OLIN CORP
Form 10-K
February 25, 2019
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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549
Form 10-K
(Mark One)
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
.. TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the transition period from to
Commission file number 1-1070
OLIN CORPORATION
(Exact name of registrant as specified in its charter)

Virginia	13-1872319
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
190 Carondelet Plaza, Suite 1530, Clayton, MO	63105
(Address of principal executive offices)	(Zip code)

Registrant's telephone number, including area code: (314) 480-1400
Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
Common Stock, par value $1 per share	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act: None
Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes 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 Exchange 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 the past 90 days.
Yes x No ¨
Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes x No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. 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. 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

As of June 30, 2018, the aggregate market value of registrant's common stock, par value $1 per share, held by non-affiliates of registrant was approximately $4,774,200,502 based on the closing sale price as reported on the New York Stock Exchange.

As of January 31, 2019, 164,877,488 shares of the registrant's common stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the following document are incorporated by reference in this Form 10-K as indicated herein:

Document	Part of 10-K into which incorporated
Proxy Statement relating to Olin's Annual Meeting of Shareholders to be held in 2019	Part III

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PART I

Item 1. BUSINESS

GENERAL

Olin Corporation (Olin) is a Virginia corporation, incorporated in 1892, having its principal executive offices in Clayton, MO. We are a manufacturer concentrated in three business segments: Chlor Alkali Products and Vinyls, Epoxy and Winchester. The Chlor Alkali Products and Vinyls segment manufactures and sells chlorine and caustic soda, ethylene dichloride and vinyl chloride monomer, methyl chloride, methylene chloride, chloroform, carbon tetrachloride, perchloroethylene, trichloroethylene and vinylidene chloride, hydrochloric acid, hydrogen, bleach products and potassium hydroxide, which represent 57% of 2018 sales. The Epoxy segment produces and sells a full range of epoxy materials, including allyl chloride, epichlorohydrin, liquid epoxy resins, solid epoxy resins and downstream products such as differentiated epoxy resins and additives, which represent 33% of 2018 sales. The Winchester segment produces and sells sporting ammunition, reloading components, small caliber military ammunition and components, and industrial cartridges, which represent 10% of 2018 sales. See our discussion of our segment disclosures contained in Item 7—"Management's Discussion and Analysis of Financial Condition and Results of Operations."

GOVERNANCE

We maintain an Internet website at www.olin.com. Our reports on Form 10-K, Form 10-Q and Form 8-K, as well as amendments to those reports, are available free of charge on our website, as soon as reasonably practicable after we file the reports with the Securities and Exchange Commission (SEC). Also, a copy of our electronically filed materials can be obtained at www.sec.gov. Our Principles of Corporate Governance, Committee Charters and Code of Conduct are available on our website at www.olin.com in the Leadership & Governance Section under Governance Documents and Committees.

In May 2018, our Chief Executive Officer executed the annual Section 303A.12(a) CEO Certification required by the New York Stock Exchange (NYSE), certifying that he was not aware of any violation of the NYSE's corporate governance listing standards by us. Additionally, our Chief Executive Officer and Chief Financial Officer executed the required Sarbanes-Oxley Act of 2002 Sections 302 and 906 certifications relating to this Annual Report on Form 10-K, which are filed with the SEC as exhibits to this Annual Report on Form 10-K.

PRODUCTS, SERVICES AND STRATEGIES

Chlor Alkali Products and Vinyls

Products and Services

We have been involved in the chlor alkali industry for more than 120 years and are a major participant in the global chlor alkali industry. Chlorine, caustic soda and hydrogen are co-produced commercially by the electrolysis of salt. These co-produced products are produced simultaneously, and in a fixed ratio of 1.0 ton of chlorine to 1.1 tons of caustic soda and 0.03 tons of hydrogen. The industry refers to this as an Electrochemical Unit or ECU. With a demonstrated capacity of 5.8 million ECUs as of the end of 2018, we have the largest global chlor alkali capacity, according to data from IHS, Inc. (IHS). IHS is a global information consulting company established in 1959 that provides information to a variety of industries.

Chlorine is used as a raw material in the production of thousands of products, including vinyls, urethanes, epoxy, water treatment chemicals and a variety of other organic and inorganic chemicals. A significant portion of chlorine production is consumed in the manufacture of ethylene dichloride (EDC) and vinyl chloride monomer (VCM), both of which our Chlor Alkali Products and Vinyls segment produces. A large portion of our EDC production is utilized in the production of VCM, but we are also one of the largest global participants in merchant EDC sales. EDC and VCM are precursors for polyvinyl chloride (PVC). PVC is a plastic used in applications such as vinyl siding, pipe, pipe fittings and automotive parts.

