5 million related to the revision of indemnifications previously recorded from disposed businesses.

(h) Included amounts for the year ended December 31, 2018 recorded in:

- Cost of goods sold - $4.9 million for the write-off of fixed assets related to a major capacity expansion in our Jordanian joint venture and $8.8 million related to non-routine labor and compensation related costs in Chile that are outside normal compensation arrangements.
- Selling, general and administrative expenses - $2.3 million of shortfall contributions for our multiemployer plan financial improvement plan and a $1.2 million contribution, using a portion of the proceeds received from the Polyolefin Catalysts Divestiture, to schools in the state of Louisiana for qualified tuition purposes. This contribution is significant in size and is intended to provide long-term benefits for families in the Louisiana community. This was partially offset by a $1.5 million gain related to a refund from Chilean authorities due to an overpayment made in a prior year.
- Other expenses, net - $1.5 million gain related to the reversal of previously recorded liabilities of disposed businesses.

(i) In connection with the acquisition of Jiangli New Materials, the Company valued inventory purchased from Jiangli New Materials at fair value, which resulted in a markup of the underlying net book value of the inventory totaling approximately $23.1 million. The utilization of this inventory markup was included in Cost of goods sold during the year ended December 31, 2017, the estimated remaining selling period.

(j) During 2017, we initiated action to reduce costs in each of our reportable segments at several locations, primarily at our Lithium sites in Germany. Based on the restructuring plans, we have recorded expenses of $2.9 million in Cost of goods sold, $8.4 million in Selling, general and administrative expenses, and $5.7 million in Research and development expenses, primarily related to expected severance payments. The unpaid balance is recorded in Accrued expenses at December 31, 2018, with the expectation that the remaining balance will be paid by the end of 2019.

(k) Gain recorded in Other expenses, net related to the acquisition of the remaining 50% interest in Salmag. See Note 2, "Acquisitions," to our consolidated financial statements included in Part II, Item 8 of this report for additional information.

(l) Included in Interest and financing expenses is a loss on early extinguishment of debt of $52.8 million. See Note 14, "Long-Term Debt," to our consolidated financial statements included in Part II, Item 8 of this report for additional information.

(m) Reserve recorded in Other expenses, net against a note receivable on one of our European entities no longer deemed probable of collection.

(n) Included amounts for the year ended December 31, 2017 recorded in:

- Cost of goods sold - $1.3 million reversal of deferred income related to an abandoned project at an unconsolidated investment.
- Selling, general and administrative expenses - $3.3 million of shortfall contributions for our multiemployer plan financial improvement plan, partially offset by $1.0 million related to a reversal of an accrual recorded as part of purchase accounting from a previous acquisition.
- Other expenses, net - $3.2 million of asset retirement obligation charges related to the revision of an estimate at a site formerly owned by Albemarle, losses of $8.7 million related to adjustments of settlements and indemnifications of previously disposed businesses, the revision of tax indemnification expenses of $3.7 million primarily related to the filing of tax returns and a competent authority agreement for a previously disposed business and $1.0 million related to the settlement of a legal claim. This is partially offset by gains of $10.6 million and $1.1 million related to the

reversal of liabilities recorded as part of purchase accounting from a previous acquisition and the previous disposal of a property, respectively.
Lithium
Lithium segment net sales for the year ended December 31, 2018 were $1.23 billion, up $209.3 million, or 21%, compared to the corresponding period of 2017. The increase was primarily driven by $105.3 million of higher sales volumes largely in battery grade salts and specialty downstream products due to strong demand, $87.4 million of favorable pricing due to strong demand of our contracted customers for battery grade materials and $17.0 million of favorable currency translation resulting from the weaker U.S. Dollar against the Euro. Adjusted EBITDA for Lithium increased 19%, or $84.1 million, to $530.8 million for the year ended December 31, 2018, compared to the corresponding period of 2017, primarily driven by favorable pricing due to strong demand, increases of approximately $33 million from higher volumes and $4.2 million of favorable currency translation. These increases were partially offset by approximately $30 million in higher price-related royalties and approximately $12 million of higher SG&A costs to support business growth.
Bromine Specialties
Bromine Specialties segment net sales for the year ended December 31, 2018 were $917.9 million, up $62.7 million, or 7%, compared to the corresponding period of 2017. The increase was driven primarily by $36.9 million in favorable pricing due to continued constrained production of elemental bromine by Chinese bromine companies, $19.9 million in higher sales volumes in flame-retardants and other bromine derivatives due to continued strong demand, and $5.9 million of favorable currency translation resulting from the weaker U.S. Dollar against the Euro. Adjusted EBITDA for Bromine Specialties increased 11%, or $29.2 million, to $288.1 million for the year ended December 31, 2018, compared to the corresponding period of 2017, primarily due to favorable pricing across most products, which was partially offset by higher raw material costs

of approximately $19 million. The improvement in adjusted EBITDA was also due to $5.1 million of favorable currency translation related to the Euro, and higher sales volumes due to continued strong demand.

Catalysts

Catalysts segment net sales for the year ended December 31, 2018 were $1.10 billion, an increase of $34.0 million, or 3%, compared to the corresponding period of 2017. This increase was primarily due to $83.5 million of higher sales volumes driven by refining catalyst products due to favorable mix in hydro-processing catalysts, $21.6 million of favorable pricing, mainly in CFT and FCC catalysts as a result of strong demand for transportation fuels, and $7.7 million of favorable currency translation resulting from the weaker U.S. Dollar against the Euro. These increases were partially offset by $78.9 million of net sales impact from Polyolefin Catalysts Divestiture. Catalysts adjusted EBITDA increased $0.4 million, to $284.3 million for the year ended December 31, 2018 compared to the corresponding period of 2017. Strong volumes resulting in approximately $57 million of adjusted EBITDA, including the 2017 negative impact of hurricane Harvey of $13.8 million, were partially offset by $30.4 million of adjusted EBITDA impact from the Polyolefin Catalysts Divestiture. Favorable pricing of $21.6 million and partial insurance claim reimbursements of $4.2 million received in 2018 related to hurricane Harvey, were more than offset by higher raw material and utility costs, resulting in a net unfavorable impact of approximately $9 million.

All Other

All Other net sales for the year ended December 31, 2018 were $127.2 million, a decrease of $1.7 million compared to the year ended December 31, 2017. This decrease was primarily due to unfavorable pricing, partially offset by higher volumes for the fine chemistry services business. All Other adjusted EBITDA was up 2%, or $0.2 million, for the year ended December 31, 2018 in comparison to the same period of 2017.

Corporate

Corporate adjusted EBITDA was a charge of $110.6 million for the year ended December 31, 2018, a decrease of $7.2 million, compared to the year ended December 31, 2017, primarily due to lower SG&A spend related to compensation related costs and professional fees.

Comparison of 2017 to 2016

Net Sales

For the year ended December 31, 2017, we recorded net sales of $3.07 billion, a 15% increase compared to net sales of $2.68 billion for the corresponding period of 2016. Net sales increased due to $272.2 million of higher volumes, $157.8 million of favorable pricing impacts and $3.4 million of favorable currency exchange impacts, partially offset by the $38.6 million impact of the sale of the minerals-based flame retardants and specialty chemicals business.

Gross Profit

For the year ended December 31, 2017, our gross profit increased $136.0 million, or 14%, compared to the corresponding period of 2016. Included in Cost of goods sold for the year ended December 31, 2017 are: (1) a $23.1 million charge related to the markup of inventory purchased as part of the acquisition of the lithium hydroxide and lithium carbonate conversion business of Jiangli New Materials; (2) $14.3 million of acquisition and integration related costs resulting from the Jiangli New Materials acquisition; and (3) restructuring costs of $2.9 million related to a plan to reduce costs at several locations. In addition, gross profit decreased $3.1 million related to the divested minerals-based flame retardants and specialty chemicals business in the first quarter of 2016. Excluding the impact of these items, gross profit increased by $179.4 million, or 19%, primarily due to higher overall sales volumes and favorable price impacts, partially offset by increased costs in Lithium and a $15.4 million negative impact from hurricane Harvey. Overall, these factors contributed to a gross profit margin for the years ended December 31, 2017 and 2016 of 36.0% and 36.2%, respectively. Excluding the impact of the charges noted above, gross profit margin was 37.3% for the year ended December 31, 2017 as compared to 36.1% for the year ended December 31, 2016.

Selling, General and Administrative Expenses

For the year ended December 31, 2017, our SG&A expenses increased $96.5 million, or 27%, from the year ended December 31, 2016. The year ended December 31, 2017 included $19.6 million of acquisition and integration related costs, primarily resulting from the acquisition of Jiangli New Materials, $8.4 million of restructuring costs related to several locations, primarily our Lithium sites in Germany and $3.3 million of multiemployer plan financial improvement plan shortfall contributions for our employees. Excluding the impact of these charges, SG&A expenses increased by $65.2 million, or 18%, primarily due to increased compensation costs, Lithium growth spending and professional fees, partially offset by savings from our restructuring. As a percentage of net sales, SG&A expenses were 14.7% in 2017, compared to 13.2% in 2016. Excluding the impact of these charges, SG&A expenses as a percentage of net sales were 13.6% in 2017 and 13.2% in 2016.

Research and Development Expenses

For the year ended December 31, 2017, our R&D expenses increased $3.9 million, or 5%, from the year ended December 31, 2016. Included in R&D expenses for the year ended December 31, 2017 are $5.7 million of restructuring costs related to our Lithium sites in Germany. As a percentage of net sales, R&D expenses were 2.7% in 2017, compared to 3.0% in 2016.

Gain on Sales of Businesses, Net

The year ended December 31, 2016 included gains before income taxes of $11.5 million and $112.3 million related to the sales of the metal sulfides business and the minerals-based flame retardants and specialty chemicals business, respectively, both of which closed in the first quarter of 2016. In addition, Gain on sales of businesses, net, for the year ended December 31, 2016, included a loss of $1.5 million on the sale of our wafer reclaim business.

Acquisition and Integration Related Costs

Acquisition and integration related costs for the year ended December 31, 2017 are reported in Cost of goods sold and SG&A expenses, as noted above. The year ended December 31, 2016 included $52.1 million of acquisition and integration related costs directly related to the acquisition of Rockwood (mainly consisting of professional services, costs to achieve synergies, relocation costs, and other integration costs) and $5.3 million of costs in connection with other significant projects.

Interest and Financing Expenses

Interest and financing expenses for the year ended December 31, 2017 increased $50.2 million to $115.4 million from the corresponding 2016 period, due mainly to a loss of $52.8 million on early extinguishment of debt related to the tender premiums, fees, unamortized discounts and unamortized deferred financing costs from the repayment of the 3.00% Senior notes in full, €307.0 million of the 1.875% Senior notes and $174.7 million of the 4.50% Senior notes.

Other Expenses, Net

Other expenses, net, for the year ended December 31, 2017 was $9.5 million versus $20.5 million for the corresponding 2016 period. Other expenses, net for 2017 included approximately $16.1 million of pension and OPEB benefits (including mark-to-market actuarial gains of $11.4 million) allocated to Other expenses, net, as compared to $26.4 million of pension and OPEB costs (including mark-to-market actuarial losses of $26.7 million) allocated to Other expenses, net in 2016. In addition, during the year ended December 31, 2017, we recorded a $28.7 million reserve recorded against a note receivable in one of our European entities no longer deemed probable of collection, $11.0 million of charges related to previously disposed properties or businesses, partially offset by a $10.6 million gain related to the reversal of liabilities recorded as part of purchase accounting from a previous acquisition, a $6.2 million gain related to the acquisition of the 50% interest of an equity investment and $1.1 million related to a reversal of a liability associated with the previous disposal of a property. The remaining change was primarily due to an increase in foreign exchange losses of $13.5 million and a $2.9 million gain in the fair value of our investment in private equity securities recorded during the third quarter of 2016.

The mark-to-market actuarial gain in 2017 is primarily attributable to a higher return on pension plan assets in 2017 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 14.31% versus an expected return of 6.73%. The mark-to-market actuarial gain in 2017 was partially offset by a decrease in the weighted-average discount rate to 4.03% from 4.43% for our U.S. pension plans and to 1.94% from 2.00% for our foreign pension plans to reflect market conditions as of the December 31, 2017 measurement date.

The mark-to-market actuarial loss in 2016 is primarily attributable to a decrease in the weighted-average discount rate to 4.43% from 4.67% for our U.S. pension plans and to 2.00% from 2.76% for our foreign pension plans to reflect market conditions as of the December 31, 2016 measurement date. The mark-to-market actuarial loss in 2016 was partially offset by a higher return on pension plan assets in 2016 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 8.11% versus an expected return of 6.85%.

Income Tax Expense

The effective income tax rate for 2017 was 96.6% compared to 18.7% for 2016. Our effective income tax rate for 2017 was primarily affected by the enactment of the TCJA in December 2017. The tax effects of the TCJA are recorded in connection with the one-time transition tax expense of $429.2 million, partially offset by the remeasurement of deferred tax assets and liabilities due to a decrease in corporate tax rate from 35% to 21% of $62.3 million tax benefit. Exclusive of the enactment of the TCJA, the Company's effective tax rate differs from the U.S. Federal statutory income tax rate due to the impact of earnings from outside the U.S., mainly attributable to our share of the income of our JBC joint venture, a Free Zones company under the laws of the Hashemite Kingdom of Jordan. In addition, income tax expense for the year ended December 31, 2017, included foreign rate changes of $16.2 million and a $5.1 million out-of-period adjustment due to changes in our deferred tax liabilities for basis differences in Chilean fixed assets offset by a $10.9 million benefit from the release of valuation allowances due to a foreign restructuring plan that was initiated during the second quarter of 2017 and a $8.8 million benefit from excess tax benefits realized from stock-based compensation arrangements.

Our effective tax rate for 2016 was affected by discrete net tax expense items of $20.2 million related mainly to a tax gain from restructuring the ownership of a foreign subsidiary, foreign tax rate changes, provision to return adjustments and changes in valuation allowances necessary due to the restructuring. See Note 20, "Income Taxes," to our consolidated financial statements included in Part II, Item 8 of this report for a reconciliation of the U.S. Federal statutory income tax rate to our effective rate for 2017 and 2016.

Equity in Net Income of Unconsolidated Investments

Equity in net income of unconsolidated investments was $84.5 million for the year ended December 31, 2017 compared to $59.6 million in the same period last year. This increase of $24.9 million was primarily due to higher equity income reported by our Lithium segment joint venture, Windfield Holdings Pty. Ltd., resulting from favorable pricing and volumes in our lithium business.

Income from Discontinued Operations (Net of Tax)

The year ended December 31, 2016 income from discontinued operations, after income taxes, of $202.1 million included a pre-tax gain of $388.0 million ($135.0 million after income taxes) related to the sale of our Chemetall Surface Treatment business, which closed on December 14, 2016. This gain represents the difference between the carrying value of the related assets and their fair value as determined by the sales price less estimated costs to sell, and included the reversal of $81.4 million of foreign currency translation loss out of Accumulated other comprehensive loss.

Net Income Attributable to Noncontrolling Interests

For the year ended December 31, 2017, net income attributable to noncontrolling interests was $44.6 million compared to $37.1 million in the same period of 2016. This increase of $7.5 million was due primarily to changes in consolidated income related to our JBC joint venture resulting from higher sales volumes.

Net Income Attributable to Albemarle Corporation

Net income attributable to Albemarle Corporation decreased to $54.9 million for the year ended December 31, 2017, from $643.7 million for the corresponding period of 2016. The year ended December 31, 2017 was negatively impacted by the one-time transition tax expense of $429.2 million recorded as a result of the enactment of the TCJA in December 2017. In addition, the year ended December 31, 2017 included a $52.8 million loss on early extinguishment of debt and $17.1 million of restructuring and other costs, while the year ended December 31, 2016 included net gains of $250.5 million after income taxes related to the sale of businesses, including discontinued operations. Excluding these items, net income attributable to Albemarle increased by $160.8 million. The increase was primarily due to the increase in gross profit from higher overall sales volumes and favorable price impacts, the remeasurement of deferred tax assets and liabilities due to a decrease in corporate tax rate from 35% to 21% of $62.3 million tax benefit resulting from the enactment of the TCJA, and lower acquisition and integration related costs, partially offset by an increase in

SG&A expenses, income before taxes from discontinued operations in 2016 and the negative impact of hurricane Harvey.

Other Comprehensive Income, Net of Tax

Total other comprehensive income, after income taxes, was $187.6 million in 2017 compared to $8.3 million in 2016. This change is primarily due to changes in foreign currency translations. We translate our foreign subsidiary financial statements from their local currencies to U.S. Dollars. In 2017, other comprehensive income from foreign currency translation adjustments was $227.4 million, mainly as a result of favorable movements in the Euro of approximately $192 million, the Korean Won of approximately $16 million, the Chinese Renminbi of approximately $13 million and the Taiwan Dollar of approximately $4 million. Also included in total other comprehensive income for 2017 is a loss of $41.8 million in connection with the revaluation of our Euro-based 1.875% Senior notes which have been designated as a hedge of our net investment in foreign operations. In 2016, other comprehensive loss from foreign currency translation adjustments was $20.8 million, mainly as a result of unfavorable movements in the British Pound Sterling of approximately $25 million, the Chinese Renminbi of approximately $12 million, the Korean Won of approximately $6 million, the Turkish Lira of approximately $6 million, partially offset by favorable movements in the Euro of approximately $15 million and the Brazilian Real of approximately $13 million. Included in the currency movements for 2016 is the favorable effect of $81.4 million in accumulated foreign currency translation losses that were reversed as a result of the sale of the Chemetall Surface Treatment business. Also included in total other comprehensive income for 2016 is income of $26.1 million in connection with the revaluation of our Euro-based 1.875% Senior notes and which have been designated as a hedge of our net investment in foreign operations.

Segment Information Overview. Summarized financial information concerning our reportable segments is shown in the following tables. Results for 2017 and 2016 have been recast to reflect the change in segments previously noted.

	Year Ended December 31,				Percentage Change
	2017	%	2016	%	2017 vs. 2016
	(In thousands, except percentages)				
Net sales:					
Lithium	$1,018,885	33.2 %	$668,852	25.0 %	52 %
Bromine Specialties	855,143	27.8 %	792,425	29.6 %	8 %
Catalysts	1,067,572	34.7 %	1,031,501	38.5 %	3 %
All Other	128,914	4.2 %	180,988	6.8 %	(29)%
Corporate	1,462	0.1 %	3,437	0.1 %	(57)%
Total net sales	$3,071,976	100.0 %	$2,677,203	100.0 %	15 %
Adjusted EBITDA:					
Lithium	$446,652	50.4 %	$285,714	37.7 %	56 %
Bromine Specialties	258,901	29.2 %	226,926	29.9 %	14 %
Catalysts	283,883	32.1 %	316,609	41.8 %	(10)%
All Other	13,878	1.6 %	14,772	1.9 %	(6)%
Corporate	(117,834)	(13.3)%	(85,804)	(11.3)%	37 %
Total adjusted EBITDA	$885,480	100.0 %	$758,217	100.0 %	17 %

Albemarle Corporation and Subsidiaries

See below for a reconciliation of adjusted EBITDA, the non-GAAP financial measure, from Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with GAAP, (in thousands):

	Lithium	Bromine Specialties	Catalysts	Reportable Segments Total	All Other	Corporate	Consolidated Total
2017							
Net income (loss) attributable to Albemarle Corporation	$342,992	$218,839	$230,665	$792,496	$5,521	$(743,167)	$54,850
Depreciation and amortization	87,879	40,062	54,468	182,409	8,357	6,162	196,928
Utilization of inventory markup[(a)]	23,095	—	—	23,095	—	—	23,095
Restructuring and other[(b)]	—	—	—	—	—	17,056	17,056
Gain on acquisition[(c)]	(6,221)	—	—	(6,221)	—	—	(6,221)
Acquisition and integration related costs[(d)]	—	—	—	—	—	33,954	33,954
Interest and financing expenses[(e)]	—	—	—	—	—	115,350	115,350
Income tax expense	—	—	—	—	—	431,817	431,817
Non-operating pension and OPEB items	—	—	—	—	—	(16,125)	(16,125)
Note receivable reserve[(f)]	—	—	—	—	—	28,730	28,730
Other[(g)]	(1,093)	—	(1,250)	(2,343)	—	8,389	6,046
Adjusted EBITDA	$446,652	$258,901	$283,883	$989,436	$13,878	$(117,834)	$885,480
2016							
Net income (loss) attributable to Albemarle Corporation	$198,852	$187,364	$265,416	$651,632	$131,301	$(139,258)	$643,675
Depreciation and amortization	86,862	39,562	51,193	177,617	7,302	6,056	190,975
(Gain) loss on sales of businesses, net[(h)]	—	—	—	—	(123,831)	1,533	(122,298)
Acquisition and integration related costs[(i)]	—	—	—	—	—	57,384	57,384
Interest and financing expenses	—	—	—	—	—	65,181	65,181
Income tax expense	—	—	—	—	—	96,263	96,263
Income from discontinued operations (net of tax)	—	—	—	—	—	(202,131)	(202,131)
Non-operating pension and OPEB items	—	—	—	—	—	25,589	25,589
Other[(j)]	—	—	—	—	—	3,579	3,579
Adjusted EBITDA	$285,714	$226,926	$316,609	$829,249	$14,772	$(85,804)	$758,217

(a) In connection with the acquisition of Jiangli New Materials, the Company valued inventory purchased from Jiangli New Materials at fair value, which resulted in a markup of the underlying net book value of the inventory totaling approximately $23.1 million. The utilization of this inventory markup was included in Cost of goods sold during the year ended December 31, 2017, the estimated remaining selling period.

(b) During 2017, we initiated action to reduce costs in each of our reportable segments at several locations, primarily at our Lithium sites in Germany. Based on the restructuring plans, we have recorded expenses of $2.9 million in

Cost of goods sold, $8.4 million in Selling, general and administrative expenses, and $5.7 million in Research and development expenses, primarily related to expected severance payments. The unpaid balance is recorded in Accrued expenses at December 31, 2018, with the expectation that the remaining balance will be paid by the end of 2019.

(c) Gain recorded in Other expenses, net related to the acquisition of the remaining 50% interest in Salmag. See Note 2, “Acquisitions,” to our consolidated financial statements included in Part II, Item 8 of this report for additional information.

(d) Acquisition and integration related costs of $14.3 million and $19.6 million were included in Cost of goods sold and Selling, general and administrative expenses, respectively, for the year ended December 31, 2017 primarily resulting from the Jiangli New Materials acquisition, including non-routine compensation related costs negotiated specifically as a result of this acquisition that are outside the Company’s normal compensation arrangements.

(e) Included in Interest and financing expenses is a loss on early extinguishment of debt of $52.8 million. See Note 14, “Long-Term Debt,” to our consolidated financial statements included in Part II, Item 8 of this report for additional information.

(f) Reserve recorded in Other expenses, net against a note receivable on one of our European entities no longer deemed probable of collection.

(g) Included amounts for the year ended December 31, 2017 recorded in:

- Cost of goods sold - $1.3 million reversal of deferred income related to an abandoned project at an unconsolidated investment.

- Selling, general and administrative expenses - $3.3 million of shortfall contributions for our multiemployer plan financial improvement plan, partially offset by $1.0 million related to a reversal of an accrual recorded as part of purchase accounting from a previous acquisition.
- Other expenses, net - $3.2 million of asset retirement obligation charges related to the revision of an estimate at a site formerly owned by Albemarle, losses of $8.7 million related to adjustments of settlements and indemnifications of previously disposed businesses, the revision of tax indemnification expenses of $3.7 million primarily related to the filing of tax returns and a competent authority agreement for a previously disposed business and $1.0 million related to the settlement of a legal claim. This is partially offset by gains of $10.6 million and $1.1 million related to the reversal of liabilities recorded as part of purchase accounting from a previous acquisition and the previous disposal of a property, respectively.

(h) See "Gain on Sales of Businesses, Net" on page 40 for a description of these items.

(i) See "Acquisition and Integration Related Costs" on page 40 for a description of these items.

(j) Included amounts for the year ended December 31, 2016 recorded in:

- Selling, general and administrative expenses - $0.9 million related to the net loss on the sales of properties.
- Research and development expenses - $1.4 million related to the write-off of fixed assets in China.
- Other expenses, net - $2.4 million related to environmental charges related to a site formerly owned by Albemarle, partially offset by a gain related to a previously disposed of site in China of $1.1 million.

Lithium

Lithium segment net sales for the year ended December 31, 2017 were $1.02 billion, up $350.0 million, or 52%, in comparison to the same period in 2016. The increase was primarily driven by $163.2 million of favorable Lithium sales volumes, largely from battery grade applications, due to market demand and $186.3 million of favorable Lithium price impacts due primarily to price increases in our battery grade lithium salts. Adjusted EBITDA for Lithium increased 56%, or $160.9 million, to $446.7 million for the year ended December 31, 2017, compared to the corresponding period of 2016, primarily due to favorable pricing and higher overall sales volumes, partially offset by Lithium growth spending and $0.4 million of unfavorable currency translation impacts.

Bromine Specialties

Bromine Specialties segment net sales for the year ended December 31, 2017 were $855.1 million, up $62.7 million, or 8%, compared to the corresponding period of 2016. The increase was driven primarily by $60.4 million of higher sales volumes due to strong demand in flame retardants and reduced production in 2017 by Chinese bromine companies, and $2.3 million of favorable pricing on certain bromine derivatives. Adjusted EBITDA for Bromine Specialties increased 14%, or $32.0 million, to $258.9 million for the year ended December 31, 2017, compared to the corresponding period of 2016, primarily due to higher overall sales volumes and favorable pricing, partially offset by higher variable and fixed costs and a $1.5 million negative impact from hurricane Harvey.

Catalysts

Catalysts segment net sales for the year ended December 31, 2017 were $1.07 billion, an increase of $36.1 million, or 3%, compared to the corresponding period of 2016. This increase was primarily due to $48.7 million of higher volumes from strong demand in our customer base and $2.8 million of favorable currency exchange impacts, partially offset by $15.5 million of unfavorable price impacts due to customer and product mix and the bankruptcy filing of one of our customers. Catalysts adjusted EBITDA decreased 10%, or $32.7 million, to $283.9 million for the year ended December 31, 2017 compared to the corresponding period of 2016, primarily due to unfavorable price and mix impacts, higher costs and a $13.8 million negative impact from hurricane Harvey, partially offset by $2.3 million of favorable currency translation impacts.

All Other

All Other net sales for the year ended December 31, 2017 were $128.9 million, a decrease of $52.1 million compared to the year ended December 31, 2016. This decrease was primarily due to the impact of the sale of the minerals-based flame retardants and specialty chemicals business of $38.6 million, as well as unfavorable fine chemistry services pricing impacts due to a contract formula change which did not impact earnings. All Other adjusted EBITDA was down 6%, or $0.9 million, for the year ended December 31, 2017 in comparison to the same period of 2016. The year ended December 31, 2016 included the impact of the sale of the minerals-based flame retardants and specialty chemicals business of $3.4 million and a $2.9 million gain in the fair value of our investment in private equity securities.

Corporate

Corporate adjusted EBITDA was a charge of $117.8 million for the year ended December 31, 2017, an increase of $32.0 million, compared to the year ended December 31, 2016, primarily due to increased compensation costs, professional fees and $13.5 million of unfavorable currency impacts.

Summary of Critical Accounting Policies and Estimates

Estimates, Assumptions and Reclassifications

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of revenues, expenses, assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Listed below are the estimates and assumptions that we consider to be critical in the preparation of our financial statements.

Certain amounts in the accompanying consolidated financial statements and notes thereto have been reclassified to conform to the current presentation.

Property, Plant and Equipment. We assign the useful lives of our property, plant and equipment based upon our internal engineering estimates which are reviewed periodically. The estimated useful lives of our property, plant and equipment range from two to sixty years and depreciation is recorded on the straight-line method, with the exception of our long-term mineral rights, which are depleted on a units-of-production method. We evaluate the recovery of our property, plant and equipment by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized.

Acquisition Method of Accounting. We recognize the identifiable assets acquired, the liabilities assumed and any noncontrolling interest in the acquiree at their estimated fair values on the date of acquisition for acquired businesses. Determining the fair value of these items requires management's judgment, the utilization of independent valuation experts and involves the use of significant estimates and assumptions with respect to the timing and amounts of future cash inflows and outflows, discount rates, customer attrition rates, royalty rates, market prices and tax rates, among other items. The judgments made in the determination of the estimated fair value assigned to the assets acquired, the liabilities assumed and any noncontrolling interest in the investee, as well as the estimated useful life of each asset and the duration of each liability, can materially impact the financial statements in periods after acquisition, such as through depreciation and amortization expense. For more information on our acquisitions and application of the acquisition method, see Note 2, "Acquisitions," to our consolidated financial statements included in Part II, Item 8 of this report.

Income Taxes. We assume the deductibility of certain costs in our income tax filings, and we estimate the future recovery of deferred tax assets, uncertain tax positions and indefinite investment assertions.

Environmental Remediation Liabilities. We estimate and accrue the costs required to remediate a specific site depending on site-specific facts and circumstances. Cost estimates to remediate each specific site are developed by assessing (i) the scope of our contribution to the environmental matter, (ii) the scope of the anticipated remediation and monitoring plan and (iii) the extent of other parties' share of responsibility.

Actual results could differ materially from the estimates and assumptions that we use in the preparation of our financial statements.

Revenue Recognition

Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services, and is recognized when performance obligations are satisfied under the terms of contracts with our customers. A performance obligation is deemed to be satisfied when control of the product or service is transferred to our customer. The transaction price of a contract, or the amount we expect to receive upon satisfaction of all performance obligations, is determined by reference to the contract’s terms and includes adjustments, if applicable, for any variable consideration, such as customer rebates, noncash consideration or consideration payable to the customer, although these adjustments are generally not material. Where a contract contains more than one distinct performance obligation, the transaction price is allocated to each performance obligation based on the standalone selling price of each performance obligation, although these situations do not occur frequently and are generally not built into our contracts. Any unsatisfied performance obligations are not material. Standalone selling prices are based on prices we charge to our customers, which in some cases is based on established market prices. Sales and other similar taxes collected from customers on behalf of third parties are excluded from revenue. Our payment terms are generally between 30 to 90 days, however, they vary by market factors, such as customer size, creditworthiness, geography and competitive environment.

All of our revenue is derived from contracts with customers, and almost all of our contracts with customers contain one performance obligation for the transfer of goods where such performance obligation is satisfied at a point in time. Control of a product is deemed to be transferred to the customer upon shipment or delivery. Significant portions of our sales are sold free on board shipping point or on an equivalent basis, while delivery terms of other transactions are based upon specific contractual arrangements. Our standard terms of delivery are generally included in our contracts of sale, order confirmation documents and invoices, while the timing between shipment and delivery generally ranges between 1 and 45 days. Costs for shipping and handling activities, whether performed before or after the customer obtains control of the goods, are accounted for as fulfillment costs.

The Company currently utilizes the following practical expedients, as permitted by Accounting Standards Codification ("ASC") 606, Revenue from Contracts with Customers:

- All sales and other pass-through taxes are excluded from contract value;
- In utilizing the modified retrospective transition method, no adjustment was necessary for contracts that did not cross over the reporting year;
- We will not consider the possibility of a contract having a significant financing component (which would effectively attribute a portion of the sales price to interest income) unless, if at contract inception, the expected payment terms (from time of delivery or other relevant criterion) are more than one year;
- If our right to customer payment is directly related to the value of our completed performance, we recognize revenue consistent with the invoicing right; and
- We expense as incurred all costs of obtaining a contract incremental to any costs/compensation attributable to individual product sales/shipments for contracts where the amortization period for such costs would otherwise be one year or less.

Certain products we produce are made to our customer's specifications where such products have no alternative use or would need significant rework costs in order to be sold to another customer. In management's judgment, control of these arrangements is transferred to the customer at a point in time (upon shipment or delivery) and not over the time they are produced. Therefore revenue is recognized upon shipment or delivery of these products.

Costs incurred to obtain contracts with customers are not significant and are expensed immediately as the amortization period would be one year or less. When the Company incurs pre-production or other fulfillment costs in connection with an existing or specific anticipated contract and such costs are recoverable through margin or explicitly reimbursable, such costs are capitalized and amortized to Cost of goods sold on a systematic basis that is consistent with the pattern of transfer to the customer of the goods or services to which the asset relates, which is less than one year. We record bad debt expense in specific situations when we determine the customer is unable to meet its financial obligation.

Goodwill and Other Intangible Assets

We account for goodwill and other intangibles acquired in a business combination in conformity with current accounting guidance which requires goodwill and indefinite-lived intangible assets to not be amortized.

We test goodwill for impairment by comparing the estimated fair value of our reporting units to the related carrying value. Our reporting units are either our operating business segments or one level below our operating business segments for which discrete financial information is available and for which operating results are regularly reviewed by the business management. We estimate the fair value based on present value techniques involving future cash flows. Future cash flows include assumptions about sales volumes, selling prices, raw material prices, labor and other employee benefit costs, capital additions, income taxes, working capital, and other economic or market-related factors. Significant management judgment is involved in estimating these variables, and they include inherent uncertainties since they are forecasting future events. We perform a sensitivity analysis by using a range of inputs to confirm the reasonableness of these estimates being used in the goodwill impairment analysis. We use a Weighted Average Cost of Capital ("WACC") approach to determine our discount rate for goodwill recoverability testing. Our WACC calculation incorporates industry-weighted average returns on debt and equity from a market perspective. The factors in this calculation are largely external to the Company and, therefore, are beyond our control. We test our recorded goodwill for impairment in the fourth quarter of each year or upon the occurrence of events or changes in circumstances that would more likely than not reduce the fair value of our reporting units below their carrying amounts. The Company performed its annual goodwill impairment test as of October 31, 2018 and concluded there was no impairment as of that date. In addition, no material indications of impairment in any of our reporting units were indicated by the sensitivity analysis.

We assess our indefinite-lived intangible assets, which include trade names, for impairment annually and between annual tests if events or changes in circumstances indicate that it is more likely than not that the asset is impaired. The indefinite-lived intangible asset impairment standard allows us to first assess qualitative factors to determine if a quantitative impairment test is necessary. Further testing is only required if we determine, based on the qualitative assessment, that it is more likely than not that the indefinite-lived intangible asset's fair value is less than its carrying amount. If we determine based on the qualitative assessment that it is more likely than not that the asset is impaired, an impairment test is performed by comparing the fair value of the indefinite-lived intangible asset to its carrying amount.

Definite-lived intangible assets, such as purchased technology, patents and customer lists, are amortized over their estimated useful lives generally for periods ranging from five to twenty-five years. Except for customer lists and relationships associated with the majority of our Lithium business, which are amortized using the pattern of economic benefit method, definite-lived intangible assets are amortized using the straight-line method. We evaluate the recovery of our definite-lived intangible assets by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized. See Note 12, "Goodwill and Other Intangibles," to our consolidated financial statements included in Part II, Item 8 of this report.

Resource Development Expenses

We incur costs in resource exploration, evaluation and development during the different phases of our resource development projects. Exploration costs incurred before obtaining legal rights to explore an area are generally expensed as incurred. After obtaining legal rights, exploration costs are expensed in areas where we have uncertainty about obtaining proven resources. In areas where we have substantial knowledge about the area and consider it probable to obtain commercially viable proven resources, exploration and evaluation costs are capitalized.

If technical feasibility studies have been obtained, resource evaluation expenses are capitalized when the study demonstrates proven or probable resources for which future economic returns are expected, while costs for projects that are not considered viable are expensed. Development costs that are necessary to bring the property to commercial production or increase the capacity or useful life are capitalized. Costs to maintain the production capacity in a property under production are expensed as incurred.

Capitalized resource costs are depleted using the units-of-production method. Our resource development assets are evaluated for impairment when events or changes in circumstances indicate that the carrying amount may not be recoverable.

Pension Plans and Other Postretirement Benefits

Under authoritative accounting standards, assumptions are made regarding the valuation of benefit obligations and the performance of plan assets. As required, we recognize a balance sheet asset or liability for each of our pension and OPEB plans equal to the plan's funded status as of the measurement date. The primary assumptions are as follows:

- Discount Rate—The discount rate is used in calculating the present value of benefits, which is based on projections of benefit payments to be made in the future.
- Expected Return on Plan Assets—We project the future return on plan assets based on prior performance and future expectations for the types of investments held by the plans as well as the expected long-term allocation of plan assets for these investments. These projected returns reduce the net benefit costs recorded currently.
- Rate of Compensation Increase—For salary-related plans, we project employees' annual pay increases, which are used to project employees' pension benefits at retirement.

- Mortality Assumptions—Assumptions about life expectancy of plan participants are used in the measurement of related plan obligations.

Actuarial gains and losses are recognized annually in our consolidated statements of income in the fourth quarter and whenever a plan is determined to qualify for a remeasurement during a fiscal year. The remaining components of pension and OPEB plan expense, primarily service cost, interest cost and expected return on assets, are recorded on a monthly basis. The market-related value of assets equals the actual market value as of the date of measurement.

During 2018, we made changes to assumptions related to discount rates and expected rates of return on plan assets. We consider available information that we deem relevant when selecting each of these assumptions.

Our U.S. defined benefit plans for non-represented employees are closed to new participants, with no additional benefits accruing under these plans as participants' accrued benefits have been frozen. In selecting the discount rates for the U.S. plans, we consider expected benefit payments on a plan-by-plan basis. As a result, the Company uses different discount rates for each plan depending on the demographics of participants and the expected timing of benefit payments. For 2018, the discount rates were calculated using the results from a bond matching technique developed by Milliman, which matched the future estimated annual benefit payments of each respective plan against a portfolio of bonds of high quality to determine the discount rate. We believe our selected discount rates are determined using preferred methodology under authoritative accounting guidance and accurately reflect market conditions as of the December 31, 2018 measurement date.

In selecting the discount rates for the foreign plans, we look at long-term yields on AA-rated corporate bonds when available. Our actuaries have developed yield curves based on the yields of constituent bonds in the various indices as well as on other market indicators such as swap rates, particularly at the longer durations. For the Eurozone, we apply the Aon Hewitt yield curve to projected cash flows from the relevant plans to derive the discount rate. For the U.K., the discount rate is determined by applying the Aon Hewitt yield curve for typical schemes of similar duration to projected cash flows of Albemarle's U.K. plan. In other countries where there is not a sufficiently deep market of high-quality corporate bonds, we set the discount rate by referencing the yield on government bonds of an appropriate duration.

At December 31, 2018, the weighted-average discount rate for the U.S. and foreign pension plans was increased to 4.59% and 2.15%, respectively, from 4.03% and 1.94%, respectively, at December 31, 2017 to reflect market conditions as of the December 31, 2018 measurement date. The discount rate for the OPEB plans at December 31, 2018 and 2017 was 4.55% and 3.99%, respectively.

In estimating the expected return on plan assets, we consider past performance and future expectations for the types of investments held by the plan as well as the expected long-term allocations of plan assets to these investments. For the years 2018 and 2017, the weighted-average expected rate of return on U.S. pension plan assets was 6.89%, and the weighted-average expected rate of return on foreign pension plan assets was 5.52% and 6.16%, respectively. Effective January 1, 2019, the weighted-average expected rate of return on U.S. and foreign pension plan assets is 6.89% and 5.69%, respectively. The weighted-average expected rate of return on plan assets for our OPEB plans was 7.00% during 2018 and 2017.

In projecting the rate of compensation increase, we consider past experience in light of movements in inflation rates. At December 31, 2018 and 2017, the assumed weighted-average rate of compensation increase was 3.63% and 3.18%, respectively, for our foreign pension plans.

In October 2017, the Society of Actuaries ("SOA") published an updated Mortality Improvement Scale, MP-2017. The updated improvement scale incorporates an additional year of mortality data (2015). We utilized the same base, SOA RP-2014 Adjusted to 2006 Total Dataset Mortality, but we revised our mortality assumption to incorporate the MP-2017 Mortality Improvement Scale for purposes of measuring our U.S. pension and OPEB obligations at December 31, 2017. In October 2018, the SOA published an updated Mortality Improvement Scale, MP-2018. The updated Improvement Scale incorporates an additional year of mortality data (2016). We utilized the same base mortality, SOA RP-2014 Adjusted to 2006 Total Dataset Mortality, but we revised our mortality assumption to incorporate the MP-2018 Mortality Improvement Scale for purposes of measuring our U.S. pension and OPEB obligations at December 31, 2018.

At December 31, 2018, the assumed rate of increase in the pre-65 and post-65 per capita cost of covered health care benefits for U.S. retirees was zero as the employer-paid premium caps (pre-65 and post-65) were met starting January 1, 2013.

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Albemarle Corporation and Subsidiaries

A variance in the assumptions discussed above would have an impact on the projected benefit obligations, the accrued OPEB liabilities, and the annual net periodic pension and OPEB cost. The following table reflects the sensitivities associated with a hypothetical change in certain assumptions, primarily in the U.S. (in thousands):

	(Favorable) Unfavorable			
	1% Increase		1% Decrease	
	Increase (Decrease) in Benefit Obligation	Increase (Decrease) in Benefit Cost	Increase (Decrease) in Benefit Obligation	Increase (Decrease) in Benefit Cost
Actuarial Assumptions				
Discount Rate:				
Pension	$(94,999)	$ 3,492	$116,592	$ (5,024)
Other postretirement benefits	$(4,403)	$ 239	$5,226	$ (298)
Expected return on plan assets:				
Pension	*	$ (5,595)	*	$ 5,595
Other postretirement benefits	*	$ —	*	$ —

* Not applicable.

Of the $583.7 million total pension and postretirement assets at December 31, 2018, $72.0 million, or approximately 12%, are measured using the net asset value as a practical expedient. Gains or losses attributable to these assets are recognized in the consolidated balance sheets as either an increase or decrease in plan assets. See Note 15, “Pension Plans and Other Postretirement Benefits,” to our consolidated financial statements included in Part II, Item 8 of this report.

Income Taxes

We use the liability method for determining our income taxes, under which current and deferred tax liabilities and assets are recorded in accordance with enacted tax laws and rates. Under this method, the amounts of deferred tax liabilities and assets at the end of each period are determined using the tax rate expected to be in effect when taxes are actually paid or recovered. Future tax benefits are recognized to the extent that realization of such benefits is more likely than not. In order to record deferred tax assets and liabilities, we are following guidance under ASU 2015-17, which requires deferred tax assets and liabilities to be classified as noncurrent on the balance sheet, along with any related valuation allowance. Tax effects are released from Accumulated Other Comprehensive Income using either the specific identification approach or the portfolio approach based on the nature of the underlying item.

Deferred income taxes are provided for the estimated income tax effect of temporary differences between the financial statement carrying amounts and the tax basis of existing assets and liabilities. Deferred tax assets are also provided for operating losses, capital losses and certain tax credit carryovers. A valuation allowance, reducing deferred tax assets, is established when it is more likely than not that some portion or all of the deferred tax assets will not be realized. The realization of such deferred tax assets is dependent upon the generation of sufficient future taxable income of the appropriate character. Although realization is not assured, we do not establish a valuation allowance when we believe it is more likely than not that a net deferred tax asset will be realized.

We only recognize a tax benefit after concluding that it is more likely than not that the benefit will be sustained upon audit by the respective taxing authority based solely on the technical merits of the associated tax position. Once the recognition threshold is met, we recognize a tax benefit measured as the largest amount of the tax benefit that, in our judgment, is greater than 50% likely to be realized. Interest and penalties related to income tax liabilities are included in Income tax expense on the consolidated statements of income.

We are subject to income taxes in the U.S. and numerous foreign jurisdictions. Due to the statute of limitations, we are no longer subject to U.S. federal income tax audits by the Internal Revenue Service (“IRS”) for years prior to 2011. Due to the statute of limitations, we also are no longer subject to U.S. state income tax audits prior to 2011.

With respect to jurisdictions outside the U.S., several audits are in process. We have audits ongoing for the years 2006 through 2017 related to Germany, Taiwan, Italy, India, Belgium, and Chile, some of which are for entities that have since been divested.

While we believe we have adequately provided for all tax positions, amounts asserted by taxing authorities could be greater than our accrued position. Accordingly, additional provisions on federal and foreign tax-related matters could be recorded in the future as revised estimates are made or the underlying matters are settled or otherwise resolved.

Since the timing of resolutions and/or closure of tax audits are uncertain, it is difficult to predict with certainty the range of reasonably possible significant increases or decreases in the liability related to uncertain tax positions that may occur within the next twelve months. Our current view is that it is reasonably possible that we could record a decrease in the liability related to uncertain tax positions, relating to a number of issues, up to approximately $4.4 million as a result of closure of tax statutes. As a result of the sale of the Chemetall Surface Treatment business in 2016, we agreed to indemnify certain income and non-income tax liabilities, including uncertain tax positions, associated with the entities sold. The associated liability is recorded in Other noncurrent liabilities. See Note 16, "Other Noncurrent Liabilities," and Note 20, "Income Taxes," for further details.

We have designated the undistributed earnings of a portion of our foreign operations as indefinitely reinvested and as a result we do not provide for deferred income taxes on the unremitted earnings of these subsidiaries. Our foreign earnings are computed under U.S. federal tax earnings and profits ("E&P") principles. In general, to the extent our financial reporting book basis over tax basis of a foreign subsidiary exceeds these E&P amounts, deferred taxes have not been provided, as they are essentially permanent in duration. The determination of the amount of such unrecognized deferred tax liability is not practicable. We provide for deferred income taxes on our undistributed earnings of foreign operations that are not deemed to be indefinitely invested. We will continue to evaluate our permanent investment assertion taking into consideration all relevant and current tax laws.

On December 22, 2017, the TCJA was signed into law in the U.S. The TCJA contains several key tax provisions including, among other things, the reduction of the corporate income tax rate from 35% to 21% effective January 1, 2018, the requirement of companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred, and the creation of new taxes on certain foreign sourced earnings such as global intangible low-taxed income ("GILTI"). A company can elect an accounting policy to account for GILTI as a period charge in the future period the tax arises or as part of deferred taxes related to the investment or subsidiary. The Company has elected to account for GILTI as a period cost.

Stock-based Compensation Expense

The fair value of restricted stock awards, restricted stock unit awards and performance unit awards with a service condition are determined based on the number of shares or units granted and the quoted price of our common stock on the date of grant, and the fair value of stock options is determined using the Black-Scholes valuation model. The fair value of performance unit awards with a service and a market condition are estimated on the date of grant using a Monte Carlo simulation model. The fair value of these awards is determined after giving effect to estimated forfeitures. Such value is recognized as expense over the service period, which is generally the vesting period of the equity grant. To the extent restricted stock awards, restricted stock unit awards, performance unit awards and stock options are forfeited prior to vesting in excess of the estimated forfeiture rate, the corresponding previously recognized expense is reversed as an offset to operating expenses.

Financial Condition and Liquidity

Overview

The principal uses of cash in our business generally have been capital investments and resource development costs, funding working capital and service of debt. We also make contributions to our defined benefit pension plans, pay dividends to our shareholders and repurchase shares of our common stock. Historically, cash to fund the needs of our business has been principally provided by cash from operations, debt financing and equity issuances.

We are continually focused on working capital efficiency particularly in the areas of accounts receivable and inventory. We anticipate that cash on hand, cash provided by operating activities, proceeds from divestitures and borrowings will be sufficient to pay our operating expenses, satisfy debt service obligations, fund capital expenditures and other investing activities, fund pension contributions and pay dividends for the foreseeable future.

Cash Flow

Our cash and cash equivalents were $555.3 million at December 31, 2018 as compared to $1.14 billion at December 31, 2017. Cash provided by operating activities was $546.2 million, $304.0 million and $735.5 million during the years ended December 31, 2018, 2017 and 2016, respectively.

The increase in cash provided by operating activities in 2018 versus 2017 was primarily due to higher income tax payments in 2017, including approximately $257 million of income taxes from the gain on sale of the Chemetall Surface Treatment business. In addition, 2018 benefited from increased earnings in each of our reportable segments, increased dividends received from unconsolidated investments and lower interest payments. This was partially offset by increased receivables from higher net sales during 2018 and the build-up of inventory in our Lithium and Catalysts segments due to higher forecasted sales. The decrease in cash provided by operating activities in 2017 versus 2016 was primarily due to the 2017 income tax payment noted above that was recorded in income taxes payable in 2016. In addition, the decrease resulted from the build-up of inventory in the Lithium reportable segment in 2017. This was partially offset by increased overall sales volumes and prices, lower acquisition and integration related costs and lower interest payments in 2017 as compared to 2016.

During 2018, cash on hand, cash provided by operations and $413.6 million of net proceeds from divestitures funded $114.7 million of commercial paper repayments, net of borrowings, $500.0 million of accelerated share repurchase programs, $700.0 million of capital expenditures for plant, machinery and equipment, and mining resource development, dividends to shareholders of $144.6 million, and pension and postretirement contributions of $15.2 million. During 2017, cash on hand, cash provided by operations and net borrowings of $138.8 million funded $778.2 million of debt repayments, $317.7 million of capital expenditures for plant, machinery and equipment, a $250.0 million accelerated share repurchase program, dividends to shareholders of $140.6 million, and pension and postretirement contributions of $13.3 million. During 2016, cash on hand, cash provided by operations and $3.33 billion of cash proceeds from divestitures funded $1.42 billion of debt repayments, $196.7 million of capital expenditures for plant, machinery and equipment, dividends to shareholders of $135.4 million, and pension and postretirement contributions of $20.1 million. In addition, during the years ended December 31, 2018, 2017 and 2016, our consolidated joint venture, JBC, paid dividends of approximately $40.0 million, $102.5 million and $105.0 million, respectively, which resulted in dividends to noncontrolling interests of $14.8 million, $36.8 million and $35.9 million, respectively.

On April 3, 2018, we completed the Polyolefin Catalysts Divestiture to W.R. Grace & Co. for net cash proceeds of approximately $413.6 million and recorded a gain of $210.4 million before income taxes in 2018 related to the sale of this business. The transaction includes Albemarle’s Product Development Center located in Baton Rouge, Louisiana, and operations at our Yeosu, South Korea site. The sale did not include the organometallics or curatives portion of the PCS business. The Polyolefin Catalysts Divestiture reflects our commitment to investing in the future growth of our high priority businesses and returning capital to our shareholders.

On December 14, 2016, we completed the sale of the Chemetall Surface Treatment business to BASF SE for cash proceeds of approximately $3.1 billion, net of purchase price adjustments. As a result of the sale, we recorded a gain of $388.0 million before income taxes and a tax liability of $253.0 million related to the difference between the sales price and the proportionate carrying value of the interests sold in 2016. We used the proceeds to significantly reduce leverage, including repaying the outstanding balance of the September 2015 Term Loan in full and approximately $153 million of Commercial Paper Notes in December 2016. In addition, during the first quarter of 2017, we repaid the 3.00% Senior notes in full, €307.0 million of the 1.875% Senior notes and $174.7 million of the 4.50% Senior notes, as well as related redemption premiums of $45.2 million.

In 2016, we also completed the sales of our metal sulfides business and our mineral-based flame retardants and specialty chemicals businesses for net proceeds of approximately $137 million and $187 million, respectively. The net proceeds from both sales were used to repay a portion of the outstanding balance under the September 2015 Term Loan Agreement.

Capital expenditures were $700.0 million, $317.7 million and $196.7 million for the years ended December 31, 2018, 2017 and 2016, respectively, and were incurred mainly for plant, machinery and equipment, and mining resource development. The increase in capital expenditures during the year ended December 31, 2018 was primarily driven by expansion in our Lithium business. Capital expenditures for discontinued operations were $19.3 million for the year ended December 31, 2016. We expect our capital expenditures to be between $800 million and $900 million in 2019 for Lithium growth, mining resource development and capacity increases, as well as productivity and continuity of operations projects in all segments. Of the total capital expenditures, our projects related to the continuity of

operations is expected to remain in the range of 4-6% of net sales, similar to prior years.
During 2018, we incurred $19.4 million of acquisition and integration related costs related to various significant projects. During 2017, we incurred $33.9 million of acquisition and integration related costs related to various significant projects, including the Jiangli New Materials acquisition, which contains non-routine compensation related costs negotiated specifically as a result of this acquisition that are outside of the Company’s ordinary course compensation arrangements. During 2016, we incurred $52.1 million of acquisition and integration related costs directly related to the acquisition of Rockwood (mainly consisting of professional services, costs to achieve synergies, relocation costs, and other integration costs) and $5.3 million of costs in connection with other significant projects.
In November 2016, our Board of Directors authorized an increase in the number of shares the Company is permitted to repurchase under our share repurchase program, pursuant to which the Company was permitted to repurchase up to a maximum

of 15,000,000 shares, including those previously authorized but not yet repurchased. Under our existing Board authorized share repurchase program, during 2018 and 2017, the Company repurchased approximately 5.3 million shares and 2.3 million shares of our common stock, respectively, which reduced the Company's weighted average shares outstanding for purposes of calculating basic and diluted earnings per share for the years ended December 31, 2018 and 2017, respectively. All of the shares repurchased in 2018 and 2017 were also repurchased pursuant to the terms of ASR agreements with major financial institutions. As of December 31, 2018, there were 7,396,263 remaining shares available for repurchase under the Company's authorized share repurchase program. There were no shares of our common stock repurchased during 2016.

Net current assets decreased to approximately $815.2 million at December 31, 2018 from $1.28 billion at December 31, 2017, with the decrease being largely due to the reduction in cash and cash equivalents to fund the ASR programs we entered into during 2018 and capital expenditure projects. Additional changes in the components of net current assets are primarily due to the timing of the sale of goods and other ordinary transactions leading up to the balance sheet dates and are not the result of any policy changes by the Company, and do not reflect any change in either the quality of our net current assets or our expectation of success in converting net working capital to cash in the ordinary course of business.

On February 26, 2019, we increased our quarterly dividend rate to $0.3675 per share, a 10% increase from the quarterly rate of $0.335 per share paid in 2018.

At December 31, 2018 and December 31, 2017, our cash and cash equivalents included $525.8 million and $1.10 billion, respectively, held by our foreign subsidiaries. The majority of these foreign cash balances are associated with earnings that we have asserted are indefinitely reinvested and which we plan to use to support our continued growth plans outside the U.S. through funding of capital expenditures, acquisitions, research, operating expenses or other similar cash needs of our foreign operations. From time to time, we repatriate cash associated with earnings from our foreign subsidiaries to the U.S. for normal operating needs through intercompany dividends, but only from subsidiaries whose earnings we have not asserted to be indefinitely reinvested or whose earnings qualify as "previously taxed income" as defined by the Internal Revenue Code. For the years ended December 31, 2018, 2017 and 2016, we repatriated approximately $621.8 million, $20.5 million and $53.7 million of cash, respectively, as part of these foreign earnings cash repatriation activities. A portion of the cash repatriations was used to repay a net amount of $114.7 million of commercial paper during 2018.

While we continue to closely monitor our cash generation, working capital management and capital spending in light of continuing uncertainties in the global economy, we believe that we will continue to have the financial flexibility and capability to opportunistically fund future growth initiatives. Additionally, we anticipate that future capital spending including business acquisitions, share repurchases and other cash outlays, should be financed primarily with cash flow provided by operations and cash on hand, with additional cash needed, if any, provided by borrowings. The amount and timing of any additional borrowings will depend on our specific cash requirements.

Long-Term Debt

We currently have the following senior notes outstanding:

Issue Month/Year	Principal (in millions)	Interest Rate	Interest Payment Dates		Maturity Date
December 2014	€393.0	1.875%	December 8		December 8, 2021
November 2014	$425.0	4.15%	June 1	December 1	December 1, 2024
November 2014	$350.0	5.45%	June 1	December 1	December 1, 2044
December 2010	$175.3	4.50%	June 15	December 15	December 15, 2020

Our senior notes are senior unsecured obligations and rank equally with all our other senior unsecured indebtedness from time to time outstanding. The senior notes are effectively subordinated to any of our existing or future secured indebtedness and to the existing and future indebtedness of our subsidiaries. As is customary for such long-term debt instruments, each senior note outstanding has terms that allow us to redeem the notes before its maturity, in whole at any time or in part from time to time, at a redemption price equal to the greater of (i) 100% of the principal amount of the senior notes to be redeemed, or (ii) the sum of the present values of the remaining scheduled payments of principal and interest thereon (exclusive of interest accrued to the date of redemption) discounted to the redemption date on a semi-annual basis using the comparable government rate (as defined in the indentures governing the senior notes) plus between 25 and 40 basis points, depending on the note, plus, in each case, accrued interest thereon to the date of redemption. Holders may require us to purchase such notes at 101% upon a change of control triggering event, as defined in the indentures. The senior notes are subject to typical events of default, including bankruptcy and insolvency events, nonpayment and the acceleration of certain subsidiary indebtedness of $40 million or more caused by a nonpayment default.

On June 21, 2018, we entered into the 2018 Credit Agreement to replace our revolving, unsecured credit agreement dated as of February 7, 2014, as amended. The 2018 Credit Agreement currently provides for borrowings of up to $1.0 billion and matures on June 23, 2023. Borrowings under the 2018 Credit Agreement bear interest at variable rates based on an average London inter-bank offered rate ("LIBOR") for deposits in the relevant currency plus an applicable margin which ranges from 0.910% to 1.500%, depending on the Company's credit rating from Standard & Poor's Rating Services, Moody's Investors Services and Fitch Ratings. The applicable margin on the facility was 1.125% as of December 31, 2018. There were no borrowings outstanding under the 2018 Credit Agreement as of December 31, 2018.

Borrowings under the 2018 Credit Agreement are conditioned upon satisfaction of certain conditions precedent, including the absence of defaults. The Company is subject to one financial covenant, as well as customary affirmative and negative covenants. The financial covenant requires that the Company's consolidated funded debt to consolidated EBITDA ratio (as such terms are defined in the 2018 Credit Agreement) to be less than or equal to 3.50:1.00, subject to adjustments in accordance with the terms of the 2018 Credit Agreement relating to a consummation of an acquisition where the consideration includes cash proceeds from issuance of funded debt in excess of $500 million. The 2018 Credit Agreement also contains customary default provisions, including defaults for non-payment, breach of representations and warranties, insolvency, non-performance of covenants and cross-defaults to other material indebtedness. The occurrence of an event of default under the 2018 Credit Agreement could result in all loans and other obligations becoming immediately due and payable and the credit facility being terminated.

On May 29, 2013, we entered into agreements to initiate a commercial paper program on a private placement basis under which we may issue unsecured commercial paper notes (the "Commercial Paper Notes") from time-to-time up to a maximum aggregate principal amount outstanding at any time of $750.0 million. The proceeds from the issuance of the Commercial Paper Notes are expected to be used for general corporate purposes, including the repayment of other debt of the Company. Our 2018 Credit Agreement is available to repay the Commercial Paper Notes, if necessary. Aggregate borrowings outstanding under the 2018 Credit Agreement and the Commercial Paper Notes will not exceed the $1.0 billion current maximum amount available under the 2018 Credit Agreement. The Commercial Paper Notes will be sold at a discount from par, or alternatively, will be sold at par and bear interest at rates that will vary based upon market conditions at the time of issuance. The maturities of the Commercial Paper Notes will vary but may not exceed 397 days from the date of issue. The definitive documents relating to the commercial paper program contain customary representations, warranties, default and indemnification provisions. At December 31, 2018, we had $306.6 million of Commercial Paper Notes outstanding bearing a weighted-average interest rate of approximately 2.91% and a weighted-average maturity of 38 days. During 2018, we repaid a net amount of $114.7 million of commercial paper notes using cash on hand. The Commercial Paper Notes are classified as Current portion of long-term debt in our consolidated balance sheets at December 31, 2018 and December 31, 2017.

The non-current portion of our long-term debt amounted to $1.40 billion at December 31, 2018, compared to $1.42 billion at December 31, 2017. In addition, at December 31, 2018, we had the ability to borrow $693.4 million under our commercial paper program and the 2018 Credit Agreement, and $251.0 million under other existing lines of credit, subject to various financial covenants under our 2018 Credit Agreement. We have the ability and intent to refinance our borrowings under our other existing credit lines with borrowings under the 2018 Credit Agreement, as applicable. Therefore, the amounts outstanding under those credit lines, if any, are classified as long-term debt. We believe that as of December 31, 2018 we were, and currently are, in compliance with all of our debt covenants. For additional information about our long-term debt obligations, see Note 14, "Long-Term Debt," to our consolidated financial statements included in Part II, Item 8 of this report.

Off-Balance Sheet Arrangements

In the normal course of business with customers, vendors and others, we have entered into off-balance sheet arrangements, including bank guarantees and letters of credit, which totaled approximately $71.8 million at

December 31, 2018. None of these off-balance sheet arrangements has, or is likely to have, a material effect on our current or future financial condition, results of operations, liquidity or capital resources.

Other Obligations

The following table summarizes our contractual obligations for capital projects, various take or pay and throughput agreements, long-term debt, operating leases and other commitments as of December 31, 2018 (in thousands):

	2019	2020	2021	2022	2023	Thereafter
Long-term debt obligations[(a)]	$307,294	$175,302	$446,996	$—	$7,216	$778,720
Expected interest payments on long-term debt obligations[(b)]	53,004	53,004	45,119	36,738	36,738	418,213
Operating lease obligations (rental)	25,608	17,918	12,478	10,794	10,109	87,085
Take or pay / throughput agreements[(c)]	26,570	17,293	9,018	7,541	5,595	15,737
Letters of credit and guarantees	45,342	12,924	1,883	1,277	—	10,389
Transition tax on foreign earnings[(d)]	14,379	14,379	30,230	30,442	44,497	198,197
Capital projects	256,165	89	—	—	—	—
Total	$728,362	$290,909	$545,724	$86,792	$104,155	$1,508,341

(a) Amounts represent the expected principal payments of our long-term debt and do not include any fair value adjustments, premiums or discounts. Obligations in 2019 include our outstanding Commercial Paper Notes of $306.6 million with a weighted average maturity of 38 days.

(b) Interest on our fixed rate borrowings was calculated based on the stated rates of such borrowings. A weighted average interest rate of approximately 0.35% was used for our remaining long-term debt obligations.

(c) These amounts primarily relate to contracts entered into with certain third party vendors in the normal course of business to secure raw materials for our production processes. In order to secure materials, sometimes for long durations, these contracts mandate a minimum amount of product to be purchased at predetermined rates over a set timeframe.

(d) In December 2017, the TCJA was signed into law imposing a one-time transition tax on foreign earnings, payable over an eight-year period. The one-time transition tax imposed by the TCJA is based on our total post-1986 earnings and profits that we previously deferred from U.S. income taxes.

Amounts in the table above exclude required employer pension contributions. Contributions to our domestic and foreign qualified and nonqualified pension plans, including our supplemental executive retirement plan (“SERP”), are expected to approximate $12 million in 2019. We may choose to make additional pension contributions in excess of this amount. We made contributions of approximately $12.9 million to our domestic and foreign pension plans (both qualified and nonqualified) during the year ended December 31, 2018.

The liability related to uncertain tax positions, including interest and penalties, recorded in Other noncurrent liabilities totaled $22.9 million and $24.4 million at December 31, 2018 and 2017, respectively. Related assets for corresponding offsetting benefits recorded in Other assets totaled $13.0 million and $14.6 million at December 31, 2018 and 2017, respectively. We cannot estimate the amounts of any cash payments during the next twelve months associated with these liabilities and are unable to estimate the timing of any such cash payments in the future at this time.

Liquidity Outlook

We anticipate that cash on hand and cash provided by operating activities, divestitures, including the Polyolefin Catalysts Divestiture, and borrowings will be sufficient to pay our operating expenses, satisfy debt service obligations, fund any capital expenditures and share repurchases, make acquisitions, make pension contributions and pay dividends for the foreseeable future. Our main focus over the next three years, in terms of uses of cash, will be investing in growth of the businesses and the return of value to shareholders. Additionally, we will continue to evaluate the merits of any opportunities that may arise for acquisitions of businesses or assets, which may require additional liquidity. For example, we expect that the purchase price for the announced acquisition of the Wodgina Project, of approximately $1.15 billion, will be funded with available cash and new debt borrowings.

Our cash flows from operations may be negatively affected by adverse consequences to our customers and the markets in which we compete as a result of moderating global economic conditions and reduced capital availability.
While we maintain business relationships with a diverse group of financial institutions, an adverse change in their credit standing could lead them to not honor their contractual credit commitments, decline funding under existing but uncommitted lines of credit, not renew their extensions of credit or not provide new financing. While the global corporate bond and bank loan markets remain strong, periods of elevated uncertainty related to global economic and/or geopolitical concerns may limit

efficient access to such markets for extended periods of time. If such concerns heighten, we may incur increased borrowing costs and reduced credit capacity as our various credit facilities mature. When the U.S. Federal Reserve or similar national reserve banks in other countries decide to tighten the monetary supply in response, for example, to improving economic conditions, we may incur increased borrowing costs as interest rates increase on our variable rate credit facilities, as our various credit facilities mature or as we refinance any maturing fixed rate debt obligations, although these cost increases would be partially offset by increased income rates on portions of our cash deposits. Overall, with generally strong cash-generative businesses and no significant long-term debt maturities before 2020, we believe we have, and will maintain, a solid liquidity position.

As previously reported in 2018, following receipt of information regarding potential improper payments being made by third party sales representatives of our Refining Solutions business, within our Catalysts segment, we promptly retained outside counsel and forensic accountants to investigate potential violations of the Company's Code of Conduct, the FCPA, and other potentially applicable laws. Based on this internal investigation, we have voluntarily self-reported potential issues relating to the use of third party sales representatives in our Refining Solutions business, within our Catalysts segment, to the DOJ, the SEC, and the DPP, and are cooperating with the DOJ, the SEC, and DPP in their review of these matters. In connection with our internal investigation, we have implemented, and are continuing to implement, appropriate remedial measures.

At this time, we are unable to predict the duration, scope, result or related costs associated with the investigations by the DOJ, the SEC, or DPP. We are unable to predict what, if any, action may be taken by the DOJ, the SEC, or DPP, or what penalties or remedial actions they may seek to impose. Any determination that our operations or activities are not in compliance with existing laws or regulations could result in the imposition of fines, penalties, disgorgement, equitable relief, or other losses. We do not believe, however, that any such fines, penalties, disgorgement, equitable relief or other losses would have a material adverse effect on our financial condition or liquidity.

We had cash and cash equivalents totaling $555.3 million as of December 31, 2018, of which $525.8 million is held by our foreign subsidiaries. This cash represents an important source of our liquidity and is invested in bank accounts or money market investments with no limitations on access. The cash held by our foreign subsidiaries is intended for use outside of the U.S. We anticipate that any needs for liquidity within the U.S. in excess of our cash held in the U.S. can be readily satisfied with borrowings under our existing U.S. credit facilities or our commercial paper program.

Safety and Environmental Matters

We are subject to federal, state, local and foreign requirements regulating the handling, manufacture and use of materials (some of which may be classified as hazardous or toxic by one or more regulatory agencies), the discharge of materials into the environment and the protection of the environment. To our knowledge, we are currently complying and expect to continue to comply in all material respects with applicable environmental laws, regulations, statutes and ordinances. Compliance with existing federal, state, local and foreign environmental protection laws is not expected to have a material effect on capital expenditures, earnings or our competitive position, but the costs associated with increased legal or regulatory requirements could have an adverse effect on our operating results.

Among other environmental requirements, we are subject to the federal Superfund law, and similar state laws, under which we may be designated as a PRP, and may be liable for a share of the costs associated with cleaning up various hazardous waste sites. Management believes that in cases in which we may have liability as a PRP, our liability for our share of cleanup is de minimis. Further, almost all such sites represent environmental issues that are quite mature and have been investigated, studied and in many cases settled. In de minimis situations, our policy generally is to negotiate a consent decree and to pay any apportioned settlement, enabling us to be effectively relieved of any further liability as a PRP, except for remote contingencies. In other than de minimis PRP matters, our records indicate that unresolved PRP exposures should be immaterial. We accrue and expense our proportionate share of PRP costs. Because management has been actively involved in evaluating environmental matters, we are able to conclude that the outstanding environmental liabilities for unresolved PRP sites should not have a material adverse effect upon our results of operations or financial condition.

Our environmental and safety operating costs charged to expense were $42.9 million, $40.1 million and $34.4 million in 2018, 2017 and 2016, respectively, excluding depreciation of previous capital expenditures, and are expected to be in the same range in the next few years. Costs for remediation have been accrued and payments related to sites are charged against accrued liabilities, which at December 31, 2018 totaled approximately $49.6 million, an increase of $9.8 million from $39.8 million at December 31, 2017. See Note 17, "Commitments and Contingencies" to our consolidated financial statements included in Part II, Item 8 of this report for a reconciliation of our environmental liabilities for the years ended December 31, 2018, 2017 and 2016.

We believe that any sum we may be required to pay in connection with environmental remediation and asset retirement obligation matters in excess of the amounts recorded should occur over a period of time and should not have a material adverse effect upon our results of operations, financial condition or cash flows on a consolidated annual basis, although any such sum could have a material adverse impact on our results of operations, financial condition or cash flows in a particular quarterly reporting period.

Capital expenditures for pollution-abatement and safety projects, including such costs that are included in other projects, were approximately $47.3 million, $28.1 million and $28.8 million in 2018, 2017 and 2016, respectively. In the future, capital expenditures for these types of projects may increase due to more stringent environmental regulatory requirements and our efforts in reaching sustainability goals. Management's estimates of the effects of compliance with governmental pollution-abatement and safety regulations are subject to (a) the possibility of changes in the applicable statutes and regulations or in judicial or administrative construction of such statutes and regulations and (b) uncertainty as to whether anticipated solutions to pollution problems will be successful, or whether additional expenditures may prove necessary.

Recently Issued Accounting Pronouncements

See Note 1, "Summary of Significant Accounting Policies" to our consolidated financial statements included in Part II, Item 8 of this report for a discussion of our Recently Issued Accounting Pronouncements.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

The primary currencies to which we have foreign currency exchange rate exposure are the Euro, Japanese Yen, Chinese Renminbi, South Korean Won, Australian Dollar, Chilean Peso and Taiwan Dollar. In response to greater fluctuations in foreign currency exchange rates in recent periods, we have increased the degree of exposure risk management activities to minimize the potential impact on earnings.

We manage our foreign currency exposures by balancing certain assets and liabilities denominated in foreign currencies and through the use, from time to time, of foreign currency forward contracts. The principal objective of such contracts is to minimize the financial impact of changes in foreign currency exchange rates. The counterparties to these contractual agreements are major financial institutions with which we generally have other financial relationships. We are exposed to credit loss in the event of nonperformance by these counterparties. However, we do not anticipate nonperformance by the counterparties. We do not utilize financial instruments for trading or other speculative purposes.

The primary method we use to reduce foreign currency exposure is to identify natural hedges, in which the operating activities denominated in respective currencies across various subsidiaries balance in respect to timing and the underlying exposures. In the event a natural hedge is not available, we may employ a forward contract to reduce exposure, generally expiring within one year. While these contracts are subject to fluctuations in value, such fluctuations are intended to offset the changes in the value of the underlying exposures being hedged. Unless otherwise noted, gains and losses on foreign currency forward contracts are recognized currently in Other expenses, net, and generally do not have a significant impact on results of operations.

At December 31, 2018, our financial instruments subject to foreign currency exchange risk consisted of foreign currency forward contracts with an aggregate notional value of $626.5 million and with a fair value representing a net asset position of $0.4 million. Fluctuations in the value of these contracts are intended to offset the changes in the value of the underlying exposures being hedged. We conducted a sensitivity analysis on the fair value of our foreign currency hedge portfolio assuming an instantaneous 10% change in select foreign currency exchange rates from their levels as of December 31, 2018, with all other variables held constant. A 10% appreciation of the U.S. Dollar against foreign currencies that we hedge would result in a decrease of approximately $24.4 million in the fair value of our foreign currency forward contracts. A 10% depreciation of the U.S. Dollar against these foreign currencies would result in an increase of approximately $26.8 million in the fair value of our foreign currency forward contracts. The sensitivity of the fair value of our foreign currency hedge portfolio represents changes in fair values estimated based on market conditions as of December 31, 2018, without reflecting the effects of underlying anticipated transactions. When those anticipated transactions are realized, actual effects of changing foreign currency exchange rates could have a material impact on our earnings and cash flows in future periods.

On December 18, 2014, the carrying value of our 1.875% Euro-denominated senior notes was designated as an effective hedge of our net investment in foreign subsidiaries where the Euro serves as the functional currency, and beginning on the date of designation, gains or losses on the revaluation of these senior notes to our reporting currency have been and will be recorded in Accumulated other comprehensive loss. In January 2017, we repaid €307.0 million of these senior notes using proceeds from the sale of the Chemetall Surface Treatment business. This repayment did not impair the designated hedge of our net investment in foreign subsidiaries where the Euro serves as the functional currency.

We are exposed to changes in interest rates that could impact our results of operations and financial condition. We manage global interest rate and foreign exchange exposure as part of our regular operational and financing strategies. We had variable interest rate borrowings of $313.8 million and $426.6 million outstanding at December 31, 2018 and 2017, respectively. These borrowings represented 18% and 23% of total outstanding debt and bore average interest rates of 2.85% and 1.78% at December 31, 2018 and 2017, respectively. A hypothetical 10% increase (approximately 29 basis points) in the average interest rate applicable to these borrowings would change our annualized interest expense by approximately $0.9 million as of December 31, 2018. We may enter into interest rate swaps, collars or similar instruments with the objective of reducing interest rate volatility relating to our borrowing costs.

Our raw materials are subject to price volatility caused by weather, supply conditions, political and economic variables and other unpredictable factors. Historically, we have not used futures, options or swap contracts to manage the volatility related to the above exposures. However, the refinery catalysts business has used financing arrangements to provide long-term protection against changes in metals prices. We seek to limit our exposure by entering into long-term contracts when available, and we seek price increase limitations through contracts. These contracts do not have a significant impact on our results of operations.

Item 8. Financial Statements and Supplementary Data.

MANAGEMENT’S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Exchange Act Rule 13a-15(f) and 15d-15(f). Our 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 accounting principles generally accepted in the United States. Our 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 assets; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with accounting principles generally accepted in the United States, and that receipts and expenditures of the Company are being made only in accordance with management’s and our directors’ authorizations; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of our assets that could have a material effect on the financial statements.

Under the supervision and with the participation of our management, including our principal executive officer and principal financial officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting as of December 31, 2018. In making this assessment, management used the criteria for effective internal control over financial reporting described in the Internal Control—Integrated Framework 2013 set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on the assessment, management concluded that, as of December 31, 2018, our internal control over financial reporting was effective 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 in the United States. The concept of reasonable assurance is based on the recognition that there are inherent limitations in all systems of internal control. 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.

The effectiveness of our internal control over financial reporting as of December 31, 2018 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report which is included herein.

/S/ LUTHER C. KISSAM IV

Luther C. Kissam IV
Chairman, President and Chief Executive Officer
(principal executive officer)
February 27, 2019

Albemarle
Corporation
and
Subsidiaries

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Albemarle Corporation:

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Albemarle Corporation and its subsidiaries (the "Company") as of December 31, 2018 and 2017, and the related consolidated statements of income, comprehensive income (loss), changes in equity and cash flows for each of the three years in the period ended December 31, 2018, including the related notes (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.

Change in Accounting Principle

As discussed in Note 1 to the consolidated financial statements, the Company changed the manner in which it accounts for revenues from contracts with customers in 2018.

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 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
Charlotte, North Carolina
February 27, 2019

We have served as the Company’s auditor since 1994.

Albemarle Corporation and Subsidiaries
CONSOLIDATED STATEMENTS OF INCOME

(In Thousands, Except Per Share Amounts)			
Year Ended December 31	2018	2017	2016
Net sales	$3,374,950	$3,071,976	$2,677,203
Cost of goods sold	2,157,694	1,965,700	1,706,897
Gross profit	1,217,256	1,106,276	970,306
Selling, general and administrative expenses	446,090	450,286	353,765
Research and development expenses	70,054	84,330	80,475
Gain on sales of businesses, net	(210,428)	—	(122,298)
Acquisition and integration related costs	—	—	57,384
Operating profit	911,540	571,660	600,980
Interest and financing expenses	(52,405)	(115,350)	(65,181)
Other expenses, net	(64,434)	(9,512)	(20,535)
Income from continuing operations before income taxes and equity in net income of unconsolidated investments	794,701	446,798	515,264
Income tax expense	144,826	431,817	96,263
Income from continuing operations before equity in net income of unconsolidated investments	649,875	14,981	419,001
Equity in net income of unconsolidated investments (net of tax)	89,264	84,487	59,637
Net income from continuing operations	739,139	99,468	478,638
Income from discontinued operations (net of tax)	—	—	202,131
Net income	739,139	99,468	680,769
Net income attributable to noncontrolling interests	(45,577)	(44,618)	(37,094)
Net income attributable to Albemarle Corporation	$693,562	$54,850	$643,675
Basic earnings per share:			
Continuing operations	$6.40	$0.49	$3.93
Discontinued operations	—	—	1.80
	$6.40	$0.49	$5.73
Diluted earnings per share:			
Continuing operations	$6.34	$0.49	$3.90
Discontinued operations	—	—	1.78
	$6.34	$0.49	$5.68
Weighted-average common shares outstanding—basic	108,427	110,914	112,379
Weighted-average common shares outstanding—diluted	109,458	112,380	113,239

See accompanying notes to the consolidated financial statements.

Albemarle Corporation and Subsidiaries
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

(In Thousands)

Year Ended December 31	2018	2017	2016
Net income	$739,139	$99,468	$680,769
Other comprehensive (loss) income, net of tax:			
Foreign currency translation	(150,258)	227,439	(20,825)
Pension and postretirement benefits	(138)	(97)	834
Net investment hedge	25,786	(41,827)	26,133
Interest rate swap	(585)	2,116	2,116
Total other comprehensive (loss) income, net of tax	(125,195)	187,631	8,258
Comprehensive income	613,944	287,099	689,027
Comprehensive income attributable to noncontrolling interests	(45,396)	(45,505)	(36,477)
Comprehensive income attributable to Albemarle Corporation	$568,548	$241,594	$652,550

See accompanying notes to the consolidated financial statements.

Albemarle Corporation and Subsidiaries
CONSOLIDATED BALANCE SHEETS

(In Thousands)

December 31	2018	2017
Assets		
Current assets:		
Cash and cash equivalents	$555,320	$1,137,303
Trade accounts receivable, less allowance for doubtful accounts (2018—$4,460; 2017—$10,425)	605,712	534,326
Other accounts receivable	52,059	37,937
Inventories	700,540	592,781
Other current assets	84,790	136,064
Assets held for sale	—	39,152
Total current assets	1,998,421	2,477,563
Property, plant and equipment, at cost	4,799,063	4,124,335
Less accumulated depreciation and amortization	1,777,979	1,631,025
Net property, plant and equipment	3,021,084	2,493,310
Investments	528,722	534,064
Noncurrent assets held for sale	—	139,813
Other assets	80,135	74,164
Goodwill	1,567,169	1,610,355
Other intangibles, net of amortization	386,143	421,503
Total assets	$7,581,674	$7,750,772
Liabilities and Equity		
Current liabilities:		
Accounts payable	$522,516	$418,537
Accrued expenses	257,323	268,336
Current portion of long-term debt	307,294	422,012
Dividends payable	35,169	35,165
Liabilities held for sale	—	1,938
Income taxes payable	60,871	54,937
Total current liabilities	1,183,173	1,200,925
Long-term debt	1,397,916	1,415,360
Postretirement benefits	46,157	52,003
Pension benefits	285,396	294,611
Noncurrent liabilities held for sale	—	614
Other noncurrent liabilities	526,942	599,174
Deferred income taxes	382,982	370,389
Commitments and contingencies (Note 17)		
Equity:		
Albemarle Corporation shareholders' equity:		
Common stock, $.01 par value (authorized 150,000 shares), issued and outstanding — 105,616 in 2018 and 110,547 in 2017	1,056	1,105
Additional paid-in capital	1,368,897	1,863,949
Accumulated other comprehensive loss	(350,682)	(225,668)
Retained earnings	2,566,050	2,035,163
Total Albemarle Corporation shareholders' equity	3,585,321	3,674,549

Noncontrolling interests	173,787	143,147
Total equity	3,759,108	3,817,696
Total liabilities and equity	$7,581,674	$7,750,772

See accompanying notes to the consolidated financial statements.

Albemarle Corporation and Subsidiaries
CONSOLIDATED STATEMENTS OF CHANGES IN EQUITY

(In Thousands, Except Share Data)

	Common Stock Shares	Common Stock Amounts	Additional Paid-in Capital	Accumulated Other Comprehensive (Loss) Income	Retained Earnings	Total Albemarle Shareholders' Equity	Noncontrolling Interests	Total Equity
Balance at January 1, 2016	112,219,351	$1,122	$2,059,151	$(421,288)	$1,615,407	$3,254,392	$146,921	$3,401,313
Net income					643,675	643,675	37,094	680,769
Other comprehensive income (loss)				8,876		8,876	(618)	8,258
Cash dividends declared, $1.22 per common share					(137,151)	(137,151)	(35,855)	(173,006)
Stock-based compensation and other			16,251			16,251		16,251
Exercise of stock options	212,343	2	9,400			9,402		9,402
Tax benefit related to stock plans			1,811			1,811		1,811
Issuance of common stock, net	131,596	1	(1)			—		—
Shares withheld for withholding taxes associated with common stock issuances	(39,500)	—	(2,194)			(2,194)		(2,194)
Balance at December 31, 2016	112,523,790	$1,125	$2,084,418	$(412,412)	$2,121,931	$3,795,062	$147,542	$3,942,604
Balance at January 1, 2017	112,523,790	$1,125	$2,084,418	$(412,412)	$2,121,931	$3,795,062	$147,542	$3,942,604
Net income					54,850	54,850	44,618	99,468
Other comprehensive income				186,744		186,744	887	187,631

Cash dividends declared, $1.28 per common share					(141,618)	(141,618)	(36,756)	(178,374)
Stock-based compensation and other			16,505			16,505		16,505
Exercise of stock options	210,432	2	8,236			8,238		8,238
Shares repurchased	(2,341,083)	(23)	(249,977)			(250,000)		(250,000)
Issuance of common stock, net	243,024	2	(2)			—		—
Termination of Tianqi Lithium Corporation option agreement			13,144			13,144	(13,144)	—
Shares withheld for withholding taxes associated with common stock issuances	(89,489)	(1)	(8,375)			(8,376)		(8,376)
Balance at December 31, 2017	110,546,674	$1,105	$1,863,949	$(225,668)	$2,035,163	$3,674,549	$143,147	$3,817,696
Balance at January 1, 2018	110,546,674	$1,105	$1,863,949	$(225,668)	$2,035,163	$3,674,549	$143,147	$3,817,696
Net income					693,562	693,562	45,577	739,139
Other comprehensive loss				(125,014)		(125,014)	(181)	(125,195)
Cash dividends declared, $1.34 per common share					(144,601)	(144,601)	(14,756)	(159,357)
Cumulative adjustments from adoption of income tax standard updates (Note 1)					(18,074)	(18,074)		(18,074)
Stock-based compensation and other			18,506			18,506		18,506
Exercise of stock options	94,031	1	3,632			3,633		3,633

Shares repurchased	(5,262,654)	(53)	(499,947)			(500,000)		(500,000)
Issuance of common stock, net	383,974	4	(4)			—		—
Shares withheld for withholding taxes associated with common stock issuances	(145,997)	(1)	(17,239)			(17,240)		(17,240)
Balance at December 31, 2018	105,616,028	$1,056	$1,368,897	$(350,682)	$2,566,050	$3,585,321	$173,787	$3,759,108

See accompanying notes to the consolidated financial statements.

Albemarle Corporation and Subsidiaries
CONSOLIDATED STATEMENTS OF CASH FLOWS

(In Thousands)

Year Ended December 31	2018	2017	2016
Cash and cash equivalents at beginning of year	$1,137,303	$2,269,756	$213,734
Cash flows from operating activities:			
Net income	739,139	99,468	680,769
Adjustments to reconcile net income to cash flows from operating activities:			
Depreciation and amortization	200,698	196,928	226,169
Gain on acquisition	—	(6,221)	—
Gain on sales of businesses, net	(210,428)	—	(510,278)
Stock-based compensation	15,228	19,404	17,031
Equity in net income of unconsolidated investments (net of tax)	(89,264)	(84,487)	(61,534)
Dividends received from unconsolidated investments and nonmarketable securities	57,415	39,386	43,759
Pension and postretirement expense (benefit)	10,410	(12,436)	41,546
Pension and postretirement contributions	(15,236)	(13,341)	(20,068)
Unrealized gain on investments in marketable securities	(527)	(3,135)	(3,655)
Loss on early extinguishment of debt	—	52,801	1,921
Deferred income taxes	49,164	(41,941)	21,121
Changes in current assets and liabilities, net of effects of acquisitions and divestitures:			
(Increase) in accounts receivable	(97,448)	(74,545)	(42,816)
(Increase) decrease in inventories	(124,067)	(101,545)	25,974
(Increase) decrease in other current assets	(2,181)	(213)	1,808
Increase in accounts payable	73,730	53,421	43,953
(Decrease) increase in accrued expenses and income taxes payable	(1,999)	(269,381)	210,276
Other, net	(58,469)	449,816	59,548
Net cash provided by operating activities	546,165	303,979	735,524
Cash flows from investing activities:			
Acquisitions, net of cash acquired	(11,403)	(44,367)	(126,747)
Cash payments related to acquisitions and other	—	—	(81,987)
Capital expenditures	(699,991)	(317,703)	(196,654)
Cash proceeds from divestitures, net	413,569	6,857	3,325,571
(Investments in) sales of marketable securities, net	(270)	(275)	305
Repayments from joint ventures	—	1,250	—
Investments in equity and other corporate investments	(5,600)	(3,565)	—
Net cash (used in) provided by investing activities	(303,695)	(357,803)	2,920,488
Cash flows from financing activities:			
Proceeds from borrowings of other long-term debt	—	27,000	—
Repayments of long-term debt	—	(778,209)	(1,252,302)
Other (repayments) borrowings, net	(113,567)	138,751	(163,721)
Fees related to early extinguishment of debt	—	(46,959)	—
Dividends paid to shareholders	(144,596)	(140,557)	(135,353)
Dividends paid to noncontrolling interests	(14,756)	(36,756)	(35,855)

Repurchases of common stock	(500,000)	(250,000)	—
Proceeds from exercise of stock options	3,633	8,238	9,401
Withholding taxes paid on stock-based compensation award distributions	(17,240)	(8,376)	(2,194)
Net cash used in financing activities	(786,526)	(1,086,868)	(1,580,024)
Net effect of foreign exchange on cash and cash equivalents	(37,927)	8,239	(19,966)
(Decrease) increase in cash and cash equivalents	(581,983)	(1,132,453)	2,056,022
Cash and cash equivalents at end of year	$555,320	$1,137,303	$2,269,756

See accompanying notes to the consolidated financial statements.

NOTE 1—Summary of Significant Accounting Policies:

Basis of Consolidation

The consolidated financial statements include the accounts and operations of Albemarle Corporation and our wholly owned, majority owned and controlled subsidiaries. Unless the context otherwise indicates, the terms “Albemarle,” “we,” “us,” “our” or “the Company” mean Albemarle Corporation and its consolidated subsidiaries. For entities that we control and are the primary beneficiary, but own less than 100%, we record the minority ownership as noncontrolling interest. We apply the equity method of accounting for investments in which we have an ownership interest from 20% to 50% or where we exercise significant influence over the related investee’s operations. All significant intercompany accounts and transactions are eliminated in consolidation.

Discontinued Operations

A component or group of components that is classified as held for sale or that has been disposed of by sale, and which represents a strategic shift that has or will have a major effect on our operations and financial results, is reported as discontinued operations beginning in the period when these criteria are met. Our assets and liabilities held for sale at December 31, 2017 related to the polyolefin catalysts and components business did not meet the criteria to be presented as discontinued operations.

On December 14, 2016, the Company closed the sale of the Chemetall Surface Treatment business to BASF SE. In accordance with the applicable accounting guidance, the Company began accounting for this business as discontinued operations in the consolidated statements of income and excluded the business from segment results for the year ended December 31, 2016. See Note 3, “Divestitures,” for additional information.

Estimates, Assumptions and Reclassifications

The preparation of financial statements in conformity with generally accepted accounting principles (“GAAP”) in the United States (“U.S.”) requires management to make estimates and assumptions that affect the reported amounts of revenues, expenses, assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Actual results could differ from those estimates.

Certain amounts in the accompanying consolidated financial statements and notes thereto have been reclassified to conform to the current presentation. Income tax expense for the year ended December 31, 2017 includes expense of $5.1 million due to an adjustment in the Company’s deferred tax liabilities for basis differences in Chilean fixed assets related to the year ended December 31, 2016. The Company does not believe this adjustment is material to the consolidated financial statements for the years ended December 31, 2017 or 2016. In addition, for the year ended December 31, 2017, the Company began reporting its acquisition and integration related costs and restructuring and other costs in Cost of goods sold, Selling, general and administrative expenses and Research and development expenses. See Note 2, “Acquisitions,” and Note 24, “Segment and Geographic Area Information,” for further details.

Revenue Recognition

Effective January 1, 2018, we adopted Accounting Standards Update (“ASU”) No. 2014-09, “Revenue from Contracts with Customers” and all related amendments using the modified retrospective method. There was no material impact to our results of operations or financial position upon adoption, and no adjustment was made to Retained earnings in our consolidated balance sheets because such adjustment was determined to be immaterial. In addition, new presentation requirements, including separate disclosure of net sales from sources other than customers on our consolidated statements of income and separate disclosures of contract assets or liabilities on our consolidated balance sheets, generally did not have a material impact. However, business circumstances, including the nature of customer contracts, can change and as such, we have expanded processes and controls to recognize such changes, and as necessary, consider whether any of these currently immaterial items might differ in the future.

Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services, and is recognized when performance obligations are satisfied under the terms of contracts with our customers. A performance obligation is deemed to be satisfied when control of the product or service is transferred to our customer. The transaction price of a contract, or the amount we expect to receive upon satisfaction of all performance obligations, is determined by reference to the contract’s terms and includes adjustments, if applicable, for any variable consideration, such as customer rebates, noncash consideration or consideration payable to the customer, although these adjustments are generally not material. Where a contract contains more than one distinct performance obligation, the transaction price is allocated to each performance obligation based on the standalone selling price of each performance obligation, although these situations do not occur frequently and are generally not built into our contracts. Any unsatisfied performance obligations are not material. Standalone selling prices are based on prices we charge to our customers, which in some cases is based on established market prices. Sales and other similar taxes collected from customers on behalf of third parties are excluded from revenue. Our payment terms are generally between 30 to 90 days, however, they vary by market factors, such as customer size, creditworthiness, geography and competitive environment.

All of our revenue is derived from contracts with customers, and almost all of our contracts with customers contain one performance obligation for the transfer of goods where such performance obligation is satisfied at a point in time. Control of a product is deemed to be transferred to the customer upon shipment or delivery. Significant portions of our sales are sold free on board shipping point or on an equivalent basis, while delivery terms of other transactions are based upon specific contractual arrangements. Our standard terms of delivery are generally included in our contracts of sale, order confirmation documents and invoices, while the timing between shipment and delivery generally ranges between 1 and 45 days. Costs for shipping and handling activities, whether performed before or after the customer obtains control of the goods, are accounted for as fulfillment costs.

The Company currently utilizes the following practical expedients, as permitted by Accounting Standards Codification ("ASC") 606, Revenue from Contracts with Customers:

- All sales and other pass-through taxes are excluded from contract value;
- In utilizing the modified retrospective transition method, no adjustment was necessary for contracts that did not cross over the reporting year;
- We will not consider the possibility of a contract having a significant financing component (which would effectively attribute a portion of the sales price to interest income) unless, if at contract inception, the expected payment terms (from time of delivery or other relevant criterion) are more than one year;
- If our right to customer payment is directly related to the value of our completed performance, we recognize revenue consistent with the invoicing right; and
- We expense as incurred all costs of obtaining a contract incremental to any costs/compensation attributable to individual product sales/shipments for contracts where the amortization period for such costs would otherwise be one year or less.

Certain products we produce are made to our customer's specifications where such products have limited alternative use or would need significant rework costs in order to be sold to another customer. In management's judgment, control of these arrangements is transferred to the customer at a point in time (upon shipment or delivery) and not over the time they are produced. Therefore revenue is recognized upon shipment or delivery of these products.

Costs incurred to obtain contracts with customers are not significant and are expensed immediately as the amortization period would be one year or less. When the Company incurs pre-production or other fulfillment costs in connection with an existing or specific anticipated contract and such costs are recoverable through margin or explicitly reimbursable, such costs are capitalized and amortized to Cost of goods sold on a systematic basis that is consistent with the pattern of transfer to the customer of the goods or services to which the asset relates, which is less than one year. We record bad debt expense in specific situations when we determine the customer is unable to meet its financial obligation.

Included in Trade accounts receivable at December 31, 2018 is approximately $590.3 million arising from contracts with customers. The remaining balance of Trade accounts receivable at December 31, 2018 primarily includes value-added taxes collected from customers on behalf of various taxing authorities.

Cash and Cash Equivalents

Cash and cash equivalents include cash and money market investments with insignificant interest rate risks and no limitations on access.

Inventories

Inventories are stated at lower of cost and net realizable value with cost determined primarily on the first-in, first-out basis. Cost is determined on the weighted-average basis for a small portion of our inventories at foreign plants and our stores, supplies and other inventory. A portion of our domestic produced finished goods and raw materials are determined on the last-in, first-out basis.

Albemarle Corporation and Subsidiaries
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

Property, Plant and Equipment

Property, plant and equipment include costs of assets constructed, purchased or leased under a capital lease, related delivery and installation costs and interest incurred on significant capital projects during their construction periods. Expenditures for renewals and betterments also are capitalized, but expenditures for normal repairs and maintenance are expensed as incurred. Costs associated with yearly planned major maintenance are generally deferred and amortized over 12 months or until the same major maintenance activities must be repeated, whichever is shorter. The cost and accumulated depreciation applicable to assets retired or sold are removed from the respective accounts, and gains or losses thereon are included in income.

We assign the useful lives of our property, plant and equipment based upon our internal engineering estimates which are reviewed periodically. The estimated useful lives of our property, plant and equipment range from two to sixty years and depreciation is recorded on the straight-line method, with the exception of our long-term mineral rights, which are depleted on a units-of-production method.

We evaluate the recovery of our property, plant and equipment by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized.

Resource Development Expenses

We incur costs in resource exploration, evaluation and development during the different phases of our resource development projects. Exploration costs incurred before obtaining legal rights to explore an area are generally expensed as incurred. After obtaining legal rights, exploration costs are expensed in areas where we have uncertainty about obtaining proven resources. In areas where we have substantial knowledge about the area and consider it probable to obtain commercially viable proven resources, exploration and evaluation costs are capitalized.

If technical feasibility studies have been obtained, resource evaluation expenses are capitalized when the study demonstrates proven or probable resources for which future economic returns are expected, while costs for projects that are not considered viable are expensed. Development costs that are necessary to bring the property to commercial production or increase the capacity or useful life are capitalized. Costs to maintain the production capacity in a property under production are expensed as incurred.

Capitalized resource costs are depleted using the units-of-production method. Our resource development assets are evaluated for impairment when events or changes in circumstances indicate that the carrying amount may not be recoverable.

Investments

Investments are accounted for using the equity method of accounting if the investment gives us the ability to exercise significant influence, but not control, over the investee. Significant influence is generally deemed to exist if we have an ownership interest in the voting stock of the investee between 20% and 50%, although other factors, such as representation on the investee's board of directors and the impact of commercial arrangements, are considered in determining whether the equity method of accounting is appropriate. Under the equity method of accounting, we record our investments in equity-method investees in the consolidated balance sheets as Investments and our share of investees' earnings or losses together with other-than-temporary impairments in value as Equity in net income of unconsolidated investments in the consolidated statements of income. We evaluate our equity method investments for impairment whenever events or changes in circumstances indicate that the carrying amounts of such investments may be impaired. If a decline in the value of an equity method investment is determined to be other than temporary, a loss is recorded in earnings in the current period.

Certain mutual fund investments are accounted for as trading equities and are marked-to-market on a periodic basis through the consolidated statements of income. Investments in joint ventures and nonmarketable securities of immaterial entities are estimated based upon the overall performance of the entity where financial results are not available on a timely basis.

Environmental Compliance and Remediation

Environmental compliance costs include the cost of purchasing and/or constructing assets to prevent, limit and/or control pollution or to monitor the environmental status at various locations. These costs are capitalized and depreciated based on estimated useful lives. Environmental compliance costs also include maintenance and operating costs with respect to pollution prevention and control facilities and other administrative costs. Such operating costs are expensed as incurred. Environmental remediation costs of facilities used in current operations are generally immaterial and are expensed as incurred. We accrue for environmental remediation costs and post-remediation costs that relate to existing conditions caused by past operations at facilities or off-plant disposal sites in the accounting period in which responsibility is established and when the related costs are estimable. In developing these cost estimates, we evaluate currently available facts regarding each site, with consideration given to existing technology, presently enacted laws and regulations, prior experience in remediation of contaminated sites, the financial capability of other potentially responsible parties and other factors, subject to uncertainties inherent in the estimation process. If the amount and timing of the cash payments for a site are fixed or reliably determinable, the liability is discounted, if the calculated discount is material. Additionally, these estimates are reviewed periodically, with adjustments to the accruals recorded as necessary.

Research and Development Expenses

Our research and development expenses related to present and future products are expensed as incurred. These expenses consist primarily of personnel-related costs and other overheads, as well as outside service and consulting costs incurred for specific programs. Our U.S. facilities in Michigan, Pennsylvania, Texas and Louisiana and our global facilities in the Netherlands, Germany, Belgium and Korea form the capability base for our contract research and custom manufacturing businesses. These business areas provide research and scale-up services primarily to innovative life science companies.

Goodwill and Other Intangible Assets

We account for goodwill and other intangibles acquired in a business combination in conformity with current accounting guidance that requires that goodwill and indefinite-lived intangible assets not be amortized.

We test goodwill for impairment by comparing the estimated fair value of our reporting units to the related carrying value. Our reporting units are either our operating business segments or one level below our operating business segments for which discrete financial information is available and for which operating results are regularly reviewed by the business management. We estimate the fair value based on present value techniques involving future cash flows. Future cash flows include assumptions about sales volumes, selling prices, raw material prices, labor and other employee benefit costs, capital additions, income taxes, working capital, and other economic or market-related factors. Significant management judgment is involved in estimating these variables and they include inherent uncertainties since they are forecasting future events. We perform a sensitivity analysis by using a range of inputs to confirm the reasonableness of these estimates being used in the goodwill impairment analysis. We use a Weighted Average Cost of Capital (“WACC”) approach to determine our discount rate for goodwill recoverability testing. Our WACC calculation incorporates industry-weighted average returns on debt and equity from a market perspective. The factors in this calculation are largely external to the Company and, therefore, are beyond our control. We test our recorded goodwill for impairment in the fourth quarter of each year or upon the occurrence of events or changes in circumstances that would more likely than not reduce the fair value of our reporting units below their carrying amounts. The Company performed its annual goodwill impairment test as of October 31, 2018 and concluded there was no impairment as of that date. In addition, no material indications of impairment in any of our reporting units were indicated by the sensitivity analysis.

We assess our indefinite-lived intangible assets, which include trade names, for impairment annually and between annual tests if events or changes in circumstances indicate that it is more likely than not that the asset is impaired. The indefinite-lived intangible asset impairment standard allows us to first assess qualitative factors to determine if a quantitative impairment test is necessary. Further testing is only required if we determine, based on the qualitative assessment, that it is more likely than not that the indefinite-lived intangible asset's fair value is less than its carrying amount. If we determine based on the qualitative assessment that it is more likely than not that the asset is impaired, an impairment test is performed by comparing the fair value of the indefinite-lived intangible asset to its carrying amount.

Definite-lived intangible assets, such as purchased technology, patents and customer lists, are amortized over their estimated useful lives generally for periods ranging from five to twenty-five years. Except for customer lists and relationships associated with the majority of our Lithium business, which are amortized using the pattern of economic benefit method, definite-lived intangible assets are amortized using the straight-line method. We evaluate the recovery of our definite-lived intangible assets by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized. See Note 12, "Goodwill and Other Intangibles."

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Pension Plans and Other Postretirement Benefits

Under authoritative accounting standards, assumptions are made regarding the valuation of benefit obligations and the performance of plan assets. As required, we recognize a balance sheet asset or liability for each of our pension and other postretirement benefit ("OPEB") plans equal to the plan's funded status as of the measurement date. The primary assumptions are as follows:

- Discount Rate—The discount rate is used in calculating the present value of benefits, which is based on projections of benefit payments to be made in the future.
- Expected Return on Plan Assets—We project the future return on plan assets based on prior performance and future expectations for the types of investments held by the plans, as well as the expected long-term allocation of plan assets for these investments. These projected returns reduce the net benefit costs recorded currently.
- Rate of Compensation Increase—For salary-related plans, we project employees' annual pay increases, which are used to project employees' pension benefits at retirement.
- Mortality Assumptions—Assumptions about life expectancy of plan participants are used in the measurement of related plan obligations.

Actuarial gains and losses are recognized annually in our consolidated statements of income in the fourth quarter and whenever a plan is determined to qualify for a remeasurement during a fiscal year. The remaining components of pension and OPEB plan expense, primarily service cost, interest cost and expected return on assets, are recorded on a monthly basis. The market-related value of assets equals the actual market value as of the date of measurement.

During 2018, we made changes to assumptions related to discount rates and expected rates of return on plan assets. We consider available information that we deem relevant when selecting each of these assumptions.

In selecting the discount rates for the U.S. plans, we consider expected benefit payments on a plan-by-plan basis. As a result, the Company uses different discount rates for each plan depending on the demographics of participants and the expected timing of benefit payments. For 2018, the discount rates were calculated using the results from a bond matching technique developed by Milliman, which matched the future estimated annual benefit payments of each respective plan against a portfolio of bonds of high quality to determine the discount rate. We believe our selected discount rates are determined using preferred methodology under authoritative accounting guidance and accurately reflect market conditions as of the December 31, 2018 measurement date.

In selecting the discount rates for the foreign plans, we look at long-term yields on AA-rated corporate bonds when available. Our actuaries have developed yield curves based on the yields on the constituent bonds in the various indices as well as on other market indicators such as swap rates, particularly at the longer durations. For the Eurozone, we apply the Aon Hewitt yield curve to projected cash flows from the relevant plans to derive the discount rate. For the United Kingdom ("U.K."), the discount rate is determined by applying the Aon Hewitt yield curve for typical schemes of similar duration to projected cash flows of Albemarle's U.K. plan. In other countries where there is not a sufficiently deep market of high-quality corporate bonds, we set the discount rate by referencing the yield on government bonds of an appropriate duration.

In estimating the expected return on plan assets, we consider past performance and future expectations for the types of investments held by the plan as well as the expected long-term allocation of plan assets to these investments. In projecting the rate of compensation increase, we consider past experience in light of movements in inflation rates.

In October 2017, the Society of Actuaries ("SOA") published an updated Mortality Improvement Scale, MP-2017. The updated improvement scale incorporates an additional year of mortality data (2015). We utilized the same base mortality, SOA RP-2014 Adjusted to 2006 Total Dataset Mortality, but we revised our mortality assumption to incorporate the MP-2017 Mortality Improvement Scale for purposes of measuring our U.S. pension and OPEB obligations at December 31, 2017. In October 2018, the SOA published an updated Mortality Improvement Scale, MP-2018. The updated Improvement Scale incorporates an additional year of mortality (2016). We utilized the same base mortality, SOA RP-2014 Adjusted to 2006 Total Dataset Mortality, but we revised our mortality assumption to incorporate the MP-2018 Mortality Improvement Scale for purposes of measuring our U.S. pension and OPEB obligations at December 31, 2018.

Stock-based Compensation Expense

The fair value of restricted stock awards, restricted stock unit awards and performance unit awards with a service condition are determined based on the number of shares or units granted and the quoted price of our common stock on the date of grant, and the fair value of stock options is determined using the Black-Scholes valuation model. The fair value of performance unit awards with a service condition and a market condition are estimated on the date of grant using a Monte Carlo simulation model. The fair value of these awards is determined after giving effect to estimated forfeitures. Such value is recognized as expense over the service period, which is generally the vesting period of the equity grant. To the extent restricted stock awards, restricted stock unit awards, performance unit awards and stock options are forfeited prior to vesting in excess of the estimated forfeiture rate, the corresponding previously recognized expense is reversed as an offset to operating expenses.

Income Taxes

We use the liability method for determining our income taxes, under which current and deferred tax liabilities and assets are recorded in accordance with enacted tax laws and rates. Under this method, the amounts of deferred tax liabilities and assets at the end of each period are determined using the tax rate expected to be in effect when taxes are actually paid or recovered. Future tax benefits are recognized to the extent that realization of such benefits is more likely than not. In order to record deferred tax assets and liabilities, we are following guidance under Financial Accounting Standards Board (“FASB”) ASU 2015-17, which requires deferred tax assets and liabilities to be classified as noncurrent on the balance sheet, along with any related valuation allowance. Tax effects are released from Accumulated Other Comprehensive Income using either the specific identification approach or the portfolio approach based on the nature of the underlying item.

Deferred income taxes are provided for the estimated income tax effect of temporary differences between the financial statement carrying amounts and the tax basis of existing assets and liabilities. Deferred tax assets are also provided for operating losses, capital losses and certain tax credit carryovers. A valuation allowance, reducing deferred tax assets, is established when it is more likely than not that some portion or all of the deferred tax assets will not be realized. The realization of such deferred tax assets is dependent upon the generation of sufficient future taxable income of the appropriate character. Although realization is not assured, we do not establish a valuation allowance when we believe it is more likely than not that a net deferred tax asset will be realized.

We only recognize a tax benefit after concluding that it is more likely than not that the benefit will be sustained upon audit by the respective taxing authority based solely on the technical merits of the associated tax position. Once the recognition threshold is met, we recognize a tax benefit measured as the largest amount of the tax benefit that, in our judgment, is greater than 50% likely to be realized. Under current accounting guidance for uncertain tax positions, interest and penalties related to income tax liabilities are included in Income tax expense on the consolidated statements of income.

We have designated the undistributed earnings of a portion of our foreign operations as indefinitely reinvested and as a result we do not provide for deferred income taxes on the unremitted earnings of these subsidiaries. Our foreign earnings are computed under U.S. federal tax earnings and profits, or E&P, principles. In general, to the extent our financial reporting book basis over tax basis of a foreign subsidiary exceeds these E&P amounts, deferred taxes have not been provided as they are essentially permanent in duration. The determination of the amount of such unrecognized deferred tax liability is not practicable. We provide for deferred income taxes on our undistributed earnings of foreign operations that are not deemed to be indefinitely invested. Management’s assertion of indefinite reinvestment of undistributed foreign earnings was unchanged within the measurement period ending December 22, 2018, as allowed under Staff Accounting Bulletin (“SAB”) 118. We will continue to evaluate our permanent investment assertion taking into consideration all relevant, current tax laws.

On December 22, 2017, the Tax Cuts and Jobs Act ("TCJA") was signed into law in the U.S. The TCJA contains several key tax provisions including, among other things, the reduction of the corporate income tax rate from 35% to 21% effective January 1, 2018, the requirement of companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred, and the creation of new taxes on certain foreign sourced earnings such as global intangible low-taxed income ("GILTI"). A company can elect an accounting policy to account for GILTI as a period charge in the future period the tax arises or as part of deferred taxes related to the investment or subsidiary. The Company has elected to account for GILTI as a period cost.

Accumulated Other Comprehensive Loss

Accumulated other comprehensive loss comprises principally foreign currency translation adjustments, amounts related to the revaluation of our euro-denominated senior notes which were designated as a hedge of our net investment in foreign operations in 2014, a realized loss on a forward starting interest rate swap entered into in 2014 which was designated as a cash flow hedge, and deferred income taxes related to the aforementioned items.

Foreign Currency Translation

The assets and liabilities of all foreign subsidiaries were prepared in their respective functional currencies and translated into U.S. Dollars based on the current exchange rate in effect at the balance sheet dates, while income and expenses were translated at average exchange rates for the periods presented. Translation adjustments are reflected as a separate component of equity.

Foreign exchange transaction and revaluation (losses) gains were ($10.5) million, ($11.1) million and $2.4 million for the years ended December 31, 2018, 2017 and 2016, respectively, and are included in Other expenses, net, in our consolidated statements of income, with the unrealized portion included in Other, net, in our consolidated statements of cash flows.

Derivative Financial Instruments

We manage our foreign currency exposures by balancing certain assets and liabilities denominated in foreign currencies and through the use of foreign currency forward contracts from time to time, which generally expire within one year. The principal objective of such contracts is to minimize the financial impact of changes in foreign currency exchange rates. While these contracts are subject to fluctuations in value, such fluctuations are generally expected to be offset by changes in the value of the underlying foreign currency exposures being hedged. Unless otherwise noted, gains and losses on foreign currency forward contracts are recognized currently in Other expenses, net, and generally do not have a significant impact on results of operations.

We may also enter into interest rate swaps, collars or similar instruments from time to time, with the objective of reducing interest rate volatility relating to our borrowing costs.

The counterparties to these contractual agreements are major financial institutions with which we generally have other financial relationships. We are exposed to credit loss in the event of nonperformance by these counterparties. However, we do not anticipate nonperformance by the counterparties. We do not utilize financial instruments for trading or other speculative purposes. Our foreign currency forward contracts outstanding at December 31, 2018 and 2017 have not been designated as hedging instruments under ASC 815, Derivatives and Hedging.

Recently Issued Accounting Pronouncements

In May 2014, the FASB issued accounting guidance designed to enhance comparability of revenue recognition practices across entities, industries, jurisdictions and capital markets. The core principle of the guidance is that revenue recognized from a transaction or event that arises from a contract with a customer should reflect the consideration to which an entity expects to be entitled in exchange for goods or services provided. To achieve that core principle the new guidance sets forth a five-step revenue recognition model that will need to be applied consistently to all contracts with customers, except those that are within the scope of other topics in the ASC. Also required are new disclosures to help users of financial statements better understand the nature, amount, timing and uncertainty of revenues and cash flows from contracts with customers. The new disclosures include qualitative and quantitative information about contracts with customers, significant judgments made in applying the revenue guidance, and assets recognized related to the costs to obtain or fulfill a contract. During 2016, the FASB issued amendments to this new guidance that provided clarification, technical corrections and practical expedients. Topics of potential relevance to the Company include principal versus agent considerations, collectability, presentation of sales tax from customers, contract modifications at transition and accounting transition. These new requirements became effective on January 1, 2018 and did not have a material impact on our consolidated financial statements. We adopted the new standard using the modified retrospective method. We have implemented appropriate changes to the business processes, controls and control activities to support recognition, presentation and disclosure under the new standard for the first quarter of 2018, however, we have not made any significant changes to our existing systems as a result of this new standard.

In February 2016, the FASB issued accounting guidance that requires assets and liabilities arising from leases to be recorded on the balance sheet. Additional disclosures are required regarding the amount, timing, and uncertainty of cash flows from leases. This new guidance will be effective for fiscal years beginning after December 15, 2018, including interim periods within those fiscal years, and is to be applied using a modified retrospective approach. In July 2018, the FASB issued an amendment which would allow entities to initially apply this new standard at the adoption date and recognize a cumulative effect adjustment to the opening balance of retained earnings. The Company adopted this standard on January 1, 2019 using this transition method. We evaluated our existing lease contracts and believe this standard will have a material impact on the consolidated financial statements and related disclosures. The implementation of this standard will result in the addition of right-of-use assets and lease liabilities on our balance sheet by approximately $135 million. We have made the decision to adopt several practical expedients as allowed by this new standard, such as the short-term lease exemption and the relief package. In addition, we have implemented new software, as well as changes to controls that support recognition and disclosure under this new standard.

In June 2016, the FASB issued accounting guidance that, among other things, changes the way entities recognize impairment of financial assets by requiring immediate recognition of estimated credit losses expected to occur over the remaining life of the financial asset. Additional disclosures are required regarding an entity's assumptions, models and methods for estimating the expected credit loss. This guidance will be effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years, and is to be applied using a modified retrospective approach. Early adoption is permitted. We currently do not expect this guidance to have a significant impact on our consolidated financial statements.

In October 2016, the FASB issued accounting guidance that eliminated the deferral of tax effects of intra-entity asset transfers other than inventory. As a result, the tax expense from the intercompany sale of assets, other than inventory, and associated changes to deferred taxes will be recognized when the sale occurs even though the pre-tax effects of the transaction have not been recognized as they are eliminated in consolidation. This guidance was effective using the modified retrospective method as of January 1, 2018, which resulted in an $11.2 million cumulative adjustment to decrease Retained earnings and is not reflected in periods prior to this date.

In November 2016, the FASB issued accounting guidance that requires restricted cash and restricted cash equivalents to be included with cash and cash equivalents when reconciling the beginning and end of period total amounts shown on the statement of cash flows. This guidance became effective on January 1, 2018 and did not have a significant impact on our consolidated financial statements.

In January 2017, the FASB issued accounting guidance to clarify the definition of a business for determining whether transactions should be accounted for as acquisitions (or disposals) of assets or businesses. This guidance became effective on January 1, 2018 and did not have a significant impact on our consolidated financial statements.

In January 2017, the FASB issued accounting guidance to simplify the accounting for goodwill impairment. The guidance removes Step 2 of the goodwill impairment test, which requires a reporting unit to calculate 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 has been acquired in a business combination. A goodwill impairment will now be the amount by which a reporting unit's carrying value exceeds its fair value, not to exceed the carrying amount of goodwill. All other goodwill impairment guidance will remain unchanged. Entities will continue to have the option to perform a qualitative assessment to determine if a quantitative impairment test is necessary. This guidance will be effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years, and is to be applied on a prospective basis. Early adoption is permitted for goodwill impairment tests performed after January 1, 2017. We expect to adopt this guidance on January 1, 2020 and do not expect it to have a significant impact on our consolidated financial statements.

In March 2017, the FASB issued accounting guidance that changes the presentation of net periodic pension and postretirement benefit cost ("net benefit cost") in the income statement. This new guidance requires service cost to be presented as part of operating income (expense) and all other components of net benefit cost are to be shown outside of operations. This guidance became effective on January 1, 2018 and did not have a significant impact on our consolidated financial statements. The consolidated statements of income for the years ended December 31, 2017 and 2016 have been recast to conform to the current presentation required by this guidance. See Note 15, "Pension Plans and Other Postretirement Benefits," for additional details.

In May 2017, the FASB issued accounting guidance to clarify when to account for a change to the terms or conditions of a share-based payment award as a modification. Under the new guidance, modification accounting is required only if the fair value, the vesting conditions, or the classification of the award (as equity or liability) changes as a result of the change in terms or conditions. This new guidance became effective on January 1, 2018 and did not have a significant impact on our consolidated financial statements.

In August 2017, the FASB issued accounting guidance to better align an entity's risk management activities with hedge accounting, simply the application of hedge accounting, and increase transparency as to the scope and results of hedging programs. This guidance will make more financial and nonfinancial hedging strategies eligible for hedge accounting. It also amends the presentation and disclosure requirements and changes how companies assess effectiveness. In October 2018, the FASB issued additional guidance that permits the use of the Overnight Index Swap Rate based on the Secured Overnight Financing Rate as a U.S. benchmark interest rate for hedge accounting purposes under ASC 815, Derivatives and Hedging. These new requirements will be effective for fiscal years beginning after December 15, 2018, including interim periods within those fiscal years, and are to be applied on a prospective basis. Early adoption is permitted. We currently do not expect this guidance to have a significant impact on our consolidated financial statements.

In February 2018, the FASB issued accounting guidance that gives companies the option to reclassify stranded tax effects caused by the TCJA from accumulated other comprehensive income to retained earnings. As allowed by its provisions, we early-adopted this new guidance in the fourth quarter of 2018, which resulted in a $6.9 million cumulative adjustment to decrease Retained earnings and is not reflected in periods prior to this date.

In August 2018, the FASB issued accounting guidance that, among other things, eliminates certain disclosure requirements for fair value measurements. Under the new guidance, entities will no longer be required to disclose (a) the amount of and reasons for transfers between Level 1 and Level 2 of the fair value hierarchy and (b) the policy for timing of transfers between levels of the fair value hierarchy. As allowed by its provisions, we early-adopted this new guidance in the third quarter of 2018. The adoption of this new guidance did not have a significant impact on our consolidated financial statements.

In August 2018, the FASB issued accounting guidance that, among other things, eliminates certain disclosure requirements for defined benefit pension and other postretirement benefit plans. Under the new guidance, entities will no longer be required to disclose the amounts in accumulated other comprehensive income expected to be recognized as components of net periodic benefit cost over the next fiscal year. As allowed by its provisions, we early-adopted this new guidance in the third quarter of 2018. The adoption of this new guidance did not have a significant impact on our consolidated financial statements.

In August 2018, the FASB issued accounting guidance that requires implementation costs incurred in a cloud computing arrangement that is a service contract to be capitalized. Entities will be required to recognize the capitalized implementation costs to expense over the noncancellable term of the cloud computing arrangement. As allowed by its provisions, we early-adopted this new guidance in the first quarter of 2019, although we do not expect it to have a material impact on our consolidated financial statements.

NOTE 2—Acquisitions:

Sales de Magnesio, Ltda.

On February 1, 2017, the Company acquired the remaining 50% interest in the Sales de Magnesio Ltda. (“Salmag”) joint venture in Chile from SQM Salar S.A. for approximately $8.3 million, net of cash acquired. In connection with the acquisition, the Company recorded a gain of $6.2 million, calculated based on the difference between the purchase price and the book value of the investment in Other expenses, net on the consolidated statements of income for the year ended December 31, 2017.

Jiangxi Jiangli New Materials Science and Technology Co. Ltd.

On December 31, 2016, we completed the acquisition of all equity interests in the lithium hydroxide and lithium carbonate conversion business of Jiangxi Jiangli New Materials Science and Technology Co. Ltd. (“Jiangli New Materials”) for a cash purchase price of approximately $145 million. This includes manufacturing assets located in both Jiangxi and Sichuan, China focused on the production of battery-grade lithium carbonate and lithium hydroxide. This acquisition has enabled us to supply premium lithium salts to an expanded global customer base, while solidifying our leading position in the lithium industry.

The aggregate purchase price was allocated to the major categories of assets and liabilities acquired based upon their estimated fair values as of December 31, 2016, which were based, in part, upon outside preliminary appraisals for certain assets. The allocation of the Jiangli New Materials acquisition was finalized in the fourth quarter of 2017. The fair values of the assets and liabilities acquired were primarily related to Accounts receivable of $0.6 million, Property, plant and equipment of $24.1 million, Other intangibles of $46.3 million, Accounts payable of $2.8 million and Deferred tax liabilities of $6.3 million. In addition, the estimated fair value of the remaining net working capital acquired was $6.2 million, however, an equal liability was recorded in Accrued expenses, as it will be repaid to the previous owners of the acquired business. The excess of the purchase price over the estimated fair value of the net assets acquired was approximately $83.1 million and was recorded as goodwill.

During the year ended December 31, 2017, the Company purchased inventory with a fair value of $37.1 million in connection with the Jiangli New Materials acquisition. The fair value included the markup of the underlying book value of $23.1 million, which was expensed in Cost of goods sold during the year ended December 31, 2017, the estimated remaining selling period.

Goodwill arising from the acquisition consists largely of the anticipated synergies and economies of scale from the combined assets and the overall strategic importance of the acquired assets to Albemarle. The goodwill attributable to the acquisition will not be amortizable or deductible for tax purposes. The weighted-average amortization periods for the other intangible assets acquired are 20 years for patents and technology, 13 years for customer lists and relationships and 20 years for other. The weighted-average amortization period for all definite-lived intangible assets acquired is 17 years. Acquisition and integration related costs for the years ended December 31, 2018 and 2017 of $3.7 million and $14.3 million, respectively, were included in Cost of goods sold and $15.7 million and $19.6 million, respectively, were included in Selling, general and administrative expenses on our consolidated statements of income. These acquisition and integration related costs relate to various significant projects, including the Jiangli New Materials acquisition, which contains non-routine compensation related costs negotiated specifically as a result of this acquisition that are outside of the Company's ordinary compensation arrangements. Included in Acquisition and integration related costs on our consolidated statements of income for the year ended December 31, 2016 is $52.1 million of integration costs resulting from the acquisition of Rockwood Holdings, Inc. ("Rockwood") (mainly consisting of professional services fees, costs to achieve synergies, relocation costs, and other integration costs) and $5.3 million of costs in connection with other significant projects.

NOTE 3—Divestitures:

Polyolefin Catalysts and Components Business
On December 14, 2017, the Company signed a definitive agreement to sell the polyolefin catalysts and components portion of its Performance Catalyst Solutions ("PCS") business ("Polyolefin Catalysts Divestiture") to W.R. Grace & Co., with the sale closing on April 3, 2018. We received net cash proceeds of approximately $413.6 million and have recorded a gain of $210.4 million before income taxes in 2018 related to the sale of this business. The transaction includes Albemarle's Product Development Center located in Baton Rouge, Louisiana, and operations at its Yeosu, South Korea site. The sale does not include the Company's organometallics or curatives portion of its PCS business. The Polyolefin Catalysts Divestiture reflects the Company's commitment to investing in the future growth of its high priority businesses and returning capital to shareholders.

In the fourth quarter of 2017, we determined that the assets held for sale criteria in accordance with ASC 360, Property, Plant and Equipment, were met for this business. As such, the assets and liabilities of this business were included in Assets held for sale and Liabilities held for sale, respectively, in the consolidated balance sheet as of December 31, 2017.

The carrying amounts of the major classes of assets and liabilities that were classified as held for sale at December 31, 2017, are as follows (in thousands):

	December 31, 2017
Assets	
Current assets	$ 39,152
Net property, plant and equipment	121,759
Goodwill	14,422

Other intangibles, net of amortization	3,632
Assets held for sale	$ 178,965
Liabilities	
Current liabilities	$ 1,938
Noncurrent liabilities	614
Liabilities held for sale	$ 2,552

The results of operations of the business classified as held for sale is included in continuing operations within the consolidated statements of income. This business did not qualify for discontinued operations treatment because the Company's management does not consider the sale as representing a strategic shift that had or will have a major effect on the Company's operations and financial results.

Chemetall Surface Treatment Business

On June 17, 2016, we entered into a definitive agreement to sell the Chemetall Surface Treatment business to BASF SE. On December 14, 2016, the Company closed the sale of this business and received cash proceeds of approximately $3.1 billion.

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Included in Income from discontinued operations (net of tax) for the year ended December 31, 2016 is a pre-tax gain of $388.0 million ($135.0 million after income taxes) related to the sale of this business, which included a reversal of $81.4 million of foreign currency translation loss out of Accumulated other comprehensive loss. This gain represents the difference between the carrying value of the related net assets and their fair value as determined by the sales price less estimated costs to sell. During the second quarter of 2017, we received a final working capital settlement of $6.9 million related to the sale of this business. The sale of the Chemetall Surface Treatment business reflects the Company's commitment to investing in the future growth of its high priority businesses, maintaining leverage flexibility and returning capital to shareholders.

The Chemetall Surface Treatment business, a separate reportable segment, was acquired on January 12, 2015 as part of the acquisition of Rockwood. This sale qualified for discontinued operations treatment because it represented a strategic shift that will have a major effect on the Company's operations and financial results. As a result, in the second quarter of 2016, the Company accounted for this business as discontinued operations in the consolidated statements of income and excluded the business from segment results for the year ended December 31, 2016. As of the date this business qualified for discontinued operations treatment, the Company stopped recording depreciation and amortization expense on assets of the Chemetall Surface Treatment business.

The major components of Income from discontinued operations (net of tax) for the year ended December 31, 2016 were as follows (in thousands):

	Year Ended December 31, 2016
Net sales	$ 813,285
Cost of goods sold	416,934
Operating expenses, net[(a)]	268,402
Interest and financing expenses[(b)]	38,227
Other income, net	(2,485)
Gain on sale of discontinued operations	(387,980)
Income before income taxes	480,187
Income tax expense[(c)]	278,056
Income from discontinued operations (net of tax)	$ 202,131

(a) Operating expenses, net for discontinued operations includes mark-to market actuarial losses of $8.5 million during the year ended December 31, 2016.

(b) Interest and financing expenses included the allocation of interest expense not directly attributable to other operations as well as interest expense related to debt to be assumed by the buyer. The allocation of interest expense to discontinued operations was based on the ratio of net assets held for sale to the sum of total net assets plus consolidated debt.

(c) Income tax expense for the year ended December 31, 2016 included a charge of $253.0 million related to the gain on sale of discontinued operations.

Depreciation and amortization and capital expenditures from discontinued operations for the year ended December 31, 2016 were as follows (in thousands):

	Year Ended December 31, 2016
Depreciation and amortization	$ 35,194
Capital expenditures	$ 19,281

Other Divestitures

On January 4, 2016, we completed the sale of our metal sulfides business to Treibacher Industrie AG for net proceeds of $137 million and recorded a gain of $11.5 million before income taxes in 2016 related to the sale of this business. Included in the transaction were sites in Vienna and Arnoldstein, Austria, and Tribotecc’s proprietary sulfide synthesis process. In addition, on February 1, 2016, we completed the sale of our minerals-based flame retardants and specialty chemicals business to Huber Engineered Materials, a division of J.M. Huber Corporation, for net proceeds of approximately $187 million and recorded a gain of $112.3 million before income taxes in 2016 related to the sale of these businesses. The transaction included Albemarle’s Martinswerk GmbH subsidiary and manufacturing facility located in Bergheim, Germany, and Albemarle’s 50% ownership interest in Magnifin Magnesiaprodukte GmbH, a joint-venture with Radex Heraklith Industriebeteiligung AG at Breitenau, Austria. Also included in Gain on sales of businesses, net, for the year ended December 31, 2016 was a loss of $1.5 million on the sale of our wafer reclaim business.

These businesses did not qualify for discontinued operations treatment because the Company's management did not consider their sale as representing a strategic shift that had or will have a major effect on the Company's operations and financial results.

NOTE 4—Supplemental Cash Flow Information:

Supplemental information related to the consolidated statements of cash flows is as follows (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Cash paid during the year for:			
Income taxes (net of refunds of $21,459, $17,522 and $9,270 in 2018, 2017 and 2016, respectively)[(a)]	$157,758	$320,222	$143,404
Interest (net of capitalization)	$49,762	$61,243	$96,948
Supplemental non-cash disclosures related to investing activities:			
Capital expenditures included in Accounts payable	$134,784	$89,188	$33,622

(a) Includes approximately $41 million of income taxes paid in 2018 from the gain on sale of the Polyolefin Catalysts Divestiture, and $257 million of income taxes paid in 2017 from the gain on sale of the Chemetall Surface Treatment business.

Other, net within Cash flows from operating activities on the consolidated statements of cash flows for the year ended December 31, 2018 included $28.4 million representing the reclassification of the current portion of the one-time transition tax resulting from the enactment of the TCJA, from Other noncurrent liabilities to Income taxes payable within current liabilities. Included in Other, net for the year ended December 31, 2017 is $394.9 million related to the noncurrent portion of the one-time transition tax resulting from the enactment of the TCJA. For additional information, see Note 20, "Income Taxes." In addition, included in Other, net for the years ended December 31, 2018, 2017 and 2016 is $10.5 million, $11.1 million and $40.8 million, respectively, related to losses on fluctuations in foreign currency exchange rates.

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NOTE 5—Earnings Per Share:
Basic and diluted earnings per share from continuing operations are calculated as follows (in thousands, except per share amounts):

	Year Ended December 31,		
	2018	2017	2016
Basic earnings per share from continuing operations			
Numerator:			
Net income from continuing operations	$739,139	$99,468	$478,638
Net income from continuing operations attributable to noncontrolling interests	(45,577)	(44,618)	(37,094)
Net income from continuing operations attributable to Albemarle Corporation	$693,562	$54,850	$441,544
Denominator:			
Weighted-average common shares for basic earnings per share	108,427	110,914	112,379
Basic earnings per share from continuing operations	$6.40	$0.49	$3.93
Diluted earnings per share from continuing operations			
Numerator:			
Net income from continuing operations	$739,139	$99,468	$478,638
Net income from continuing operations attributable to noncontrolling interests	(45,577)	(44,618)	(37,094)
Net income from continuing operations attributable to Albemarle Corporation	$693,562	$54,850	$441,544
Denominator:			
Weighted-average common shares for basic earnings per share	108,427	110,914	112,379
Incremental shares under stock compensation plans	1,031	1,466	860
Weighted-average common shares for diluted earnings per share	109,458	112,380	113,239
Diluted earnings per share from continuing operations	$6.34	$0.49	$3.90

At December 31, 2018, there were 123,730 common stock equivalents not included in the computation of diluted earnings per share because their effect would have been anti-dilutive.

Included in the calculation of basic earnings per share are unvested restricted stock awards that contain nonforfeitable rights to dividends. At December 31, 2018, there were 8,400 unvested shares of restricted stock awards outstanding.

We have the authority to issue 15 million shares of preferred stock in one or more classes or series. As of December 31, 2018, no shares of preferred stock have been issued.

In November 2016, our Board of Directors authorized an increase in the number of shares the Company is permitted to repurchase under our share repurchase program, pursuant to which the Company is now permitted to repurchase up to a maximum of 15 million shares, including those previously authorized but not yet repurchased.

Under our existing Board authorized share repurchase program, during 2018, the Company entered into two separate accelerated share repurchase (“ASR”) agreements with financial institutions. Under each ASR agreement, the Company paid $250 million from available cash on hand. Under the terms of the first ASR agreement, which was completed on September 28, 2018, the Company received and retired a total of 2,680,704 shares, calculated based on the daily Rule 10b-18 volume-weighted average prices of the Company’s common stock over the term of the ASR agreement, less an agreed discount. Under the terms of the second ASR agreement, which was completed on December 7, 2018, the company received and retired a total of 2,581,950 shares, calculated based on the daily Rule 10b-18 weighted average prices of the Company's common stock over the terms of the ASR agreement, less an agreed discount. The Company determined that each ASR agreement met the criteria to be accounted for as a forward contract indexed to its stock and was therefore treated as an equity instrument. In total, we received and retired 5,262,654 shares under these agreements, which reduced the Company's weighted average shares outstanding for purposes of calculating basic and diluted earnings per share for the year ended December 31, 2018.

Under our existing Board authorized share repurchase program, the Company entered into an ASR agreement with a financial institution on March 1, 2017. Under the ASR agreement, in March 2017, the Company paid $250 million from available cash on hand and received and retired an initial delivery of 1,948,178 shares of our common stock. Under the terms of the ASR agreement, on June 16, 2017, the transaction was completed and we received and retired a final settlement of 392,905 shares, calculated based on the daily Rule 10b-18 volume-weighted average prices of the Company's common stock over the term of the ASR agreement, less an agreed discount. The Company determined that the ASR agreement met the criteria to be accounted for as a forward contract indexed to its stock and was therefore treated as an equity instrument. In total, we received and retired 2,341,083 shares under the ASR agreement, which reduced the Company's weighted average shares outstanding for purposes of calculating basic and diluted earnings per share for the year ended December 31, 2017.

There were no shares of the Company's common stock repurchased during the year ended December 31, 2016. As of December 31, 2018, there were 7,396,263 remaining shares available for repurchase under the Company's authorized share repurchase program.

NOTE 6—Other Accounts Receivable:

Other accounts receivable consist of the following at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Value added tax/consumption tax	$40,480	$23,158
Other	11,579	14,779
Total	$52,059	$37,937

NOTE 7—Inventories:

The following table provides a breakdown of inventories at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Finished goods[(a)]	$482,355	$404,239
Raw materials and work in process[(b)]	158,290	132,891
Stores, supplies and other	59,895	55,651
Total[(c)]	$700,540	$592,781

(a) Increase primarily due to the build-up of inventory in our Lithium segment for a forecasted increase in sales in 2019.

(b) Included $71.4 million and $59.6 million at December 31, 2018 and 2017, respectively, of work in process related to lithium brine.

(c) As of December 31, 2017, $24.7 million of Inventories were classified as Assets held for sale in the consolidated balance sheets. See Note 3, "Divestitures," for additional information.

Approximately 10% and 17% of our inventories are valued using the last-in, first-out ("LIFO") method at December 31, 2018 and 2017, respectively. The portion of our domestic inventories stated on the LIFO basis amounted to $69.2 million and $99.6 million at December 31, 2018 and 2017, respectively, which are below replacement cost by approximately $32.8 million and $33.1 million, respectively.

NOTE 8—Other Current Assets:

Other current assets consist of the following at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Income tax receivables	$40,116	$47,130
Prepaid expenses	43,172	86,348
Other	1,502	2,586
Total	$84,790	$136,064

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NOTE 9—Property, Plant and Equipment:

Property, plant and equipment, at cost, consist of the following at December 31, 2018 and 2017 (in thousands):

	Useful Lives (Years)	December 31, 2018	2017
Land	—	$123,518	$118,428
Land improvements	10 – 30	63,349	63,328
Buildings and improvements	10 – 45	251,980	245,482
Machinery and equipment[(a)]	2 – 45	2,780,478	2,627,667
Long-term mineral rights and production equipment costs	7 – 60	696,033	675,832
Construction in progress	—	883,705	393,598
Total[(b)]		$4,799,063	$4,124,335

(a) Consists primarily of (1) short-lived production equipment components, office and building equipment and other equipment with estimated lives ranging 2 – 7 years, (2) production process equipment (intermediate components) with estimated lives ranging 8 – 19 years, (3) production process equipment (major unit components) with estimated lives ranging 20 – 29 years, and (4) production process equipment (infrastructure and other) with estimated lives ranging 30 – 45 years.

(b) As of December 31, 2017, $215.9 million of Property, plant and equipment, at cost, was classified as Assets held for sale in the consolidated balance sheets. See Note 3, “Divestitures,” for additional information.

The cost of property, plant and equipment is depreciated generally by the straight-line method. Depletion of long-term mineral rights is based on the units-of-production method. Depreciation expense, including depletion, amounted to $170.0 million, $169.5 million and $178.8 million during the years ended December 31, 2018, 2017 and 2016, respectively. Depreciation expense related to discontinued operations was $8.9 million during the year ended December 31, 2016. Interest capitalized on significant capital projects in 2018, 2017 and 2016 was $19.3 million, $7.4 million and $6.8 million, respectively.

NOTE 10—Investments:

Investments include our share of unconsolidated joint ventures, nonmarketable securities and marketable equity securities. The following table details our investment balances at December 31, 2018 and 2017 (in thousands):

	December 31, 2018	2017
Joint ventures	$486,032	$499,756
Nonmarketable securities	9,177	3,655
Marketable equity securities	33,513	30,653
Total	$528,722	$534,064

Our ownership positions in significant unconsolidated investments are shown below:

	December 31, 2018	2017	2016
*	49%	49%	49%

	Windfield Holdings Pty. Ltd. - a joint venture with Sichuan Tianqi Lithium Industries, Inc., that mines lithium ore and produces lithium concentrate			
*	Nippon Aluminum Alkyls - a joint venture with Mitsui Chemicals, Inc. that produces aluminum alkyls	50%	50%	50%
*	Nippon Ketjen Company Limited - a joint venture with Sumitomo Metal Mining Company Limited that produces refinery catalysts	50%	50%	50%
*	Eurecat S.A. - a joint venture with Axens Group for refinery catalysts regeneration services	50%	50%	50%
*	Fábrica Carioca de Catalisadores S.A. - a joint venture with Petrobras Quimica S.A. - PETROQUISA that produces catalysts and includes catalysts research and product development activities	50%	50%	50%

Our investment in the significant unconsolidated joint ventures above amounted to $466.1 million and $479.1 million as of December 31, 2018 and 2017, respectively, and the amount included in Equity in net income of unconsolidated investments (net of tax) in the consolidated statements of income totaled $88.8 million, $86.8 million and $56.8 million for the years ended

December 31, 2018, 2017 and 2016, respectively. Undistributed earnings attributable to our significant unconsolidated investments represented approximately $159.9 million and $127.5 million of our consolidated retained earnings at December 31, 2018 and 2017, respectively. All of the unconsolidated joint ventures in which we have investments are private companies and accordingly do not have a quoted market price available.
The following summary lists the assets, liabilities and results of operations for our significant unconsolidated joint ventures presented herein (in thousands):

	December 31,	
	2018	2017
Summary of Balance Sheet Information:		
Current assets	$476,460	$503,043
Noncurrent assets	1,159,866	1,041,519
Total assets	$1,636,326	$1,544,562
Current liabilities	$191,971	$133,670
Noncurrent liabilities	422,769	405,662
Total liabilities	$614,740	$539,332

	Year Ended December 31,		
	2018	2017	2016
Summary of Statements of Income Information:			
Net sales	$829,590	$687,561	$590,980
Gross profit	$456,518	$353,577	$267,241
Income before income taxes	$332,632	$267,805	$189,016
Net income	$225,791	$184,777	$126,872

We have evaluated each of the unconsolidated investments pursuant to current accounting guidance and none qualify for consolidation. Dividends received from our significant unconsolidated investments were $56.4 million, $38.1 million and $42.1 million in 2018, 2017 and 2016, respectively.
At December 31, 2018 and 2017, the carrying amount of our investments in unconsolidated joint ventures differed from the amount of underlying equity in net assets by approximately $0.4 million and $13.8 million, respectively. These amounts represent the differences between the value of certain assets of the joint ventures and our related valuation on a U.S. GAAP basis. As of December 31, 2018 and 2017, $0.1 million and $0.4 million, respectively, remained to be amortized over the remaining useful lives of the assets with the balance of the difference primarily representing our share of the joint ventures' goodwill.
The Company holds a 49% equity interest in Windfield Holdings Pty. Ltd. ("Windfield"), which we acquired in the Rockwood acquisition. With regards to the Company's ownership in Windfield, the parties share risks and benefits disproportionate to their voting interests. As a result, the Company considers Windfield to be a variable interest entity ("VIE"). However, the Company does not consolidate Windfield as it is not the primary beneficiary. The carrying amount of our 49% equity interest in Windfield, which is our most significant VIE, was $349.6 million and $355.2 million at December 31, 2018 and December 31, 2017, respectively. The Company's aggregate net investment in all

other entities which it considers to be VIE’s for which the Company is not the primary beneficiary was $8.1 million and $8.7 million at December 31, 2018 and December 31, 2017, respectively. Our unconsolidated VIEs are reported in Investments in the consolidated balance sheets. The Company does not guarantee debt for, or have other financial support obligations to, these entities, and its maximum exposure to loss in connection with its continuing involvement with these entities is limited to the carrying value of the investments.

As part of the original Windfield joint venture agreement, Tianqi Lithium Corporation (“Tianqi”) was granted an option to purchase from 20% to 30% of the equity interests in Rockwood Lithium GmbH, a wholly-owned German subsidiary of Albemarle, and its subsidiaries. In February 2017, Albemarle and Tianqi terminated the option agreement, and as a result, we will retain 100% of the ownership interest in Rockwood Lithium GmbH and its subsidiaries. Following the termination of the option agreement, the $13.1 million fair value of the option agreement originally recorded in Noncontrolling interests was reversed and recorded as an adjustment to Additional paid-in capital.

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The Company holds a 50% equity interest in Jordan Bromine Company Limited (“JBC”), reported in the Bromine Specialties segment. The Company consolidates this venture as it is considered the primary beneficiary due to its operational and financial control.

We maintain a Benefit Protection Trust (the “Trust”) that was created to provide a source of funds to assist in meeting the obligations of our Executive Deferred Compensation Plan (“EDCP”), subject to the claims of our creditors in the event of our insolvency. Assets of the Trust, in conjunction with our EDCP, are accounted for as trading securities in accordance with authoritative accounting guidance. The assets of the Trust consist primarily of mutual fund investments and are marked-to-market on a monthly basis through the consolidated statements of income. As of December 31, 2018 and 2017, these marketable securities amounted to $26.3 million and $25.5 million, respectively.

NOTE 11—Other Assets:

Other assets consist of the following at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Deferred income taxes[a]	$17,029	$25,108
Assets related to unrecognized tax benefits[a]	12,984	14,601
Other[b]	50,122	34,455
Total	$80,135	$74,164

(a) See Note 1, “Summary of Significant Accounting Policies” and Note 20, “Income Taxes.”

(b) As of December 31, 2018 and 2017, a $28.7 million reserve was recorded against a note receivable on one of our European entities no longer deemed probable of collection.

NOTE 12—Goodwill and Other Intangibles:

The following table summarizes the changes in goodwill by reportable segment for the years ended December 31, 2018 and 2017 (in thousands):

	Lithium	Bromine Specialties	Catalysts	All Other	Total
Balance at December 31, 2016[a]	$1,326,980	$ 20,319	$186,147	$6,586	$1,540,032
Acquisitions[b]	(26,151)	—	—	—	(26,151)
Reclass to assets held for sale[c]	—	—	(14,422)	—	(14,422)
Foreign currency translation adjustments and other	88,260	—	22,636	—	110,896
Balance at December 31, 2017[a]	1,389,089	20,319	194,361	6,586	1,610,355
Foreign currency translation adjustments and other	(34,310)	—	(8,876)	—	(43,186)
Balance at December 31, 2018	$1,354,779	$ 20,319	$185,485	$6,586	$1,567,169

(a) The December 31, 2016 and 2017 balances have been recast to reflect a change in segments. See Note 24, “Segment and Geographic Area Information,” for additional information.

(b)

Primarily represents final purchase price adjustments for the Jiangli New Materials acquisition recorded for the year ended December 31, 2017. See Note 2, “Acquisitions,” for additional information.

(c) Represents Goodwill of the Polyolefin Catalysts Divestiture. See Note 3, “Divestitures,” for additional information.

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Other intangibles consist of the following at December 31, 2018 and 2017 (in thousands):

	Customer Lists and Relationships	Trade Names and Trademarks[a]	Patents and Technology	Other	Total
Gross Asset Value					
Balance at December 31, 2016	$ 387,893	$ 16,514	$ 38,434	$ 18,844	$ 461,685
Acquisitions[b]	19,225	1,429	20,381	18,847	$ 59,882
Reclass to assets held for sale[c]	—	—	—	(4,228)	(4,228)
Foreign currency translation adjustments and other	32,194	1,038	2,803	3,793	39,828
Balance at December 31, 2017	439,312	18,981	61,618	37,256	557,167
Foreign currency translation adjustments and other	(10,940)	(528)	(5,817)	6,452	(10,833)
Balance at December 31, 2018	$ 428,372	$ 18,453	$ 55,801	$ 43,708	$ 546,334
Accumulated Amortization					
Balance at December 31, 2016	$ (49,165)	$ (7,952)	$ (31,683)	$ (18,321)	$ (107,121)
Amortization	(21,288)	—	(1,412)	(2,379)	(25,079)
Reclass to assets held for sale[c]	—	—	—	596	596
Foreign currency translation adjustments and other	(4,251)	(343)	(2,108)	2,642	(4,060)
Balance at December 31, 2017	(74,704)	(8,295)	(35,203)	(17,462)	(135,664)
Amortization	(23,402)	—	(1,450)	(3,127)	(27,979)
Foreign currency translation adjustments and other	2,309	119	1,405	(381)	3,452
Balance at December 31, 2018	$ (95,797)	$ (8,176)	$ (35,248)	$ (20,970)	$ (160,191)
Net Book Value at December 31, 2017	$ 364,608	$ 10,686	$ 26,415	$ 19,794	$ 421,503
Net Book Value at December 31, 2018	$ 332,575	$ 10,277	$ 20,553	$ 22,738	$ 386,143

(a) Includes only indefinite-lived intangible assets.
(b) Represents final purchase price adjustments for the Jiangli New Materials acquisition and the acquisition of the remaining equity interest in Salmag. See Note 2, “Acquisitions,” for additional information.
(c) Represents Other intangibles and related amortization of the Polyolefin Catalysts Divestiture. See Note 3, “Divestitures,” for additional information.

Useful lives range from 13 – 25 years for customer lists and relationships; 8 – 20 years for patents and technology; and primarily 5 – 25 years for other.

Amortization of other intangibles amounted to $28.0 million, $25.1 million and $19.0 million for the years ended December 31, 2018, 2017 and 2016, respectively. Included in amortization for the years ended December 31, 2018, 2017 and 2016 is $19.7 million, $17.7 million and $15.9 million, respectively, of amortization using the pattern of economic benefit method. Amortization of other intangibles related to discontinued operations was $26.3 million for the year ended December 31, 2016.

Total estimated amortization expense of other intangibles for the next five fiscal years is as follows (in thousands):

Estimated
Amortization

	Expense
2019	$ 27,219
2020	$ 24,878
2021	$ 24,600
2022	$ 24,006
2023	$ 23,395

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NOTE 13—Accrued Expenses:

Accrued expenses consist of the following at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Employee benefits, payroll and related taxes	$77,814	$93,393
Other[(a)]	179,509	174,943
Total	$257,323	$268,336

(a) No individual component exceeds 5% of total current liabilities.

NOTE 14—Long-Term Debt:

Long-term debt consisted of the following at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
1.875% Senior notes, net of unamortized discount and debt issuance costs of $2,841 at December 31, 2018 and $3,971 at December 31, 2017	444,155	463,575
4.15% Senior notes, net of unamortized discount and debt issuance costs of $2,884 at December 31, 2018 and $3,372 at December 31, 2017	422,116	421,628
4.50% Senior notes, net of unamortized discount and debt issuance costs of $589 at December 31, 2018 and $891 at December 31, 2017	174,626	174,325
5.45% Senior notes, net of unamortized discount and debt issuance costs of $4,004 at December 31, 2018 and $4,159 at December 31, 2017	345,996	345,841
Commercial paper notes	306,606	421,321
Variable-rate foreign bank loans	7,216	5,298
Other	4,495	5,384
Total long-term debt	1,705,210	1,837,372
Less amounts due within one year	307,294	422,012
Long-term debt, less current portion	$1,397,916	$1,415,360

Aggregate annual maturities of long-term debt as of December 31, 2018 are as follows (in millions): 2019—$307.3; 2020—$175.3; 2021—$447.0; 2022—$0.0; 2023—$7.2; thereafter—$778.7.

Senior Notes

In the fourth quarter of 2014, we issued a series of senior notes (collectively, the “2014 Senior Notes”) as follows:

- €700.0 million aggregate principal amount of senior notes, issued on December 8, 2014, bearing interest at a rate of 1.875% payable annually on December 8 of each year, beginning in 2015. The effective interest rate on these senior notes is approximately 2.10%. These senior notes mature on December 8, 2021.
- $250.0 million aggregate principal amount of senior notes, issued on November 24, 2014, bearing interest at a rate of 3.00% payable semi-annually on June 1 and December 1 of each year, beginning June 1, 2015. The effective interest rate on these senior notes is approximately 3.18%. These senior notes mature on December 1, 2019.
- $425.0 million aggregate principal amount of senior notes, issued on November 24, 2014, bearing interest at a rate of 4.15% payable semi-annually on June 1 and December 1 of each year, beginning June 1, 2015. The effective interest

rate on these senior notes is approximately 5.06%. These senior notes mature on December 1, 2024.

- $350.0 million aggregate principal amount of senior notes, issued on November 24, 2014, bearing interest at a rate of 5.45% payable semi-annually on June 1 and December 1 of each year, beginning June 1, 2015. The effective interest rate on these senior notes is approximately 5.50%. These senior notes mature on December 1, 2044.

Our $350.0 million aggregate principal amount of senior notes, issued on December 10, 2010, bear interest at a rate of 4.50% payable semi-annually on June 15 and December 15 of each year. The effective interest rate on these senior notes is approximately 4.70%. These senior notes mature on December 15, 2020.

In the first quarter of 2017, using a portion of the proceeds from the sale of the Chemetall Surface Treatment business, we repaid the 3.00% Senior notes in full, €307.0 million of the 1.875% Senior notes and $174.7 million of the 4.50% Senior notes, as well as related tender premiums of $45.2 million. As a result, Interest and financing expenses on the consolidated statements of income includes a loss on early extinguishment of debt of $52.8 million for the year ended December 31, 2017, representing the tender premiums, fees, unamortized discounts and unamortized deferred financing costs from the redemption of these senior notes.

On January 22, 2014, we entered into a pay fixed, receive variable rate forward starting interest rate swap, with a notional amount of $325.0 million, with J.P. Morgan Chase Bank, N.A., to be effective October 15, 2014. Our risk management objective and strategy for undertaking this hedge was to eliminate the variability in the interest rate and partial credit spread on the 20 future semi-annual coupon payments that we will pay in connection with our 4.15% senior notes. On October 15, 2014, the swap was settled, resulting in a payment to the counterparty of $33.4 million. This amount was recorded in Accumulated other comprehensive loss and is being amortized to interest expense over the life of the 4.15% senior notes. The amount to be reclassified to interest expense from Accumulated other comprehensive loss during the next twelve months is approximately $3.3 million.

On December 18, 2014, the carrying value of the 1.875% Euro-denominated senior notes was designated as an effective hedge of our net investment in foreign subsidiaries where the Euro serves as the functional currency, and beginning on the date of designation, gains or losses on the revaluation of these senior notes to our reporting currency have been and will be recorded in Accumulated other comprehensive loss. During the years ended December 31, 2018, 2017 and 2016, gains (losses) of $25.8 million, ($41.8) million and $26.1 million (net of income taxes), respectively, were recorded in Accumulated other comprehensive loss in connection with the revaluation of these senior notes to our reporting currency.

September 2015 Term Loan Agreement

On September 14, 2015, we entered into a new $1.25 billion term loan agreement (the "September 2015 Term Loan Agreement") with JPMorgan Chase Bank, N.A. (the "Administrative Agent") and certain other lenders. During the year ended December 31, 2016, the Company repaid the September 2015 Term Loan Agreement in full, primarily with proceeds from the sales of the Chemetall Surface Treatment business, the metal sulfides business and the minerals-based flame retardants and specialty chemicals business. The interest rate on both Term loan facilities was LIBOR plus 1.375%.

Credit Agreement

On June 21, 2018, we entered into a revolving, unsecured credit agreement ("2018 Credit Agreement") to replace our revolving, unsecured credit agreement dated as of February 7, 2014, as amended. The 2018 Credit Agreement currently provides for borrowings of up to $1.0 billion and matures on June 21, 2023. Borrowings under the 2018 Credit Agreement bear interest at variable rates based on an average London inter-bank offered rate ("LIBOR") for deposits in the relevant currency plus an applicable margin which ranges from 0.910% to 1.500%, depending on the Company's credit rating from Standard & Poor's Ratings Services ("S&P"), Moody's Investors Services ("Moody's") and Fitch Ratings ("Fitch"). The applicable margin on the facility was 1.125% as of December 31, 2018. There were no borrowings outstanding under the 2018 Credit Agreement as of December 31, 2018.

Borrowings under the 2018 Credit Agreement are conditioned upon satisfaction of certain conditions precedent, including the absence of defaults. The Company is subject to one financial covenant, as well as customary affirmative and negative covenants. The financial covenant requires that the Company's consolidated funded debt to consolidated EBITDA ratio (as such terms are defined in the 2018 Credit Agreement) to be less than or equal to 3.50:1.00, subject to adjustments in accordance with the terms of the 2018 Credit Agreement relating to a consummation of an acquisition where the consideration includes cash proceeds from issuance of funded debt in excess of $500 million. The 2018 Credit Agreement also contains customary default provisions, including defaults for non-payment, breach of representations and warranties, insolvency, non-performance of covenants and cross-defaults to other material indebtedness. The occurrence of an event of default under the 2018 Credit Agreement could result in all loans and other obligations becoming immediately due and payable and the credit facility being terminated.

Commercial Paper Notes

On May 29, 2013, we entered into agreements to initiate a commercial paper program on a private placement basis under which we may issue unsecured commercial paper notes (the “Commercial Paper Notes”) from time-to-time up to a maximum aggregate principal amount outstanding at any time of $750.0 million. The proceeds from the issuance of the Commercial Paper Notes are expected to be used for general corporate purposes, including the repayment of other debt of the Company. Our 2018 Credit Agreement is available to repay the Commercial Paper Notes, if necessary. Aggregate borrowings outstanding under the 2018 Credit Agreement and the Commercial Paper Notes will not exceed the $1.0 billion current maximum amount available under the 2018 Credit Agreement. The Commercial Paper Notes will be sold at a discount from par, or alternatively, will be sold at par and bear interest at rates that will vary based upon market conditions at the time of issuance. The maturities of the Commercial Paper Notes will vary but may not exceed 397 days from the date of issue. The definitive documents relating to the commercial paper program contain customary representations, warranties, default and indemnification provisions. At December 31, 2018, we had $306.6 million of Commercial Paper Notes outstanding bearing a weighted-average interest rate of approximately 2.91% and a weighted-average maturity of 38 days. During the year ended December 31, 2018, we repaid a net amount of $114.7 million of commercial paper notes using cash on hand.

Other

We have additional uncommitted credit lines with various U.S. and foreign financial institutions that provide for borrowings of up to approximately $263 million at December 31, 2018. Outstanding borrowings under these agreements were $7.2 million and $5.3 million at December 31, 2018 and 2017, respectively. The average interest rate on borrowings under these agreements during 2018, 2017 and 2016 was approximately 0.69%, 1.26% and 0.94%, respectively.

At December 31, 2018 and 2017, we had the ability and intent to refinance our borrowings under our other existing credit lines with borrowings under the 2018 Credit Agreement. Therefore, the amounts outstanding under those credit lines, if any, are classified as long-term debt at December 31, 2018 and 2017. At December 31, 2018, we had the ability to borrow $693.4 million under our commercial paper program and the 2018 Credit Agreement.

We believe that as of December 31, 2018, we were, and currently are, in compliance with all of our debt covenants.

NOTE 15—Pension Plans and Other Postretirement Benefits:

We maintain various noncontributory defined benefit pension plans covering certain employees, primarily in the U.S., the U.K., Germany and Japan. We also have a contributory defined benefit plan covering certain Belgian employees. The benefits for these plans are based primarily on compensation and/or years of service. Our U.S. and U.K. defined benefit plans for non-represented employees are closed to new participants, with no additional benefits accruing under these plans as participants' accrued benefits have been frozen. The funding policy for each plan complies with the requirements of relevant governmental laws and regulations. The pension information for all periods presented includes amounts related to salaried and hourly plans.

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The following provides a reconciliation of benefit obligations, plan assets and funded status, as well as a summary of significant assumptions, for our defined benefit pension plans (in thousands):

	Year Ended December 31, 2018		Year Ended December 31, 2017	
	U.S. Pension Plans	Foreign Pension Plans	U.S. Pension Plans	Foreign Pension Plans
Change in benefit obligations:				
Benefit obligation at January 1	$685,963	$275,006	$665,688	$246,280
Service cost	1,043	3,919	985	2,547
Interest cost	26,804	5,144	28,614	5,128
Plan amendments	—	233	—	—
Actuarial (gain) loss	(36,844)	(17,885)	30,539	2,783
Benefits paid	(41,100)	(9,974)	(39,863)	(9,524)
Employee contributions	—	182	—	215
Foreign exchange (gain) loss	—	(12,632)	—	30,711
Settlements/curtailments	—	(3,628)	—	(3,065)
Other	—	(62)	—	(69)
Benefit obligation at December 31	$635,866	$240,303	$685,963	$275,006
Change in plan assets:				
Fair value of plan assets at January 1	$580,396	$79,478	$538,082	$68,875
Actual return on plan assets	(28,457)	(1,593)	80,613	6,260
Employer contributions	2,236	10,700	1,564	9,316
Benefits paid	(41,100)	(9,974)	(39,863)	(9,524)
Employee contributions	—	182	—	215
Foreign exchange (loss) gain	—	(4,519)	—	7,470
Settlements/curtailments	—	(3,628)	—	(3,065)
Other	—	(62)	—	(69)
Fair value of plan assets at December 31	$513,075	$70,584	$580,396	$79,478
Funded status at December 31	$(122,791)	$(169,719)	$(105,567)	$(195,528)

	December 31, 2018		December 31, 2017	
	U.S. Pension Plans	Foreign Pension Plans	U.S. Pension Plans	Foreign Pension Plans
Amounts recognized in consolidated balance sheets:				
Current liabilities (accrued expenses)	$(1,342)	$(5,772)	$(1,267)	$(5,217)

Noncurrent liabilities (pension benefits)	(121,449)	(163,947)	(104,300)	(190,311)
Net pension liability	$(122,791)	$(169,719)	$(105,567)	$(195,528)
Amounts recognized in accumulated other comprehensive (loss) income:				
Prior service benefit	$—	$(409)	$(60)	$(269)
Net amount recognized	$—	$(409)	$(60)	$(269)
Weighted-average assumptions used to determine benefit obligations at December 31:				
Discount rate	4.59 %	2.15 %	4.03 %	1.94 %
Rate of compensation increase	— %	3.63 %	— %	3.18 %

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The accumulated benefit obligation for all defined benefit pension plans was $867.4 million and $949.0 million at December 31, 2018 and 2017, respectively.
Postretirement medical benefits and life insurance is provided for certain groups of U.S. retired employees. Medical and life insurance benefit costs have been funded principally on a pay-as-you-go basis. Although the availability of medical coverage after retirement varies for different groups of employees, the majority of employees who retire before becoming eligible for Medicare can continue group coverage by paying a portion of the cost of a monthly premium designed to cover the claims incurred by retired employees subject to a cap on payments allowed. The availability of group coverage for Medicare-eligible retirees also varies by employee group with coverage designed either to supplement or coordinate with Medicare. Retirees generally pay a portion of the cost of the coverage. Plan assets for retiree life insurance are held under an insurance contract and are reserved for retiree life insurance benefits.
In 2005, the postretirement medical benefit available to U.S. employees was changed to provide that employees who are under age 50 as of December 31, 2005 would no longer be eligible for a company-paid retiree medical premium subsidy. Employees who are of age 50 and above as of December 31, 2005 and who retire after January 1, 2006 will have their retiree medical premium subsidy capped. Effective January 1, 2008, our medical insurance for certain groups of U.S. retired employees is now insured through a medical carrier.

The following provides a reconciliation of benefit obligations, plan assets and funded status, as well as a summary of significant assumptions, for our postretirement benefit plans (in thousands):

	Year Ended December 31,	
	2018 Other Postretirement Benefits	2017 Other Postretirement Benefits
Change in benefit obligations:		
Benefit obligation at January 1	$56,647	$ 56,141
Service cost	117	121
Interest cost	2,168	2,340
Actuarial (gain) loss	(5,661)	2,008
Benefits paid	(2,881)	(3,963)
Benefit obligation at December 31	$50,390	$ 56,647
Change in plan assets:		
Fair value of plan assets at January 1	$834	$ 2,232
Actual return on plan assets	(253)	104
Employer contributions	2,300	2,461
Benefits paid	(2,881)	(3,963)
Fair value of plan assets at December 31	$—	$ 834
Funded status at December 31	$(50,390)	$ (55,813)

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	December 31, 2018 Other Postretirement Benefits	December 31, 2017 Other Postretirement Benefits
Amounts recognized in consolidated balance sheets:		
Current liabilities (accrued expenses)	$(4,233)	$ (3,810)
Noncurrent liabilities (postretirement benefits)	(46,157)	(52,003)
Net postretirement liability	$(50,390)	$ (55,813)
Amounts recognized in accumulated other comprehensive (loss) income:		
Prior service benefit	$—	$ 48
Net amount recognized	$—	$ 48
Weighted-average assumptions used to determine benefit obligations at December 31:		
Discount rate	4.55 %	3.99 %
Rate of compensation increase	3.50 %	3.50 %

The components of pension benefits cost (credit) from continuing operations are as follows (in thousands):

	Year Ended December 31, 2018 U.S. Pension Plans	Year Ended December 31, 2018 Foreign Pension Plans	Year Ended December 31, 2017 U.S. Pension Plans	Year Ended December 31, 2017 Foreign Pension Plans	Year Ended December 31, 2016 U.S. Pension Plans	Year Ended December 31, 2016 Foreign Pension Plans
Service cost	$1,043	$3,919	$985	$2,547	$1,028	$3,133
Interest cost	26,804	5,144	28,614	5,128	30,514	6,570
Expected return on assets	(38,621)	(4,204)	(36,243)	(4,441)	(36,445)	(4,027)
Actuarial loss (gain)	30,234	(10,833)	(13,910)	483	5,988	19,418
Amortization of prior service benefit	60	34	75	56	75	859
Total net pension benefits cost (credit)[(a)]	$19,520	$(5,940)	$(20,479)	$3,773	$1,160	$25,953
Weighted-average assumption percentages:						
Discount rate	4.03 %	1.94 %	4.43 %	2.00 %	4.67 %	2.76 %
Expected return on plan assets	6.89 %	5.52 %	6.89 %	6.16 %	6.89 %	6.66 %
Rate of compensation increase	— %	3.18 %	— %	3.18 %	— %	3.16 %

(a) For the year ended December 31, 2016, $10.8 million of net pension benefits credit is included in Income from discontinued operations (net of tax) in the consolidated statements of income. See Note 3, “Divestitures,” for additional information.

Effective January 1, 2019, the weighted-average expected rate of return on plan assets for the U.S. and foreign defined benefit pension plans is 6.89% and 5.69%, respectively.

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The components of postretirement benefits (credit) cost from continuing operations are as follows (in thousands):

	Year Ended December 31,		
	2018	2017	2016
	Other Postretirement Benefits	Other Postretirement Benefits	Other Postretirement Benefits
Service cost	$117	$ 121	$ 115
Interest cost	2,168	2,340	2,483
Expected return on assets	(7)	(110)	(187)
Actuarial (gain) loss	(5,400)	2,014	1,275
Amortization of prior service benefit	(48)	(95)	(95)
Total net postretirement benefits (credit) cost	$(3,170)	$ 4,270	$ 3,591
Weighted-average assumption percentages:			
Discount rate	3.99 %	4.35 %	4.59 %
Expected return on plan assets	7.00 %	7.00 %	7.00 %
Rate of compensation increase	3.50 %	3.50 %	3.50 %

As a result of the adoption of new accounting guidance effective January 1, 2018, on a retrospective basis, all components of net benefit cost (credit), other than service cost, are to be shown outside of operations on the consolidated statements of income. We recast these components of net benefit cost (credit), which resulted in an increase (reduction) of $3.7 million and $0.3 million in Cost of goods sold, respectively, and $12.4 million and ($26.7) million in Selling, general and administrative expenses, respectively, with an offsetting impact of $16.1 million and ($26.4) million in Other expenses, net, respectively, for the years ended December 31, 2017 and 2016. There was no impact to Net income attributable to Albemarle Corporation.

The mark-to-market actuarial loss in 2018 is primarily attributable to a lower return on pension plan assets in 2018 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was (4.55)% versus an expected return of 6.73%. The mark-to-market actuarial loss in 2018 was partially offset by an increase in the weighted-average discount rate to 4.59% from 4.03% for our U.S. pension plans and to 2.15% from 1.94% for our foreign pension plans to reflect market conditions as of the December 31, 2018 measurement date.

The mark-to-market actuarial gain in 2017 is primarily attributable to a higher return on pension plan assets in 2017 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 14.31% versus an expected return of 6.73%. The mark-to-market actuarial gain in 2017 was partially offset by a decrease in the weighted-average discount rate to 4.03% from 4.43% for our U.S. pension plans and to 1.94% from 2.00% for our foreign pension plans to reflect market conditions as of the December 31, 2017 measurement date.

The mark-to-market actuarial loss in 2016 is primarily attributable to a decrease in the weighted-average discount rate to 4.43% from 4.67% for our U.S. pension plans and to 2.00% form 2.76% for our foreign pension plans to reflect market conditions as of the December 31, 2016 measurement date. The mark-to-market actuarial loss in 2016 was partially offset by a higher return on pension plan assets in 2016 than was expected, as a result of overall market and investment portfolio performance. The weighted-average return on our U.S. and foreign pension plan assets was 8.11% versus an expected return of 6.85%.

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Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (exit price). The inputs used to measure fair value are classified into the following hierarchy:

Level 1	Unadjusted quoted prices in active markets for identical assets or liabilities
Level 2	Unadjusted quoted prices in active markets for similar assets or liabilities, or unadjusted quoted prices for identical or similar assets or liabilities in markets that are not active, or inputs other than quoted prices that are observable for the asset or liability
Level 3	Unobservable inputs for the asset or liability

We endeavor to utilize the best available information in measuring fair value. Financial assets and liabilities are classified in their entirety based on the lowest level of input that is significant to the fair value measurement. Investments for which market quotations are readily available are valued at the closing price on the last business day of the year. Listed securities for which no sale was reported on such date are valued at the mean between the last reported bid and asked price. Securities traded in the over-the-counter market are valued at the closing price on the last business day of the year or at bid price. The net asset value of shares or units is based on the quoted market value of the underlying assets. The market value of corporate bonds is based on institutional trading lots and is most often reflective of bid price. Government securities are valued at the mean between bid and ask prices. Holdings in private equity securities are typically valued using the net asset valuations provided by the underlying private investment companies.

The following tables set forth the assets of our pension and postretirement plans that were accounted for at fair value on a recurring basis as of December 31, 2018 and 2017 (in thousands):

	December 31, 2018	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Pension Assets:				
Domestic Equity[(a)]	$113,355	$ 111,665	$ 1,690	$ —
International Equity[(b)]	114,554	90,651	23,903	—
Fixed Income[(c)]	254,437	219,124	35,313	—
Absolute Return Measured at Net Asset Value[(d)]	71,987	—	—	—
Cash	29,326	29,326	—	—
Total Pension Assets	$583,659	$ 450,766	$ 60,906	$ —

	December 31, 2017	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Pension Assets:				
Domestic Equity[(a)]	$163,160	$ 160,976	$ 2,184	$ —

International Equity[(b)]	130,935	101,366	29,569	—
Fixed Income[(c)]	269,365	231,506	37,859	—
Absolute Return Measured at Net Asset Value[(d)]	96,414	—	—	—
Total Pension Assets	$659,874	$ 493,848	$ 69,612	$ —
Postretirement Assets:				
Fixed Income[(c)]	$834	$ —	$ 834	$ —

(a) Consists primarily of U.S. stock funds that track or are actively managed and measured against the S&P 500 index.

(b) Consists primarily of international equity funds which invest in common stocks and other securities whose value is based on an international equity index or an underlying equity security or basket of equity securities.

(c) Consists primarily of debt obligations issued by governments, corporations, municipalities and other borrowers. Also includes insurance policies.

(d) Consists primarily of funds with holdings in private investment companies. See additional information about the Absolute Return investments below. Holdings in private investment companies are measured at fair value using the net asset value per share as a practical expedient and have not been categorized in the fair value hierarchy. The fair value amounts of $72.0 million and $96.4 million as of

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December 31, 2018 and 2017, respectively, are included in this table to permit reconciliation to the reconciliation of plan assets table above.

The Company's pension plan assets in the U.S. and U.K. represent approximately 97% of the total pension plan assets. The investment objective of these pension plan assets is to achieve solid returns while preserving capital to meet current plan cash flow requirements. Assets should participate in rising markets, with defensive action in declining markets expected to an even greater degree. Depending on market conditions, the broad asset class targets may range up or down by approximately 10%. These asset classes include but are not limited to hedge fund of funds, bonds and other fixed income vehicles, high yield fixed income securities, equities and distressed debt. At December 31, 2018 and 2017, equity securities held by our pension and OPEB plans did not include direct ownership of Albemarle common stock.

The weighted-average target allocations as of the measurement date are as follows:

	Target Allocation	
Equity securities	43	%
Fixed income	44	%
Absolute return	13	%

Our Absolute Return investments consist primarily of our investments in hedge fund of funds. These are holdings in private investment companies with fair values that are based on significant unobservable inputs including assumptions where there is little, if any, market activity for the investment. Investment managers or fund managers associated with these investments provide valuations of the investments on a monthly basis utilizing the net asset valuation approach for determining fair values. These valuations are reviewed by the Company for reasonableness based on applicable sector, benchmark and company performance to validate the appropriateness of the net asset values as a fair value measurement. Where available, audited financial statements are obtained and reviewed for the investments as support for the manager's investment valuation. In general, the investment objective of these funds is high risk-adjusted returns with an emphasis on preservation of capital. The investment strategies of each of the funds vary; however, the objective of our Absolute Return investments is complementary to the overall investment objective of our U.S. pension plan assets.

We made contributions to our defined benefit pension and OPEB plans of $15.2 million, $13.3 million and $20.1 million during the years ended December 31, 2018, 2017 and 2016, respectively, related to continuing and discontinued operations. We expect contributions to our domestic nonqualified and foreign qualified and nonqualified pension plans to approximate $12 million in 2019. Also, we expect to pay approximately $4 million in premiums to our U.S. postretirement benefit plan in 2019. However, we may choose to make additional voluntary pension contributions in excess of these amounts.

The current forecast of benefit payments, which reflects expected future service, amounts to (in millions):

	U.S. Pension Plans	Foreign Pension Plans	Other Postretirement Benefits
2019	$ 42.0	$ 12.9	$ 4.2
2020	$ 43.0	$ 9.4	$ 4.0

2021	$ 43.5	$ 9.7	$ 3.8
2022	$ 43.9	$ 9.2	$ 3.8
2023	$ 44.3	$ 12.1	$ 3.7
2024-2028	$ 220.6	$ 52.1	$ 17.4

We have a supplemental executive retirement plan ("SERP"), which provides unfunded supplemental retirement benefits to certain management or highly compensated employees. The SERP provides for incremental pension benefits to offset the limitations imposed on qualified plan benefits by federal income tax regulations. (Credits) costs relating to our SERP were ($0.8) million, $2.6 million and $1.6 million for the years ended December 31, 2018, 2017 and 2016, respectively. The projected benefit obligation for the SERP recognized in the consolidated balance sheets at December 31, 2018 and 2017 was $21.9 million and $24.8 million, respectively. The benefit expenses and obligations of this SERP are included in the tables above. Benefits of $1.3 million are expected to be paid to SERP retirees in 2019. On October 1, 2012, our Board of Directors approved amendments to the SERP, such that effective December 31, 2014, no additional benefits shall accrue under this plan and participants' accrued benefits shall be frozen as of that date to reflect the same changes as were made under the U.S. qualified defined benefit plan.

At December 31, 2018, the assumed rate of increase in the pre-65 and post-65 per capita cost of covered health care benefits for U.S. retirees was zero as the employer-paid premium caps (pre-65 and post-65) were met starting January 1, 2013.

Defined Contribution Plans

On March 31, 2004, a new defined contribution pension plan benefit was adopted under the qualified defined contribution plan for U.S. non-represented employees hired after March 31, 2004. On October 1, 2012 our Board of Directors approved certain plan amendments, such that effective January 1, 2013, the defined contribution pension plan benefit is expanded to include non-represented employees hired prior to March 31, 2004, and revised the contribution for all participants to be based on 5% of eligible employee compensation. The employer portion of contributions to our U.S. defined contribution pension plan amounted to $11.8 million, $10.3 million, and $15.1 million in 2018, 2017 and 2016, respectively, related to continuing and discontinued operations.

Certain of our employees participate in our defined contribution 401(k) employee savings plan, which is generally available to all U.S. full-time salaried and non-union hourly employees and to employees who are covered by a collective bargaining agreement that provides for such participation. This U.S. defined contribution plan is funded with contributions made by the participants and us. Our contributions to the 401(k) plan amounted to $12.7 million, $11.3 million and $12.7 million in 2018, 2017 and 2016, respectively, related to continuing and discontinued operations.

In 2006, we formalized a new plan in the Netherlands similar to a collective defined contribution plan. The collective defined contribution plan is supported by annuity contracts through an insurance company. The insurance company unconditionally undertakes the legal obligation to provide specific benefits to specific individuals in return for a fixed amount of premiums. Our obligation under this plan is limited to a variable calculated employer match for each participant plus an additional fixed amount of contributions to assist in covering estimated cost of living and salary increases (indexing) and administrative costs for the overall plan. We paid approximately $10.2 million, $9.9 million and $9.5 million in 2018, 2017 and 2016, respectively, in annual premiums and related costs pertaining to this plan.

Multiemployer Plan

Certain current and former employees participate in a multiemployer plan in Germany, the Pensionskasse Dynamit Nobel Versicherungsverein auf Gegenseitigkeit, Troisdorf ("DN Pensionskasse") that provides monthly payments in the case of disability, death or retirement. The risks of participating in a multiemployer plan are different from single-employer plans in the following ways: (a) assets contributed to the multiemployer plan by one employer may be used to provide benefits to employees of other participating employers, and (b) if a participating employer stops contributing to the plan due to financial inability to provide funding, the unfunded obligation of the plan may be borne by remaining participating employers.

Some participants in the plan are subject to collective bargaining arrangements, which have no fixed expiration date. The contribution and benefit levels are not negotiated or significantly influenced by these collective bargaining arrangements. Also, the benefit levels generally are not subject to reduction. Under German insurance law, the DN Pensionskasse must be fully funded at all times. The DN Pensionskasse was fully funded as of December 31, 2017, the date of the most recently available information for the plan. This funding level would correspond to the highest funding zone status (at least 80% funded) under U.S. pension regulation. Since the plan liabilities need to be fully funded at all times according to local funding requirements, it is unlikely that the DN Pensionskasse plan will fail to fulfill its obligations, however, in such an event, the Company is liable for the benefits of its employees who participate in the plan. Additional information of the DN Pensionskasse is available in the public domain.

The majority of the Company's contributions are tied to employees' contributions, which are generally calculated as a percentage of base compensation, up to a certain statutory ceiling. Our normal contributions to this plan for continuing operations were approximately $1.5 million in 2018 and 2017 and $1.7 million in 2016. Contributions for discontinued operations were approximately $1.3 million in 2016. The Company's contributions represented more than 5% of total contributions to the DN Pensionskasse in 2018.

Effective July 1, 2016, the DN Pensionskasse is subject to a financial improvement plan which expires on December 31, 2022, with the final contribution in the second quarter of 2023. This financial improvement plan calls for increased capital reserves to avoid future underfunding risk. During the years ended December 31, 2018 and 2017, we made contributions for our employees covered under this plan of approximately $2.3 million and $3.3 million, respectively, recorded in Selling, general and administrative expenses, as a result of this financial improvement plan. The value of the additional funding required under the financial improvement plan each year is determined upon the completion of the annual financial statements and are payable in the second quarter of the following year. A portion of the additional funding necessary for the year will be based on an estimate prepared on September 30 of each year and payable in the fourth quarter of that same year.

NOTE 16—Other Noncurrent Liabilities:

Other noncurrent liabilities consist of the following at December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Transition tax on foreign earnings[a]	$317,745	$394,878
Liabilities related to uncertain tax positions[b]	22,877	24,369
Executive deferred compensation plan obligation	26,292	25,494
Environmental liabilities[c]	40,376	37,518
Asset retirement obligations[c]	41,489	40,450
Tax indemnification liability[d]	45,347	42,707
Other[e]	32,816	33,758
Total	$526,942	$599,174

(a) Noncurrent portion of one-time transition tax on foreign earnings. See Note 20, "Income Taxes," for additional information.
(b) See Note 20, "Income Taxes."
(c) See Note 17, "Commitments and Contingencies."
(d) Indemnification of certain income and non-income tax liabilities associated with the Chemetall Surface Treatment entities sold, as well as the proposed settlement of an ongoing audit of a previously disposed business in Germany.
(e) No individual component exceeds 5% of total liabilities.

NOTE 17—Commitments and Contingencies:

In the ordinary course of business, we have commitments in connection with various activities. We believe that amounts recorded are adequate for known items which might become due in the current year. The most significant commitments are as follows:

Environmental

We had the following activity in our recorded environmental liabilities for the years ended December 31, 2018, 2017 and 2016 (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Balance, beginning of year	$39,808	$34,919	$31,436
Expenditures	(6,885)	(1,818)	(2,667)
Accretion of discount	1,283	896	793
Additions and changes in estimates[a]	17,039	3,344	4,004
Foreign currency translation adjustments and other	(1,676)	2,467	1,353
Balance, end of year	49,569	39,808	34,919

Less amounts reported in Accrued expenses	9,193	2,290	2,324
Amounts reported in Other noncurrent liabilities	$40,376	$37,518	$32,595

(a) Increase in additions primarily related to the indemnification of the buyer of a formerly owned site. As defined in the agreement of sale, this indemnification has a set cutoff date in 2024, at which point we will no longer be required to provide financial coverage.

Environmental remediation liabilities included discounted liabilities of $40.4 million and $28.1 million at December 31, 2018 and 2017, respectively, discounted at rates with a weighted-average of 3.7% and 3.6%, respectively, with the undiscounted amount totaling $74.5 million and $68.2 million at December 31, 2018 and 2017, respectively. For certain locations where the Company is operating groundwater monitoring and/or remediation systems, prior owners or insurers have assumed all or most of the responsibility.

The amounts recorded represent our future remediation and other anticipated environmental liabilities. These liabilities typically arise during the normal course of our operational and environmental management activities or at the time of acquisition of the site, and are based on internal analysis as well as input from outside consultants. As evaluations proceed at each relevant site, changes in risk assessment practices, remediation techniques and regulatory requirements can occur, therefore such liability estimates may be adjusted accordingly. The timing and duration of remediation activities at these sites will be determined when evaluations are completed. Although it is difficult to quantify the potential financial impact of these remediation liabilities, management estimates (based on the latest available information) that there is a reasonable possibility that future environmental remediation costs associated with our past operations, could be an additional $10 million to $35 million before income taxes, in excess of amounts already recorded. The variability of this range is primarily driven by possible environmental remediation activity at a formerly owned site where we indemnify the buyer through a set cutoff date in 2024.

We believe that any sum we may be required to pay in connection with environmental remediation matters in excess of the amounts recorded would likely occur over a period of time and would likely not have a material adverse effect upon our results of operations, financial condition or cash flows on a consolidated annual basis although any such sum could have a material adverse impact on our results of operations, financial condition or cash flows in a particular quarterly reporting period.

Asset Retirement Obligations

The following is a reconciliation of our beginning and ending asset retirement obligation balances for 2018 and 2017 (in thousands):

	Year Ended December 31,	
	2018	2017
Balance, beginning of year	$40,450	$36,296
Additions and changes in estimates	740	3,859
Accretion of discount	1,500	1,532
Liabilities settled	(786)	(789)
Foreign currency translation adjustments and other	(415)	(448)
Balance, end of year	$41,489	$40,450

Our asset retirement obligations are recorded in Other noncurrent liabilities in the consolidated balance sheets. Asset retirement obligations primarily relate to post-closure reclamation of brine wells and sites involved in the surface mining and manufacturing of lithium. We are not aware of any conditional asset retirement obligations that would require recognition in our consolidated financial statements.

Rental Expense

Our rental expenses include a number of operating lease agreements, primarily for office space, transportation equipment and storage facilities. The following schedule details the future non-cancelable minimum lease payments for the next five years and thereafter (in thousands):

	Operating Leases
2019	$ 25,608
2020	$ 17,918
2021	$ 12,478

2022	$ 10,794
2023	$ 10,109
Thereafter	$ 87,085

Rental expense was approximately $37.6 million, $31.2 million, and $31.4 million for 2018, 2017 and 2016, respectively. Rental expense related to discontinued operations was approximately $11.8 million for 2016. Rental expense is shown net of sublease income which was minimal during 2018, 2017 and 2016.

Litigation

We are involved from time to time in legal proceedings of types regarded as common in our business, including administrative or judicial proceedings seeking remediation under environmental laws, such as the federal Comprehensive Environmental Response, Compensation and Liability Act, commonly known as CERCLA or Superfund, products liability, breach of contract liability and premises liability litigation. Where appropriate, we may establish financial reserves for such proceedings. We also maintain insurance to mitigate certain of such risks. Costs for legal services are generally expensed as incurred.

As previously reported in 2018, following receipt of information regarding potential improper payments being made by third party sales representatives of our Refining Solutions business, within our Catalysts segment, we promptly retained outside counsel and forensic accountants to investigate potential violations of the Company's Code of Conduct, the Foreign Corrupt Practices Act ("FCPA"), and other potentially applicable laws. Based on this internal investigation, we have voluntarily self-reported potential issues relating to the use of third party sales representatives in our Refining Solutions business, within our Catalysts segment, to the U.S. Department of Justice ("DOJ"), the Securities and Exchange Commission ("SEC"), and the Dutch Public Prosecutor ("DPP"), and are cooperating with the DOJ, the SEC, and DPP in their review of these matters. In connection with our internal investigation, we have implemented, and are continuing to implement, appropriate remedial measures.

At this time, we are unable to predict the duration, scope, result or related costs associated with the investigations by the DOJ, the SEC, or DPP. We are unable to predict what, if any, action may be taken by the DOJ, the SEC, or DPP, or what penalties or remedial actions they may seek to impose. Any determination that our operations or activities are not in compliance with existing laws or regulations could result in the imposition of fines, penalties, disgorgement, equitable relief, or other losses. We do not believe, however, that any such fines, penalties, disgorgement, equitable relief or other losses would have a material adverse effect on our financial condition or liquidity.

During the year ended December 31, 2018, we recorded a charge of $16.2 million in Other expenses, net resulting from a jury rendering a verdict against Albemarle in a legal matter related to certain business concluded under a 2014 sales agreement for products that Albemarle no longer manufactures. In addition, during the year ended December 31, 2018, we recorded a charge of $10.8 million in Other expenses, net due to a settlement of a legal matter related to guarantees from a previously disposed business. Both matters have been resolved and paid during the year ended December 31, 2018.

Indemnities

We are indemnified by third parties in connection with certain matters related to acquired and divested businesses. Although we believe that the financial condition of those parties who may have indemnification obligations to the Company is generally sound, in the event the Company seeks indemnity under any of these agreements or through other means, there can be no assurance that any party who may have obligations to indemnify us will adhere to their obligations and we may have to resort to legal action to enforce our rights under the indemnities.

The Company may be subject to indemnity claims relating to properties or businesses it divested, including properties or businesses of acquired businesses that were divested prior to the completion of the acquisition. In the opinion of management, and based upon information currently available, the ultimate resolution of any indemnification obligations owed to the Company or by the Company is not expected to have a material effect on the Company's financial condition, results of operations or cash flows. See Note 16, "Other Noncurrent Liabilities," for the tax indemnification liability related to the sale of the Chemetall Surface Treatment business and other divested businesses.

Other

The Company has standby letters of credit and guarantees with various financial institutions. The following table summarizes our letters of credit and guarantee agreements (in thousands):

	2019	2020	2021	2022	2023	Thereafter
Letters of credit and other guarantees	$45,342	$12,924	$1,883	$1,277	$ —	$ 10,389

The outstanding letters of credit are primarily related to insurance claim payment guarantees. The majority of the Company’s other guarantees have terms of one year and mainly consist of performance and environmental guarantees, as well as guarantees to customs and port authorities. The guarantees arose during the ordinary course of business. We do not have recorded reserves for the letters of credit and guarantees as of December 31, 2018. We are unable to estimate the maximum amount of the potential future liability under guarantees and letters of credit. However, we accrue for any potential loss for which we believe a future payment is probable and a range of loss can be reasonably estimated. We believe our liability under such obligations is immaterial.

We currently, and are from time to time, subject to transactional audits in various taxing jurisdictions and to customs audits globally. We do not expect the financial impact of any of these audits to have a material adverse effect on the Company's results of operations, financial condition or cash flows.

NOTE 18—Stock-based Compensation Expense:

Incentive Plans

We have various share-based compensation plans that authorize the granting of (i) stock options to purchase shares of our common stock, (ii) restricted stock and restricted stock units, (iii) performance unit awards and (iv) stock appreciation rights ("SARs") to employees and non-employee directors. The plans provide for payment of incentive awards in one or more of the following at our option: cash, shares of our common stock, qualified and non-qualified stock options, SARs, restricted stock awards, restricted stock unit awards and performance unit awards. The share-based awards granted by us generally contain vesting provisions ranging from one to five years, and with respect to stock options granted by us, have a term of not more than ten years from the date of grant. Stock options granted to employees generally vest over three years and have a term of ten years. Restricted stock and restricted stock unit awards vest in periods ranging from one to five years from the date of grant. Performance unit awards are earned at a level ranging from 0% to 200% contingent upon the achievement of specific performance criteria over periods ranging from one to three years. Distribution of earned units occurs generally 50% upon completion of the applicable measurement period with the remaining 50% distributed one year thereafter.

We granted 63,259, 82,204 and 141,661 stock options during 2018, 2017 and 2016, respectively. There were no significant modifications made to any share-based grants during these periods.

In May 2017, the Company adopted the Albemarle Corporation 2017 Incentive Plan (the "Incentive Plan"), which replaced the Albemarle Corporation 2008 Incentive Plan. The maximum number of shares available for issuance to participants under the Incentive Plan is 4,500,000 shares. The adoption of the Incentive Plan did not affect awards already granted under the Albemarle Corporation 2008 Incentive Plan. Under the Albemarle Corporation 2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors (the "Non-Employee Directors Plan"), a maximum aggregate number of 500,000 shares of our common stock is authorized for issuance to the Company's non-employee directors; any shares remaining available for issuance under the prior plans were canceled. The aggregate fair market value of shares that may be issued to a director during any compensation year (as defined in the agreement, generally July 1 to June 30) shall not exceed $150,000. At December 31, 2018, there were 4,280,607 shares available for grant under the Incentive Plan and 388,179 shares available for grant under the Non-Employee Directors Plan.

Total stock-based compensation expense associated with our incentive plans for the years ended December 31, 2018, 2017 and 2016 amounted to $15.2 million, $19.4 million and $17.0 million, respectively, and is included in Cost of goods sold and Selling, general and administrative expenses in the consolidated statements of income. Total related recognized tax benefits for the years ended December 31, 2018, 2017 and 2016 amounted to $2.6 million, $7.0 million and $6.2 million, respectively. As a result of the sale of the Chemetall Surface Treatment business in 2016, we converted previously granted incentive awards owed to Chemetall employees to a cash liability to be paid on the original vesting dates of the awards. The Company recognized expense of $5.8 million, included in Income from discontinued operations for the year ended December 31, 2016 related to these awards. At December 31, 2018, $2.2

million and $1.2 million of this cash liability were included in Accrued liabilities and Other noncurrent liabilities, respectively.
The following table summarizes information about the Company’s fixed-price stock options as of and for the year ended December 31, 2018:

	Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value (in thousands)
Outstanding at December 31, 2017	1,401,718	$ 56.10	5.1	$ 100,632
Granted	63,259	118.75		
Exercised	(94,031)	38.64		
Forfeited	(54,213)	75.72		
Outstanding at December 31, 2018	1,316,733	$ 59.55	4.3	$ 26,438
Exercisable at December 31, 2018	911,011	$ 54.28	3.2	$ 20,872

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The fair value of each option granted during the years ended December 31, 2018, 2017 and 2016 was estimated on the date of grant using the Black-Scholes option-pricing model with the following weighted-average assumptions:

	Year Ended December 31,		
	2018	2017	2016
Dividend yield	1.44 %	1.56 %	1.84 %
Volatility	32.48 %	32.70 %	33.08 %
Average expected life (years)	6	6	6
Risk-free interest rate	3.06 %	2.51 %	1.96 %
Fair value of options granted	$37.35	$27.99	$16.06

Dividend yield is the average of historical yields and those estimated over the average expected life. The stock volatility is based on historical volatilities of our common stock. The average expected life represents the weighted average period of time that options granted are expected to be outstanding giving consideration to vesting schedules and our historical exercise patterns. The risk-free interest rate is based on the U.S. Treasury strip rate with stripped coupon interest for the period equal to the contractual term of the share option grant in effect at the time of grant.

The intrinsic value of options exercised during the years ended December 31, 2018, 2017 and 2016 was $6.2 million, $15.6 million and $7.9 million, respectively. The intrinsic value of a stock option is the amount by which the market value of the underlying stock exceeds the exercise price of the option.

Total compensation cost not yet recognized for nonvested stock options outstanding as of December 31, 2018 is approximately $3.0 million and is expected to be recognized over a remaining weighted-average period of 1.5 years. Cash proceeds from stock options exercised and tax benefits related to stock options exercised were $3.6 million and $1.5 million for the year ended December 31, 2018, respectively. The Company issues new shares of common stock upon exercise of stock options and vesting of restricted common stock awards.

The following table summarizes activity in performance unit awards as of and for the year ended December 31, 2018:

	Shares	Weighted-Average Grant Date Fair Value Per Share
Nonvested, beginning of period	433,003	$ 75.55
Granted	70,274	155.65
Vested	(164,303)	61.72
Forfeited	(21,537)	120.49
Nonvested, end of period	317,437	97.39

The weighted average grant date fair value of performance unit awards granted in 2018, 2017 and 2016 was $10.9 million, $9.6 million and $10.9 million, respectively. The fair value of each performance unit awards was estimated on the date of grant using the Monte Carlo simulation model as these equity awards are tied to a service and market condition. The calculation used the following weighted-average assumptions:

	Year Ended December 31,		
	2018	2017	2016

Volatility	29.92 %	30.34 %	27.69 %
Risk-free interest rate	2.36 %	1.34 %	0.91 %

The weighted average fair value of performance unit awards that vested during 2018, 2017 and 2016 was $20.0 million, $11.9 million and $4.6 million, respectively, based on the closing prices of our common stock on the dates of vesting. Total compensation cost not yet recognized for nonvested performance unit awards outstanding as of December 31, 2018 is approximately $11.6 million, calculated based on current expectation of specific performance criteria, and is expected to be recognized over a remaining weighted-average period of approximately 1.0 years. Each performance unit represents one share of common stock.

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The following table summarizes activity in non-performance based restricted stock and restricted stock unit awards as of and for the year ended December 31, 2018:

	Shares	Weighted-Average Grant Date Fair Value Per Share
Nonvested, beginning of period	223,338	$ 71.95
Granted	104,513	104.36
Vested	(48,178)	66.93
Forfeited	(22,155)	78.98
Nonvested, end of period	257,518	85.44

The weighted average grant date fair value of restricted stock and restricted stock unit awards granted in 2018, 2017 and 2016 was $10.9 million, $8.2 million and $8.8 million, respectively. The weighted average fair value of restricted stock and restricted stock unit awards that vested in 2018, 2017 and 2016 was $4.9 million, $3.1 million and $3.2 million, respectively, based on the closing prices of our common stock on the dates of vesting. Total compensation cost not yet recognized for nonvested, non-performance based restricted stock and restricted stock units as of December 31, 2018 is approximately $12.6 million and is expected to be recognized over a remaining weighted-average period of 2.0 years. The fair value of the non-performance based restricted stock and restricted stock units was estimated on the date of grant adjusted for a dividend factor, if necessary.

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NOTE 19—Accumulated Other Comprehensive (Loss) Income:
The components and activity in Accumulated other comprehensive (loss) income (net of deferred income taxes) consisted of the following during the years ended December 31, 2018, 2017 and 2016 (in thousands):

	Foreign Currency Translation[(a)]	Pension and Post-Retirement Benefits[(b)]	Net Investment Hedge	Interest Rate Swap[(c)]	Total
Accumulated other comprehensive (loss) income - balance at December 31, 2015	$ (463,914)	$ (758)	$ 62,245	$ (18,861)	$ (421,288)
Other comprehensive (loss) income before reclassifications	(102,246)	—	26,133	—	(76,113)
Amounts reclassified from accumulated other comprehensive loss	81,421	834	—	2,116	84,371
Other comprehensive (loss) income, net of tax	(20,825)	834	26,133	2,116	8,258
Other comprehensive loss attributable to noncontrolling interests	618	—	—	—	618
Accumulated other comprehensive (loss) income - balance at December 31, 2016	$ (484,121)	$ 76	$ 88,378	$ (16,745)	$ (412,412)
Other comprehensive income (loss) before reclassifications	227,439	—	(41,827)	—	185,612
Amounts reclassified from accumulated other comprehensive loss	—	(97)	—	2,116	2,019
Other comprehensive income (loss), net of tax	227,439	(97)	(41,827)	2,116	187,631
Other comprehensive income attributable to noncontrolling interests	(887)	—	—	—	(887)
Accumulated other comprehensive (loss) income - balance at December 31, 2017	$ (257,569)	$ (21)	$ 46,551	$ (14,629)	$ (225,668)
Other comprehensive (loss) income before reclassifications	(150,258)	—	15,695	—	(134,563)
Amounts reclassified from accumulated other comprehensive loss[(d)]	—	(138)	10,091	(585)	9,368
Other comprehensive (loss) income, net of tax	(150,258)	(138)	25,786	(585)	(125,195)
Other comprehensive loss attributable to noncontrolling interests	181	—	—	—	181
Accumulated other comprehensive (loss) income - balance at December 31, 2018	$ (407,646)	$ (159)	$ 72,337	$ (15,214)	$ (350,682)

(a) Amount reclassified from accumulated other comprehensive loss for the year ended December 31, 2016 is included in Income from discontinued operations (net of tax) for the year ended December 31, 2016 and resulted from the release of cumulative foreign currency translation adjustments into earnings upon the sale of our Chemetall Surface Treatment business which closed on December 14, 2016. See Note 3, "Divestitures," for additional information.

(b) The pre-tax portion of amounts reclassified from accumulated other comprehensive loss consists of amortization of prior service benefit, which is a component of pension and postretirement benefits cost (credit). See Note 15, “Pension Plans and Other Postretirement Benefits,” for additional information.

(c) The pre-tax portion of amounts reclassified from accumulated other comprehensive loss is included in interest expense.

(d) Amounts reclassified from accumulated other comprehensive loss include a net benefit of $6.9 million, which was reclassified to Retained earnings for stranded tax effects caused by the TCJA. See “Recently Issued Accounting Pronouncements,” included in Note 1, “Summary of Significant Accounting Policies,” for additional information.

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The amount of income tax benefit (expense) allocated to each component of Other comprehensive (loss) income for the years ended December 31, 2018, 2017 and 2016 is provided in the following tables (in thousands):

	Foreign Currency Translation	Pension and Postretirement Benefits	Net Investment Hedge	Interest Rate Swap
2018				
Other comprehensive (loss) income, before tax	$(150,262)	$(128)	$20,424	$3,336
Income tax benefit (expense)	4	(10)	5,362	(3,921)
Other comprehensive (loss) income, net of tax	$(150,258)	$(138)	$25,786	$(585)
2017				
Other comprehensive income (loss), before tax	$228,508	$(96)	$(65,958)	$3,336
Income tax (expense) benefit	(1,069)	(1)	24,131	(1,220)
Other comprehensive income (loss), net of tax	$227,439	$(97)	$(41,827)	$2,116
2016				
Other comprehensive (loss) income, before tax	$(20,849)	$839	$41,209	$3,336
Income tax benefit (expense)	24	(5)	(15,076)	(1,220)
Other comprehensive (loss) income, net of tax	$(20,825)	$834	$26,133	$2,116

NOTE 20—Income Taxes:

On December 22, 2017, the TCJA was signed into law in the U.S. The TCJA contains several key tax provisions including, among other things, the reduction of the corporate income tax rate from 35% to 21% effective January 1, 2018, the requirement of companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred, and the creation of new taxes on certain foreign sourced earnings such as GILTI. Under ASC 740, Income Taxes, the effect of changes in tax rates and laws are recognized in the period in which the new legislation is enacted. However, the SEC staff issued SAB 118, which allowed us to record provisional amounts during a measurement period ending December 22, 2018. In accordance with SAB 118, income tax effects of the TCJA could be refined as additional analysis was completed based on obtaining, preparing, or analyzing additional information about facts and circumstances that existed as of the enactment date that were not initially reported as provisional amounts. In addition, the provisional amounts could also be affected upon additional TCJA guidance issued during the measurement period.

As of December 31, 2018, we have completed our accounting for the effects of enactment of the TCJA and adjustments made to the provisional amounts allowed under SAB 118 were identified and recorded. During the year ended December 31, 2018, we recorded income tax expense of $0.4 million related to the remeasurement of our deferred tax assets and liabilities for the reduction in the Federal statutory tax rate. We also recognized an income tax benefit of $42.3 million for the refinement of the tax liability calculation related to the one-time transition tax. Additionally, during the year ended December 31, 2018 we recognized income tax expense of $2.1 million related to excess executive employee remuneration for awards determined not to be grandfathered consistent with Notice

2018-68.

The TCJA provides for a territorial tax system, beginning in 2018, which includes tax imposed on GILTI. The Company has elected to account for GILTI tax in the period in which it is incurred. The GILTI provisions require the Company to include in its U.S. income tax return foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. As of December 31, 2018, we recorded income tax expense of $6.4 million for GILTI, as well as $4.1 million related to excess employee remuneration that became effective in 2018 under the TCJA.

As additional regulations or guidance in relation to TCJA continues to be issued, the Company will analyze and record the necessary impacts in the quarter in which guidance is received.

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Income from continuing operations before income taxes and equity in net income of unconsolidated investments, and current and deferred income tax expense (benefit) are composed of the following (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Income from continuing operations before income taxes and equity in net income of unconsolidated investments:			
Domestic	$223,702	$(8,293)	$49,630
Foreign	570,999	455,091	465,634
Total	$794,701	$446,798	$515,264
Current income tax expense (benefit):			
Federal	$(2,712)	$394,747	$7,717
State	6,793	323	1,407
Foreign	91,581	78,688	63,957
Total	$95,662	$473,758	$73,081
Deferred income tax (benefit) expense:			
Federal	$15,573	$(58,640)	$12,230
State	1,614	(2,288)	(1,715)
Foreign	31,977	18,987	12,667
Total	$49,164	$(41,941)	$23,182
Total income tax expense	$144,826	$431,817	$96,263

The decrease in the current income tax expense is primarily related to the tax impact of the one-time transition tax imposed by the TCJA in 2017. The increase in the deferred tax expense in 2018 is primarily related to the tax impact associated with the remeasurement of deferred tax assets and liabilities under the recently enacted tax legislation from a statutory rate of 35% to 21% recorded in 2017.

The reconciliation of the U.S. federal statutory rate to the effective income tax rate is as follows:

	% of Income Before Income Taxes		
	2018	2017	2016
Federal statutory rate	21.0 %	35.0 %	35.0 %
State taxes, net of federal tax benefit	0.9	(0.5)	(0.1)
Change in valuation allowance [(a)]	0.7	(1.4)	3.7
Impact of foreign earnings, net[(b)]	(0.3)	(13.5)	(19.3)
Global intangible low tax inclusion	0.8	—	—
Change in U.S. federal statutory rate[(c)]	0.1	(14.0)	—
Transition tax on deferred foreign earnings[(d)]	(5.3)	96.1	—
Subpart F income	0.9	2.0	0.2
Undistributed earnings of foreign subsidiaries	—	(2.2)	0.1

Stock-based compensation	(0.7)	(1.9)	—
Depletion	(0.6)	(1.4)	(1.0)
Revaluation of unrecognized tax benefits/reserve requirements	—	(0.7)	(0.4)
Domestic manufacturing tax deduction	—	—	(0.9)
Other items, net	0.7	(0.9)	1.4
Effective income tax rate	18.2 %	96.6 %	18.7 %

(a) The year ended December 31, 2018 includes an $8.2 million expense due to the establishment of a valuation allowance due to a foreign restructuring plan and a $1.5 million benefit due to the release of a foreign valuation allowance due to changes in expected profitability. 2017 includes a $10.9 million benefit from the release of valuation allowances due to a foreign restructuring plan.

(b) Our statutory rate is decreased by of our share of the income of JBC, a Free Zones company under the laws of the Hashemite Kingdom of Jordan. The applicable provisions of the Jordanian law, and applicable regulations thereunder, do not have a termination provision and the exemption is indefinite. As a Free Zones company, JBC is not subject to income taxes on the profits of products exported from Jordan, and currently, substantially all of the profits are from exports. This resulted in a rate benefit of 3.3%, 8.9%, and 7.3% for 2018, 2017, and 2016, respectively.

(c) At December 31, 2017 we have made a reasonable estimate of the tax impact of the U.S. enacted tax law on our business and our consolidated financial statements and have recorded a provisional tax benefit of $62.3 million related to the remeasurement of our deferred tax assets and liabilities for the reduction in the Federal statutory tax rate from 35% to 21%. In 2018, the updates to our calculation of the remeasurement of deferred tax assets and liabilities resulted in income tax expense of $0.4 million.

(d) At December 31, 2017 we made a reasonable estimate of the tax impact of the U.S. enacted tax law on our business and our consolidated financial statements and recognized a provisional tax expense of $429.2 million for the one-time transition tax. During 2018, the impact of the refined one-time transition tax calculation was an income tax benefit of $42.3 million.

Deferred income tax assets and liabilities recorded on the consolidated balance sheets as of December 31, 2018 and 2017 consist of the following (in thousands):

	December 31,	
	2018	2017
Deferred tax assets:		
Accrued employee benefits	$18,462	$21,463
Operating loss carryovers[a]	1,210,377	459,644
Pensions	61,308	64,799
Tax credit carryovers	1,270	11,634
Other	35,895	44,714
Gross deferred tax assets	1,327,312	602,254
Valuation allowance[a]	(1,213,750)	(458,288)
Deferred tax assets	113,562	143,966
Deferred tax liabilities:		
Depreciation	(337,503)	(334,162)
Intangibles	(88,871)	(113,792)
Hedge of net investment of foreign subsidiary	(21,854)	(17,028)
Other	(31,287)	(24,265)
Deferred tax liabilities	(479,515)	(489,247)
Net deferred tax liabilities	$(365,953)	$(345,281)
Classification in the consolidated balance sheets:		
Noncurrent deferred tax assets	$17,029	$25,108
Noncurrent deferred tax liabilities	(382,982)	(370,389)
Net deferred tax liabilities	$(365,953)	$(345,281)

(a)

During 2018, the Company recognized intercompany losses at a foreign entity related to international restructuring resulting in an increase to the deferred tax asset for net operating losses and an associated and equal valuation allowance of $749.8 million.

Changes in the balance of our deferred tax asset valuation allowance are as follows (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Balance at January 1	$(458,288)	$(69,900)	$(84,137)
Additions	(766,012)	(408,252)	(20,568)
Deductions	10,550	19,864	34,805
Balance at December 31	$(1,213,750)	$(458,288)	$(69,900)

At December 31, 2018, we had approximately $1.3 million of domestic credits available to offset future payments of income taxes, expiring in varying amounts between 2019 and 2027. We have established valuation allowances for $0.3 million of those domestic credits since we believe that it is more likely than not that the related deferred tax assets will not be realized. We believe that sufficient taxable income will be generated during the carryover period in order to utilize the other remaining credit carryovers.

At December 31, 2018, we have on a pre-tax basis, domestic state net operating losses of $152.7 million, expiring between 2019 and 2038, which have pre-tax valuation allowances of $58.3 million established. In addition, we have on a pre-tax basis $4.64 billion of foreign net operating losses, of which a majority have an indefinite life, which have pre-tax valuation allowances for $4.61 billion established. We have established valuation allowances for these deferred tax assets since we believe that it is more likely than not that the related deferred tax assets will not be realized. For the same reason, we established pre-tax valuation allowances of $9.9 million and $55.2 million for other state and foreign deferred tax assets, respectively, unrelated to net operating losses. The realization of the deferred tax assets is dependent on the generation of sufficient taxable income in the appropriate tax jurisdictions. Although realization is not assured, we believe it is more likely than not that the remaining deferred tax assets will be realized. However, the amount considered realizable could be reduced if estimates of future taxable income change.

As of December 31, 2018, we have not recorded taxes on approximately $505.6 million of cumulative undistributed earnings of our non-U.S. subsidiaries and joint ventures. We generally do not provide for taxes related to our undistributed earnings because such earnings either would not be taxable when remitted or they are considered to be indefinitely reinvested. If in the foreseeable future, we can no longer demonstrate that these earnings are indefinitely reinvested, a deferred tax liability will be recognized. A determination of the amount of the unrecognized deferred tax liability related to these undistributed earnings is not practicable due to the complexity and variety of assumptions necessary based on the manner in which the undistributed earnings would be repatriated.

Liabilities related to uncertain tax positions were $22.9 million and $24.4 million at December 31, 2018 and 2017, respectively, inclusive of interest and penalties of $3.2 million and $2.9 million at December 31, 2018 and 2017, respectively, and are reported in Other noncurrent liabilities as provided in Note 16, “Other Noncurrent Liabilities.” These liabilities at December 31, 2018 and 2017 were reduced by $13.0 million and $14.6 million, respectively, for offsetting benefits from the corresponding effects of potential transfer pricing adjustments, state income taxes and rate arbitrage related to foreign structure. These offsetting benefits are recorded in Other assets as provided in Note 11, “Other Assets.” The resulting net liabilities of $6.7 million and $6.9 million at December 31, 2018 and 2017, respectively, if recognized and released, would favorably affect earnings.

The liabilities related to uncertain tax positions, exclusive of interest, were $19.7 million and $21.4 million at December 31, 2018 and 2017, respectively. The following is a reconciliation of our total gross liability related to uncertain tax positions for 2018, 2017 and 2016 (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Balance at January 1	$21,438	$25,384	$95,715
Divestitures[(a)]	—	—	(55,881)
Additions for tax positions related to prior years	874	—	548
Reductions for tax positions related to prior years	—	(1,933)	(1,253)
Additions for tax positions related to current year	1,091	1,132	1,271
Lapses in statutes of limitations/settlements	(3,578)	(4,198)	(12,591)
Foreign currency translation adjustment	(83)	1,053	(2,425)
Balance at December 31	$19,742	$21,438	$25,384

(a)

Reclassified to Other noncurrent liabilities as a result of the indemnification of certain income tax liabilities associated with the Chemetall Surface Treatment entities sold. See Note 16, “Other Noncurrent Liabilities.”

We are subject to income taxes in the U.S. and numerous foreign jurisdictions. Due to the statute of limitations, we are no longer subject to U.S. federal income tax audits by the Internal Revenue Service (“IRS”) for years prior to 2011. Due to the statute of limitations, we also are no longer subject to U.S. state income tax audits prior to 2011.

With respect to jurisdictions outside the U.S., several audits are in process. We have audits ongoing for the years 2006 through 2017 related to Germany, Taiwan, Italy, India, Belgium, and Chile, some of which are for entities that have since been divested.

While we believe we have adequately provided for all tax positions, amounts asserted by taxing authorities could be greater than our accrued position. Accordingly, additional provisions on federal and foreign tax-related matters could be recorded in the future as revised estimates are made or the underlying matters are settled or otherwise resolved.

Since the timing of resolutions and/or closure of tax audits is uncertain, it is difficult to predict with certainty the range of reasonably possible significant increases or decreases in the liability related to uncertain tax positions that may occur within the next twelve months. Our current view is that it is reasonably possible that we could record a decrease in the liability related to uncertain tax positions, relating to a number of issues, up to approximately $4.4 million as a result of closure of tax statutes.

NOTE 21—Fair Value of Financial Instruments:

In assessing the fair value of financial instruments, we use methods and assumptions that are based on market conditions and other risk factors existing at the time of assessment. Fair value information for our financial instruments is as follows:

Long-Term Debt—the fair values of our senior notes are estimated using Level 1 inputs and account for the difference between the recorded amount and fair value of our long-term debt. The carrying value of our remaining long-term debt reported in the accompanying consolidated balance sheets approximates fair value as substantially all of such debt bears interest based on prevailing variable market rates currently available in the countries in which we have borrowings.

	December 31,			
	2018		2017	
	Recorded Amount	Fair Value	Recorded Amount	Fair Value
	(In thousands)			
Long-term debt	$1,712,003	$1,731,271	$1,845,309	$1,949,638

Foreign Currency Forward Contracts—we enter into foreign currency forward contracts in connection with our risk management strategies in an attempt to minimize the financial impact of changes in foreign currency exchange rates. These derivative financial instruments are used to manage risk and are not used for trading or other speculative purposes. The fair values of our foreign currency forward contracts are estimated based on current settlement values. At December 31, 2018 and 2017, we had outstanding foreign currency forward contracts with notional values totaling $626.5 million and $357.4 million, respectively, hedging our exposure to various currencies including the Euro and Chinese Renminbi. Our foreign currency forward contracts outstanding at December 31, 2018 and 2017 have not been designated as hedging instruments under ASC 815, Derivatives and Hedging. The following table summarizes the fair value of our foreign currency forward contracts included in the consolidated balance sheets as of December 31, 2018 and 2017 (in thousands):

	December 31,	
	2018	2017
Foreign currency forward contracts - Other accounts receivable	$431	$—
Foreign currency forward contracts - Accrued expenses	$—	$4,954

Gains and losses on foreign currency forward contracts are recognized currently in Other expenses, net; further, fluctuations in the value of these contracts are generally expected to be offset by changes in the value of the underlying exposures being hedged, which are also reported in Other expenses, net. The following table summarizes these net (losses) gains recognized in our consolidated statements of income during the years ended December 31, 2018, 2017 and 2016 (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Foreign currency forward contracts (losses) gains	$(19,851)	$4,588	$16,095

In addition, for the years ended December 31, 2018, 2017 and 2016, we recorded losses (gains) of $19.9 million, ($4.6) million and ($16.1) million, respectively, related to the change in the fair value of our foreign currency forward contracts, and net cash (settlements) receipts of ($25.2) million, $9.4 million and $16.0 million, respectively, in Other, net, in our consolidated statements of cash flows.
The counterparties to our foreign currency forward contracts are major financial institutions with which we generally have other financial relationships. We are exposed to credit loss in the event of nonperformance by these counterparties. However, we do not anticipate nonperformance by the counterparties.

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NOTE 22—Fair Value Measurement:
Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (exit price). The inputs used to measure fair value are classified into the following hierarchy:

Level 1	Unadjusted quoted prices in active markets for identical assets or liabilities
Level 2	Unadjusted quoted prices in active markets for similar assets or liabilities, or unadjusted quoted prices for identical or similar assets or liabilities in markets that are not active, or inputs other than quoted prices that are observable for the asset or liability
Level 3	Unobservable inputs for the asset or liability

We endeavor to utilize the best available information in measuring fair value. Financial assets and liabilities are classified in their entirety based on the lowest level of input that is significant to the fair value measurement. The following tables set forth our financial assets and liabilities that were accounted for at fair value on a recurring basis as of December 31, 2018 and 2017 (in thousands):

	December 31, 2018	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Assets:				
Investments under executive deferred compensation plan[a]	$ 26,292	$ 26,292	$ —	$ —
Private equity securities[b]	$ 26	$ 26	$ —	$ —
Private equity securities measured at net asset value[b][c]	$ 7,195	$ —	$ —	$ —
Foreign currency forward contracts[d]	$ 431	$ —	$ 431	$ —
Liabilities:				
Obligations under executive deferred compensation plan [a]	$ 26,292	$ 26,292	$ —	$ —

	December 31, 2017	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Assets:				
Investments under executive deferred compensation plan[a]	$ 25,494	$ 25,494	$ —	$ —
Private equity securities[b]	$ 38	$ 38	$ —	$ —
Private equity securities measured at net asset value[b][c]	$ 5,121	$ —	$ —	$ —
Liabilities:				

Obligations under executive deferred compensation plan [a]	$ 25,494	$ 25,494	$ —	$ —
Foreign currency forward contracts[d]	$ 4,954	$ —	$ 4,954	$ —

(a) We maintain an EDCP that was adopted in 2001 and subsequently amended. The purpose of the EDCP is to provide current tax planning opportunities as well as supplemental funds upon the retirement or death of certain of our employees. The EDCP is intended to aid in attracting and retaining employees of exceptional ability by providing them with these benefits. We also maintain a Benefit Protection Trust (the "Trust") that was created to provide a source of funds to assist in meeting the obligations of the EDCP, subject to the claims of our creditors in the event of our insolvency. Assets of the Trust are consolidated in accordance with authoritative guidance. The assets of the Trust consist primarily of mutual fund investments (which are accounted for as trading securities and are marked-to-market on a monthly basis through the consolidated statements of income) and cash and cash equivalents. As such, these assets and obligations are classified within Level 1.

(b) Primarily consists of private equity securities classified as available-for-sale and are reported in Investments in the consolidated balance sheets. The changes in fair value are reported in Other expenses, net, in our consolidated statements of income.

(c) Holdings in private equity securities are measured at fair value using the net asset value per share (or its equivalent) practical expedient and have not been categorized in the fair value hierarchy. The fair value amounts of $7.2 million and $5.1 million as of December 31, 2018 and 2017, respectively, are included in this table to permit reconciliation to the marketable equity securities presented in Note 10, "Investments."

(d) As a result of our global operating and financing activities, we are exposed to market risks from changes in foreign currency exchange rates, which may adversely affect our operating results and financial position. When deemed appropriate, we minimize our risks from foreign currency exchange rate fluctuations through the use of foreign currency forward contracts. Unless otherwise noted, these derivative financial instruments are not designated as hedging instruments under ASC 815, Derivatives and Hedging. The foreign currency forward contracts are valued using broker quotations or market transactions in either the listed or over-the-counter markets. As such, these derivative instruments are classified within Level 2.

NOTE 23—Related Party Transactions:

Our consolidated statements of income include sales to and purchases from unconsolidated affiliates in the ordinary course of business as follows (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Sales to unconsolidated affiliates	$35,094	$29,514	$29,651
Purchases from unconsolidated affiliates[a]	$256,701	$209,266	$130,287

(a) Purchases from unconsolidated affiliates primarily relate to purchases from our Windfield joint venture.

Our consolidated balance sheets include accounts receivable due from and payable to unconsolidated affiliates in the ordinary course of business as follows (in thousands):

	December 31,	
	2018	2017
Receivables from related parties[a]	$14,348	$2,406
Payables to related parties	$68,357	$55,801

(a) Increase in receivables from related parties balance due to timing of payments in the normal course of business from one of our Catalysts joint ventures.

NOTE 24—Segment and Geographic Area Information:

In the first quarter of 2018, the PCS product category merged with our former Refining Solutions reportable segment to form a global business focused on catalysts. As a result, our three reportable segments include: (1) Lithium; (2) Bromine Specialties; and (3) Catalysts. On June 17, 2016, the Company signed a definitive agreement to sell its Chemetall Surface Treatment business, a separate reportable segment, to BASF SE. This business was classified as discontinued operations and its results are excluded from segment results for all periods presented. Each segment has a dedicated team of sales, research and development, process engineering, manufacturing and sourcing, and business strategy personnel and has full accountability for improving execution through greater asset and market focus, agility and responsiveness. This business structure aligns with the markets and customers we serve through each of the segments. This structure also facilitates the continued standardization of business processes across the organization, and is consistent with the manner in which information is presently used internally by the Company's chief operating decision maker to evaluate performance and make resource allocation decisions.

Summarized financial information concerning our reportable segments is shown in the following tables. Results for 2017 and 2016 have been recast to reflect the change in segments noted above.

The “All Other” category includes only the fine chemistry services business that does not fit into any of our core businesses.

The Corporate category is not considered to be a segment and includes corporate-related items not allocated to the operating segments. Pension and OPEB service cost (which represents the benefits earned by active employees during the period) and amortization of prior service cost or benefit are allocated to the reportable segments, All Other, and Corporate, whereas the remaining components of pension and OPEB benefits cost or credit (“Non-operating pension and OPEB items”) are included in Corporate. Segment data includes intersegment transfers of raw materials at cost and allocations for certain corporate costs.

The Company’s chief operating decision maker uses adjusted EBITDA (as defined below) to assess the ongoing performance of the Company’s business segments and to allocate resources. The Company defines adjusted EBITDA as earnings before interest, taxes, depreciation and amortization, as adjusted on a consistent basis for certain non-recurring or unusual items in a balanced manner and on a segment basis. These non-recurring or unusual items may include acquisition and integration related costs, utilization of inventory markup, gains or losses on sales of businesses, restructuring charges, facility divestiture charges, non-operating pension and OPEB items and other significant non-recurring items. In addition, management uses adjusted EBITDA for business planning purposes and as a significant component in the calculation of performance-based compensation for management and other employees. The Company has reported adjusted EBITDA because management believes it provides transparency to investors and enables period-to-period comparability of financial performance. Adjusted EBITDA is a financial measure that is not required by, or presented in accordance with, U.S. GAAP. Adjusted EBITDA should not be considered as an alternative to Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP, or any other financial measure reported in accordance with U.S. GAAP.

	Year Ended December 31,		
	2018	2017	2016
	(In thousands)		
Net sales:			
Lithium	$1,228,171	$1,018,885	$668,852
Bromine Specialties	917,880	855,143	792,425
Catalysts	1,101,554	1,067,572	1,031,501
All Other	127,186	128,914	180,988
Corporate	159	1,462	3,437
Total net sales	$3,374,950	$3,071,976	$2,677,203
Adjusted EBITDA:			
Lithium	$530,773	$446,652	$285,714
Bromine Specialties	288,116	258,901	226,926
Catalysts	284,307	283,883	316,609
All Other	14,091	13,878	14,772
Corporate	(110,623)	(117,834)	(85,804)
Total adjusted EBITDA	$1,006,664	$885,480	$758,217

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See below for a reconciliation of adjusted EBITDA, the non-GAAP financial measure, from Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP (in thousands):

	Lithium	Bromine Specialties	Catalysts	Reportable Segments Total	All Other	Corporate	Consolidated Total
2018							
Net income (loss) attributable to Albemarle Corporation	$428,212	$246,509	$445,604	$1,120,325	$6,018	$(432,781)	$693,562
Depreciation and amortization	95,193	41,607	49,131	185,931	8,073	6,694	200,698
Restructuring and other[(a)]	—	—	—	—	—	3,838	3,838
Gain on sale of business[(b)]	—	—	(210,428)	(210,428)	—	—	(210,428)
Acquisition and integration related costs[(c)]	—	—	—	—	—	19,377	19,377
Interest and financing expenses	—	—	—	—	—	52,405	52,405
Income tax expense	—	—	—	—	—	144,826	144,826
Non-operating pension and OPEB items	—	—	—	—	—	5,285	5,285
Legal accrual[(d)]	—	—	—	—	—	27,027	27,027
Environmental accrual[(e)]	—	—	—	—	—	15,597	15,597
Albemarle Foundation contribution[(f)]	—	—	—	—	—	15,000	15,000
Indemnification adjustments[(g)]	—	—	—	—	—	25,240	25,240
Other[(h)]	7,368	—	—	7,368	—	6,869	14,237
Adjusted EBITDA	$530,773	$288,116	$284,307	$1,103,196	$14,091	$(110,623)	$1,006,664
2017							
Net income (loss) attributable to Albemarle Corporation	$342,992	$218,839	$230,665	$792,496	$5,521	$(743,167)	$54,850
Depreciation and amortization	87,879	40,062	54,468	182,409	8,357	6,162	196,928
Utilization of inventory markup[(i)]	23,095	—	—	23,095	—	—	23,095
Restructuring and other[(j)]	—	—	—	—	—	17,056	17,056
Gain on acquisition[(k)]	(6,221)	—	—	(6,221)	—	—	(6,221)
Acquisition and integration related costs[(c)]	—	—	—	—	—	33,954	33,954
Interest and financing expenses[(l)]	—	—	—	—	—	115,350	115,350
Income tax expense	—	—	—	—	—	431,817	431,817
	—	—	—	—	—	(16,125)	(16,125)

Non-operating pension and OPEB items							
Note receivable reserve[m]	—	—	—	—	—	28,730	28,730
Other[n]	(1,093)	—	(1,250)	(2,343)	—	8,389	6,046
Adjusted EBITDA	$446,652	$258,901	$283,883	$989,436	$13,878	$(117,834)	$885,480
2016							
Net income (loss) attributable to Albemarle Corporation	$198,852	$187,364	$265,416	$651,632	$131,301	$(139,258)	$643,675
Depreciation and amortization	86,862	39,562	51,193	177,617	7,302	6,056	190,975
(Gain) loss on sales of businesses, net[b]	—	—	—	—	(123,831)	1,533	(122,298)
Acquisition and integration related costs[c]	—	—	—	—	—	57,384	57,384
Interest and financing expenses	—	—	—	—	—	65,181	65,181
Income tax expense	—	—	—	—	—	96,263	96,263
Income from discontinued operations (net of tax)	—	—	—	—	—	(202,131)	(202,131)
Non-operating pension and OPEB items	—	—	—	—	—	25,589	25,589
Other[o]	—	—	—	—	—	3,579	3,579
Adjusted EBITDA	$285,714	$226,926	$316,609	$829,249	$14,772	$(85,804)	$758,217

(a) Expected severance payments as part of a business reorganization plan, $0.1 million recorded in Cost of goods sold and $3.7 million recorded in Selling, general and administrative expenses. These severance payments have been made during the year ended December 31, 2018.
(b) See Note 3, "Divestitures," for additional information.
(c) See Note 2, "Acquisitions," for additional information.
(d) Included in Other expenses, net. See Note 17, "Commitments and Contingencies," for additional information.

(e) Increase in environmental reserve to indemnify the buyer of a formerly owned site recorded in Other expenses, net. As defined in the agreement of sale, this indemnification has a set cutoff date in 2024, at which point we will no longer be required to provide financial coverage.

(f) Including in Selling, general and administrative expenses is a charitable contribution, using a portion of the proceeds received from the Polyolefin Catalysts Divestiture, to the Albemarle Foundation, a non-profit organization that sponsors grants, health and social projects, educational initiatives, disaster relief, matching gift programs, scholarships and other charitable initiatives in locations where our employees live and operate. This contribution is in addition to the normal annual contribution made to the Albemarle Foundation by the Company, and is significant in size and nature in that it is intended to provide more long-term benefits in the communities where we live and operate.

(g) Included in Other expenses, net is $19.7 million related to the proposed settlement of an ongoing audit of a previously disposed business in Germany, and $5.5 million related to the revision of indemnifications previously recorded from disposed businesses.

(h) Included amounts for the year ended December 31, 2018 recorded in:

- Cost of goods sold - $4.9 million for the write-off of fixed assets related to a major capacity expansion in our Jordanian joint venture and $8.8 million related to non-routine labor and compensation related costs in Chile that are outside normal compensation arrangements.
- Selling, general and administrative expenses - $2.3 million of shortfall contributions for our multiemployer plan financial improvement plan and a $1.2 million contribution, using a portion of the proceeds received from the Polyolefin Catalysts Divestiture, to schools in the state of Louisiana for qualified tuition purposes. This contribution is significant in size and is intended to provide long-term benefits for families in the Louisiana community. This was partially offset by a $1.5 million gain related to a refund from Chilean authorities due to an overpayment made in a prior year.
- Other expenses, net - $1.5 million gain related to the reversal of previously recorded liabilities of disposed businesses.

(i) In connection with the acquisition of Jiangli New Materials, the Company valued inventory purchased from Jiangli New Materials at fair value, which resulted in a markup of the underlying net book value of the inventory totaling approximately $23.1 million. The utilization of this inventory markup was included in Costs of goods sold during the year ended December 31, 2017, the estimated remaining selling period.

(j) During 2017, we initiated action to reduce costs in each of our reportable segments at several locations, primarily at our Lithium sites in Germany. Based on the restructuring plans, we have recorded expenses of $2.9 million in Cost of goods sold, $8.4 million in Selling, general and administrative expenses, and $5.7 million in Research and development expenses, primarily related to expected severance payments. The unpaid balance is recorded in Accrued expenses at December 31, 2018, with the expectation that the remaining balance will be paid by the end of 2019.

(k) Gain recorded in Other expenses, net related to the acquisition of the remaining 50% interest in Salmag. See Note 2, “Acquisitions,” for additional information.

(l) Included in Interest and financing expenses is a loss on early extinguishment of debt of $52.8 million. See Note 14, “Long-Term Debt,” for additional information.

(m)

Reserve recorded in Other expenses, net against a note receivable on one of our European entities no longer deemed probable of collection.

(n) Included amounts for the year ended December 31, 2017 recorded in:

- Cost of goods sold - $1.3 million reversal of deferred income related to an abandoned project at an unconsolidated investment.
- Selling, general and administrative expenses - $3.3 million of shortfall contributions for our multiemployer plan financial improvement plan, partially offset by $1.0 million related to a reversal of an accrual recorded as part of purchase accounting from a previous acquisition.
- Other expenses, net - $3.2 million of asset retirement obligation charges related to the revision of an estimate at a site formerly owned by Albemarle, losses of $8.7 million related to adjustments of settlements and indemnifications of previously disposed businesses, the revision of tax indemnification expenses of $3.7 million primarily related to the filing of tax returns and a competent authority agreement for a previously disposed business and $1.0 million related to the settlement of a legal claim. This is partially offset by gains of $10.6 million and $1.1 million related to the reversal of liabilities recorded as part of purchase accounting from a previous acquisition and the previous disposal of a property, respectively.

(o) Included amounts for the year ended December 31, 2016 recorded in:

- Selling, general and administrative expenses - $0.9 million related to the net loss on the sales of properties.
- Research and development expenses - $1.4 million related to the write-off of fixed assets in China.
- Other expenses, net -$2.4 million related to environmental charges related to a site formerly owned by Albemarle, partially offset by a gain related to a previously disposed of site in China of $1.1 million.

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	December 31,		
	2018	2017	2016
		(In thousands)	
Identifiable assets:			
Lithium[(a)]	$4,605,070	$ 3,979,615	$3,499,302
Bromine Specialties	753,157	745,007	724,218
Catalysts	1,134,975	1,332,599	1,224,504
All Other	128,185	126,486	130,595
Corporate[(a)(b)]	960,287	1,567,065	2,582,588
Total identifiable assets	$7,581,674	$ 7,750,772	$8,161,207
Goodwill:			
Lithium	$1,354,779	$ 1,389,089	$1,326,980
Bromine Specialties	20,319	20,319	20,319
Catalysts	185,485	194,361	186,147
All Other	6,586	6,586	6,586
Total goodwill	$1,567,169	$ 1,610,355	$1,540,032

(a) The identifiable assets at December 31, 2017, have been revised to correct an error in the previously reported amounts, which understated the Lithium segment and overstated the Corporate category by $238.5 million. There is no impact to the financial statements or total identifiable assets at December 31, 2017.

(b) Decrease in Corporate identifiable assets at December 31, 2018 primarily due to the net use of cash and cash equivalents for items such as capital expenditures, share repurchases and commercial paper repayments. As of December 31, 2016, Corporate included the net proceeds received from the sale of the Chemetall Surface Treatment business completed on December 14, 2016, less the repayment of the term loans and commercial paper using those proceeds. See Note 3, "Divestitures," and Note 14, "Long-Term Debt" for additional details about these transactions.

	Year Ended December 31,		
	2018	2017	2016
		(In thousands)	
Depreciation and amortization:			
Lithium	$95,193	$ 87,879	$86,862
Bromine Specialties	41,607	40,062	39,562
Catalysts	49,131	54,468	51,193
Discontinued Operations	—	—	35,194
All Other	8,073	8,357	7,302
Corporate	6,694	6,162	6,056
Total depreciation and amortization	$200,698	$ 196,928	$226,169
Capital expenditures:			
Lithium	$500,849	$ 192,318	$72,038
Bromine Specialties	79,357	46,427	46,414

Catalysts	52,019	46,808	47,475
Discontinued Operations	—	—	19,281
All Other	5,232	3,657	9,251
Corporate	62,534	28,493	2,195
Total capital expenditures	$699,991	$ 317,703	$196,654

	Year Ended December 31,		
	2018	2017	2016
		(In thousands)	
Net Sales[(a)]:			
United States	$887,416	$ 840,589	$797,267
Foreign[(b)]	2,487,534	2,231,387	1,879,936
Total	$3,374,950	$ 3,071,976	$2,677,203

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(a) Net sales are attributed to countries based upon shipments to final destination.
(b) In 2018, net sales to Korea, China and Japan represented 13%, 12%, and 10%, respectively, of total net sales. In 2017 and 2016, net sales to China represented 15% and 13%, respectively, of total net sales. No net sales in any other foreign country exceed 10% of total net sales.

	As of December 31,		
	2018	2017	2016
		(In thousands)	
Long-Lived Assets[a]:			
United States	$929,291	$ 833,002	$850,689
Chile	1,406,478	1,069,859	922,878
Australia	407,141	364,624	288,553
Jordan	254,800	242,626	227,222
Netherlands	166,853	171,980	145,917
Germany	101,168	115,305	117,027
China	91,160	50,532	31,564
France	43,698	40,852	39,470
Brazil	40,464	47,255	46,380
Korea[b]	111	495	65,963
Other foreign countries	65,826	60,131	57,936
Total	$3,506,990	$ 2,996,661	$2,793,599

(a) Long-lived assets are comprised of the Company’s Property, plant and equipment and Investments.
(b) The reduction as of December 31, 2017, relates to the assets of the Polyolefin Catalysts Divestiture that are included in Assets held for sale in the consolidated balance sheet.

NOTE 25—Quarterly Financial Summary (Unaudited):

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	(In thousands, except per share amounts)			
2018				
Net sales	$821,629	$853,874	$777,748	$921,699
Gross profit	$304,979	$311,356	$280,537	$320,384
(Gain) loss on sales of businesses, net[a]	$—	$(218,705)	$—	$8,277
Net income	$138,925	$310,686	$143,479	$146,049
Net income attributable to noncontrolling interests	(7,165)	(8,225)	(13,734)	(16,453)
Net income attributable to Albemarle Corporation	$131,760	$302,461	$129,745	$129,596
Basic earnings per share	$1.19	$2.76	$1.21	$1.22
Shares used to compute basic earnings per share	110,681	109,671	107,315	106,042
Diluted earnings per share	$1.18	$2.73	$1.20	$1.21
Shares used to compute diluted earnings per share	111,867	110,659	108,302	107,005

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	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	(In thousands, except per share amounts)			
2017				
Net sales	$722,063	$737,258	$754,866	$857,789
Gross profit	$254,956	$271,960	$275,657	$303,703
Net income (loss)	$62,657	$113,689	$130,193	$(207,071)
Net income attributable to noncontrolling interests	(11,444)	(10,356)	(11,523)	(11,295)
Net income (loss) attributable to Albemarle Corporation	$51,213	$103,333	$118,670	$(218,366)
Basic earnings (loss) per share	$0.46	$0.93	$1.07	$(1.98)
Shares used to compute basic earnings per share	111,986	110,686	110,476	110,510
Diluted earnings (loss) per share	$0.45	$0.92	$1.06	$(1.95)
Shares used to compute diluted earnings per share	113,289	112,105	111,975	112,152

(a) Represents the gain (loss) on the Polyolefin Catalysts Divestiture. See Note 3, "Divestitures," for additional information.

As discussed in Note 1, "Summary of Significant Accounting Policies," actuarial gains and losses related to our defined benefit pension and OPEB plan obligations are recognized annually in our consolidated statements of income in the fourth quarter and whenever a plan is determined to qualify for a remeasurement during a fiscal year. During the year ended December 31, 2018, actuarial losses were recognized as follows: fourth quarter—$14.0 million ($10.6 million after income taxes) as a result of the annual remeasurement process. During the year ended December 31, 2017, actuarial gains were recognized as follows: fourth quarter—$11.4 million ($7.3 million after income taxes) as a result of the annual remeasurement process.

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

NONE

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Under the supervision and with the participation of our management, including our principal executive officer and principal financial officer, we conducted an evaluation of the effectiveness of the design and operation of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended, or the Exchange Act), as of the end of the period covered by this report. Based on this evaluation, our principal executive officer and principal financial officer concluded that, as of the end of the period covered by this report, our disclosure controls and procedures are effective to ensure that information required to be disclosed by us in the reports that we file or submit under the Exchange Act, is recorded, processed, summarized and reported within the time periods specified in the SEC’s rules and forms, and that such information is accumulated and communicated to our management, including our principal executive officer and principal financial officer, as appropriate, to allow timely decisions regarding required disclosure.

Design and Evaluation of Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Exchange Act Rule 13a-15(f) and 15d-15(f). Our management assessed the effectiveness of our internal control over financial reporting as of December 31, 2018. In making this assessment, management used the criteria for effective internal control over financial reporting described in the “Internal Control-Integrated Framework” (2013) set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on the assessment, management concluded that, as of December 31, 2018, our internal control over financial reporting was effective based on those criteria.

The effectiveness of our internal control over financial reporting as of December 31, 2018 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report, which is included herein. Management’s report and the independent registered public accounting firm’s report are included in Item 8 under the captions entitled “Management’s Report on Internal Control over Financial Reporting” and “Report of Independent Registered Public Accounting Firm” and are incorporated herein by reference.

Changes in Internal Control over Financial Reporting

No change in our internal control over financial reporting (as such term is defined in Exchange Act Rule 13a-15(f)) occurred during the fiscal quarter ended December 31, 2018 that materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

NONE

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by this Item 10 will be contained in the Proxy Statement and is incorporated herein by reference. In addition, the information in “Executive Officers of the Registrant” appearing after Item 4 in Part I of this Annual Report, is incorporated herein by reference.

Code of Conduct

We have adopted a code of conduct and ethics for directors, officers and employees, known as the Albemarle Code of Conduct. The Albemarle Code of Conduct is available on our website, www.albemarle.com. Shareholders may also request a free copy of the Albemarle Code of Conduct from: Albemarle Corporation, Attention: Investor Relations, 4250 Congress Street, Suite 900, Charlotte, North Carolina 28209. We will disclose any amendments to, or waivers from, a provision of our Code of Conduct that applies to the principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions that relates to any element of the

Code of Conduct as defined in Item 406 of Regulation S-K by posting such information on our website.

Albemarle
Corporation
and
Subsidiaries

New York Stock Exchange Certifications

Because our common stock is listed on the New York Stock Exchange ("NYSE"), our Chief Executive Officer is required to make, and he has made, an annual certification to the NYSE stating that he was not aware of any violation by us of the corporate governance listing standards of the NYSE. Our Chief Executive Officer made his annual certification to that effect to the NYSE as of June 7, 2018. In addition, we have filed, as exhibits to this Annual Report on Form 10-K, the certifications of our principal executive officer and principal financial officer required under Sections 906 and 302 of the Sarbanes-Oxley Act of 2002 to be filed with the Securities and Exchange Commission regarding the quality of our public disclosure.

Additional information will be contained in the Proxy Statement and is incorporated herein by reference.

Item 11. Executive Compensation.

The information required by this Item 11 will be contained in the Proxy Statement and is incorporated herein by reference.

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

The information required by this Item 12 will be contained in the Proxy Statement and is incorporated herein by reference.

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

The information required by this Item 13 will be contained in the Proxy Statement and is incorporated herein by reference.

Item 14. Principal Accountant Fees and Services.

The information required by this Item 14 will be contained in the Proxy Statement and is incorporated herein by reference.

PART IV

Item 15. Exhibits and Financial Statement Schedules.

(a)(1) The following consolidated financial and informational statements of the registrant are included in Part II Item 8 on pages 58 to 113:

Management's Report on Internal Control Over Financial Reporting
Report of Independent Registered Public Accounting Firm
Consolidated Balance Sheets as of December 31, 2018 and 2017
Consolidated Statements of Income, Comprehensive Income, Changes in Equity and Cash Flows for the years ended December 31, 2018, 2017 and 2016
Notes to the Consolidated Financial Statements

(a)(2) No Financial Statement Schedules are provided in accordance with Item 15(a)(2) as the information is either not applicable, not required or has been furnished in the Consolidated Financial Statements or Notes thereto.

(a)(3) Exhibits

The following documents are filed as exhibits to this Annual Report on Form 10-K pursuant to Item 601 of Regulation S-K:

2.1 Agreement and Plan of Merger, dated as of July 15, 2014, among Albemarle Corporation, Albemarle Holdings Corporation and Rockwood Holdings, Inc. [filed as Exhibit 2.1 to the Company's Current Report on Form 8-K

(No. 1-12658) filed on July 18, 2014, and incorporated herein by reference].

Albemarle Corporation and Subsidiaries

2.2	Share Purchase Agreement, dated as of June 17, 2016, between Albemarle Corporation and BASF SE [filed as Exhibit 2.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016 (No. 1-12658), filed on August 5, 2016, and incorporated herein by reference].
2.3	First Amendment to the Share Purchase Agreement, dated December 7, 2016, between Albemarle Corporation and BASF SE [filed as Exhibit 2.3 to the Company's Annual Report on Form 10-K for the year ended December 31, 2016 (No. 1-12658), and incorporated herein by reference].
2.4	Second Amendment to the Share Purchase Agreement, dated December 14, 2016, between Albemarle Corporation and BASF SE [filed as Exhibit 2.4 to the Company's Annual Report on Form 10-K for the year ended December 31, 2016 (No. 1-12658), and incorporated herein by reference].
3.1	Amended and Restated Articles of Incorporation (including Amendment thereto) of Albemarle Corporation [filed as Exhibit 4.1 to the Company's Registration Statement on Form S-3 (No. 333-119723) filed on October 13, 2004, and incorporated herein by reference].
3.2	Amended and Restated Articles of Incorporation of Albemarle Corporation [filed as Exhibit 3.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on May 12, 2017, and incorporated herein by reference].
3.3	Amended and Restated Bylaws, effective May 12, 2017, of Albemarle Corporation [filed as Exhibit 3.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on May 12, 2017, and incorporated herein by reference].
4.1	Indenture, dated as of January 20, 2005, between Albemarle Corporation and The Bank of New York, as trustee [filed as Exhibit 4.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on January 20, 2005, and incorporated herein by reference].
4.2	Second Supplemental Indenture, dated as of December 10, 2010, between Albemarle Corporation and The Bank of New York Mellon Trust Company, N.A., as successor trustee to The Bank of New York [filed as Exhibit 4.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 10, 2010, and incorporated herein by reference].
4.3	Third Supplemental Indenture, dated as of November 24, 2014, among Albemarle Corporation, Albemarle Holdings Corporation (now Rockwood Holdings, Inc.) and Albemarle Holdings II Corporation (now Rockwood Specialties Group, Inc.) and U.S. Bank National Association, as trustee [filed as Exhibit 4.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 24, 2014, and incorporated herein by reference].
4.4	Fourth Supplemental Indenture, dated as of January 29, 2015, among Albemarle Corporation, Rockwood Holdings, Inc. (as successor by merger to Albemarle Holdings Corporation), Rockwood Specialties Group, Inc. (as successor by merger to Albemarle Holdings II Corporation), The Bank of New York Mellon Trust Company, N.A., a national banking association, as successor to The Bank of New York, as resigning trustee, and U.S. Bank National Association, as successor trustee [filed as Exhibit 4.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on January 29, 2015, and incorporated herein by reference].

4.5	Form of Global Security for the 4.50% Senior Notes due 2020 [filed as Exhibit 4.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 10, 2010, and incorporated herein by reference].
4.6	Form of Global Security for the 4.150% Senior Notes due 2024 [filed as Exhibit 4.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 24, 2014, and incorporated herein by reference].
4.7	Form of Global Security for the 5.450% Senior Notes due 2044 [filed as Exhibit 4.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 24, 2014, and incorporated herein by reference].
4.8	Form of Global Security for the 1.875% Senior Notes due 2021 [filed as Exhibit 4.8 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].

#10.1	2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Annex A to the Company's definitive Proxy Statement on Schedule 14A (No. 1-12658) filed on March 28, 2013, and incorporated herein by reference].
#10.2	First Amendment to the Albemarle Corporation Stock Compensation and Deferral Election Plan [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016 (No. 1-12658), and incorporated herein by reference].
#10.3	Compensation Arrangement with Luther C. Kissam, IV, dated August 29, 2003 [filed as Exhibit 10.10 to the Company's Annual Report on Form 10-K for the year ended December 31, 2005 (No. 1-12658), and incorporated herein by reference].
#10.4	Notice of Option Grant [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 25, 2013, and incorporated herein by reference].
#10.5	Notice of Option Grant [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 28, 2014, and incorporated herein by reference].
#10.6	Notice of Option Grant [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 2, 2015, and incorporated herein by reference].
#10.7	Notice of Option Grant [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 2, 2016, and incorporated herein by reference].
#10.8	Notice of Restricted Stock Unit Award [filed as Exhibit 10.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 2, 2016, and incorporated herein by reference].
#10.9	Notice of TSR Performance Unit Award [filed as Exhibit 10.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 2, 2016, and incorporated herein by reference].
#10.10	Form Notice of Option Grant under the Albemarle Corporation 2008 Incentive Plan [filed as Exhibit 10.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 9, 2016, and incorporated herein by reference].
#10.11	Form Notice of Restricted Stock Unit Award under the Albemarle Corporation 2008 Incentive Plan [filed as Exhibit 10.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 9, 2016, and incorporated herein by reference].
#10.12	Form Notice of TSR Performance Unit Award under the Albemarle Corporation 2008 Incentive Plan [filed as Exhibit 10.5 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 9, 2016, and incorporated herein by reference].
#10.13	Notice of TSR Performance Unit Award [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 9, 2018, and incorporated herein by reference].

#10.14	Notice of Option Grant [filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 9, 2018, and incorporated herein by reference].
#10.15	Notice of Restricted Stock Unit Award [filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 9, 2018, and incorporated herein by reference].
#10.16	Amended and Restated Albemarle Corporation Supplemental Executive Retirement Plan, effective as of January 1, 2005 [filed as Exhibit 10.13 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
#10.17	First Amendment to the Albemarle Corporation Supplemental Executive Retirement Plan, dated December 1, 2010 [filed as Exhibit 10.14 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].

#10.18	Second Amendment to the Albemarle Corporation Supplemental Executive Retirement Plan, dated December 18, 2011 [filed as Exhibit 10.15 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
#10.19	Third Amendment to the Albemarle Corporation Supplemental Executive Retirement Plan, dated December 2, 2013 [filed as Exhibit 10.16 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
#10.20	Form of Severance Compensation Agreement (Pension-Eligible Employees) [filed as Exhibit 10.19 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
#10.21	Form of Severance Compensation Agreement (Non-Pension-Eligible Employees) [filed as Exhibit 10.20 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
#10.22	Form of Amendment to Severance Compensation Agreement [filed as Exhibit 10.21 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
#10.23	Second Amendment to Severance Compensation Agreement between Luther C. Kissam, IV and Albemarle Corporation [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 9, 2016, and incorporated herein by reference].
#10.24	Form of Second Amendment to Severance Compensation Agreement between each of Karen Narwold and Scott Tozier, and Albemarle Corporation [filed as Exhibit 10.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 9, 2016, and incorporated herein by reference].
#10.25	Albemarle Corporation Severance Pay Plan, as revised effective as of December 13, 2006 [filed as Exhibit 10.6 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 18, 2006, and incorporated herein by reference].
#10.26	Amended and Restated Albemarle Corporation Benefits Protection Trust, effective as of December 13, 2006 [filed as Exhibit 10.9 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 18, 2006, and incorporated herein by reference].
#10.27	Albemarle Corporation Employee Relocation Policy [filed as Exhibit 10.33 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2008 (No. 1-12658), and incorporated herein by reference].
#10.28	Albemarle Corporation 2008 Incentive Plan, as amended and restated as of April 20, 2010 [filed as Exhibit 10.1 to the Company's Registration Statement on Form S-8 (No. 333-166828) filed on May 14, 2010, and incorporated herein by reference].
#10.29	Amended and Restated Albemarle Corporation Executive Deferred Compensation Plan, effective as of January 1, 2013 [filed as Exhibit 10.23 to the Company's Annual Report on Form 10-K for the fiscal year

	ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
#10.30	First Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of November 14, 2014 [filed as Exhibit 10.24 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
#10.31	Second Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of February 12, 2015 [filed as Exhibit 10.28 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
#10.32	Third Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of July 31, 2015 [filed as Exhibit 10.29 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].

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#10.33	Fourth Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of December 17, 2015 [filed as Exhibit 10.30 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
#10.34	Fifth Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of March 31, 2017 [filed as Exhibit 10.38 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
#10.35	Sixth Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of July 5, 2017 [filed as Exhibit 10.39 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
#10.36	Seventh Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of November 9, 2017 [filed as Exhibit 10.40 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
#10.37	Albemarle Corporation 2017 Incentive Plan, adopted May 12, 2017 [filed as Appendix A to the Company's Definitive Proxy Statement filed on March 30, 2017, and incorporated herein by reference].
#10.38	Albemarle Corporation Compensation Recoupment and Forfeiture Policy effective July 10, 2017 [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2017 (No. 1-12658), and incorporated herein by reference].
#10.39	Form of letter agreement dated February 26, 2018 between the Company and each of Luther C. Kissam, IV, Karen Narwold, Scott Tozier and Donald J. LaBauve, Jr. [filed as Exhibit 10.43 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
10.40	Credit Agreement, dated as of June 21, 2018, among Albemarle Corporation, Albemarle Global Finance Company SCA and Albemarle Europe SPRL, as borrowers, certain of the Company's subsidiaries that from time to time become parties thereto, the several banks and other financial institutions as may from time to time become parties thereto, and Bank of America, N.A., as Administrative Agent and Swing Line Lender [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on August 7, 2018, and incorporated herein by reference].
*10.41	Asset Sale and Share Subscription Agreement, dated December 14, 2018, by and among Albemarle Corporation, Albemarle Wodgina Pty Ltd, a wholly-owned subsidiary of Albemarle Corporation, Mineral Resources Limited and Wodgina Lithium Pty Ltd, a wholly-owned subsidiary of Mineral Resources Limited.
*10.42	Form of Wodgina Joint Venture Agreement by and among Wodgina Lithium Pty Ltd, Albemarle Wodgina Pty Ltd and Wodgina Lithium Operations Pty Ltd.
*21.1	Subsidiaries of the Company.
*23.1	Consent of PricewaterhouseCoopers LLP.

*31.1	Certification of Chief Executive Officer pursuant to Rule 13a-15(e) and 15d-15(e) of the Securities Exchange Act of 1934, as amended.
*31.2	Certification of Chief Financial Officer pursuant to Rule 13a-15(e) and 15d-15(e) of the Securities Exchange Act of 1934, as amended.
*32.1	Certification of Chief Executive Officer pursuant to 18 U.S.C. 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
*32.2	Certification of Chief Financial Officer pursuant to 18 U.S.C. 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
*99.1	Five-Year Summary.

*101	Interactive Data Files (Annual Report on Form 10-K, for the fiscal year ended December 31, 2018, furnished in XBRL (eXtensible Business Reporting Language)). Attached as Exhibit 101 to this report are the following documents formatted in XBRL: (i) the Consolidated Statements of Income for the fiscal years ended December 31, 2018, 2017 and 2016, (ii) the Consolidated Statements of Comprehensive Income for the fiscal years ended December 31, 2018, 2017 and 2016, (iii) the Consolidated Balance Sheets at December 31, 2018 and 2017, (iv) the Consolidated Statements of Changes in Equity for the fiscal years ended December 31, 2018, 2017 and 2016, (v) the Consolidated Statements of Cash Flows for the fiscal years ended December 31, 2018, 2017 and 2016 and (vi) the Notes to Consolidated Financial Statements.

Management contract or compensatory plan or arrangement.
* Included with this filing.

Item 16. Form 10-K Summary.
NONE

Albemarle Corporation and Subsidiaries

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.

ALBEMARLE CORPORATION
(Registrant)

By: /S/ LUTHER C. KISSAM IV
(Luther C. Kissam IV)
Chairman, President and Chief Executive Officer

Dated: February 27, 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 as of February 27, 2019.

Signature	Title
/S/ LUTHER C. KISSAM IV (Luther C. Kissam IV)	Chairman, President and Chief Executive Officer (principal executive officer)
/S/ SCOTT A. TOZIER (Scott A. Tozier)	Executive Vice President, Chief Financial Officer (principal financial officer)
/S/ DONALD J. LABAUVE, JR. (Donald J. LaBauve, Jr.)	Vice President, Corporate Controller and Chief Accounting Officer (principal accounting officer)
/S/ LAURIE BRLAS (Laurie Brlas)	Director
/S/ WILLIAM H. HERNANDEZ (William H. Hernandez)	Director
/S/ DOUGLAS L. MAINE (Douglas L. Maine)	Director
/S/ J. KENT MASTERS (J. Kent Masters)	Director
/S/ JAMES J. O'BRIEN (James J. O'Brien)	Director
/S/ DIARMUID B. O'CONNELL (Diarmuid B. O'Connell)	Director
/S/ DEAN L. SEAVERS (Dean L. Seavers)	Director

/S/ GERALD A. STEINER (Gerald A. Steiner)	Director
/S/ HARRIETT TEE TAGGART (Harriett Tee Taggart)	Director
/S/ ALEJANDRO D. WOLFF (Alejandro D. Wolff)	Director