Our Chlor Alkali Products and Vinyls segment is one of the largest global marketers of caustic soda, including caustic soda produced by DowDuPont Inc. (DowDuPont) (f/k/a The Dow Chemical Company) in Brazil. The off-take arrangement with DowDuPont in Brazil entitles the Chlor Alkali Products and Vinyls segment the right to market and sell the caustic soda produced at DowDuPont's Aratu, Brazil site. The diversity of caustic soda sourcing allows us to cost effectively supply customers worldwide. Caustic soda has a wide variety of end-use applications, the largest of which includes water treatment, alumina, pulp and paper, urethanes, detergents and soaps and a variety of other organic and inorganic chemicals.

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Our Chlor Alkali Products and Vinyls segment also includes our chlorinated organics business which is the largest global producer of chlorinated organic products that include chloromethanes (methyl chloride, methylene chloride, chloroform and carbon tetrachloride) and chloroethenes (perchloroethylene, trichloroethylene, and vinylidene chloride). Chlorinated organics participates in both the solvent segment, as well as the intermediate segment of the global chlorocarbon industry with a focus on sustainable applications and in applications where we can benefit from our cost advantages. Intermediate products are used as feedstocks in the production of fluoropolymers, fluorocarbon refrigerants and blowing agents, silicones, cellulosics and agricultural chemicals. Solvent products are sold into end uses such as surface preparation, dry cleaning, pharmaceuticals and regeneration of refining catalysts. This business's unique technology allows us to utilize both hydrochloric acid and chlorinated hydrocarbon byproducts (RCls), produced by our other production processes, as raw materials in an integrated system. These manufacturing facilities also consume chlorine, which generates caustic soda production and sales.

We also manufacture and sell other chlor alkali-related products, including hydrochloric acid, sodium hypochlorite (bleach) and potassium hydroxide, which we refer to as co-products. The production of co-products, chlorinated organics and epoxy generally consume chlorine as a raw material creating downstream applications that upgrade the value of chlorine and enable caustic soda production. Our industry leadership in the production of chlorinated organics and epoxy resins, as well as other co-products, offer us nineteen integrated outlets for our captive chlorine.

The Chlor Alkali Products and Vinyls segment's products are delivered by pipeline, marine vessel, deep-water and coastal barge, railcar and truck. Our logistics and terminal infrastructure provides us with geographically advantaged storage capacity and provides us with a private fleet of trucks, tankers and trailers that expands our geographic coverage and enhances our service capabilities. At our largest integrated product sites, our deep-water access enables us to reach global markets.

Our Chlor Alkali Products and Vinyls segment maintains strong relationships with DowDuPont as both a customer and supplier. These relationships are maintained through long-term cost based contracts that provide us with a reliable supply of key raw materials and predictable and consistent demand for our end use products. Key products sold to DowDuPont include chlorine, caustic soda, chlorinated organics and VCM. Key raw materials received from DowDuPont include ethylene and electricity. Ethylene is supplied for the vinyls business under a long-term supply arrangement with DowDuPont whereby we receive ethylene at integrated producer economics.

Electricity, salt, ethylene and methanol are the major purchased raw materials for our Chlor Alkali Products and Vinyls segment. Electricity is the single largest raw material component in the production of Chlor Alkali Products and Vinyls' products. Approximately 77% of our electricity is generated from natural gas or hydroelectric sources. Approximately 69% of our salt requirements are met by internal supply. Methanol is primarily sourced domestically and internationally from large producers. The high volume nature of this industry places an emphasis on cost management and we believe that our scale, integration and raw material positions make us one of the low cost producers in the industry.

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The following table lists principal products and services of our Chlor Alkali Products and Vinyls segment.

Products & Services	Major End Uses	Plants & Facilities	Major Raw Materials & Components for Products/Services
Chlorine/caustic soda	Pulp & paper processing, chemical manufacturing, water purification, vinyl chloride manufacturing, bleach, swimming pool chemicals and urethane chemicals	Becancour, Canada Charleston, TN Freeport, TX McIntosh, AL Niagara Falls, NY Plaquemine, LA St. Gabriel, LA	salt, electricity
Ethylene dichloride/vinyl chloride monomer	Precursor to polyvinyl chloride used in vinyl siding, plumbing and automotive parts	Freeport, TX Plaquemine, LA	chlorine, ethylene, ethylene dichloride
Chlorinated organics intermediates	Used as feedstocks in the production of fluoropolymers, fluorocarbon refrigerants and blowing agents, silicones, cellulosics and agricultural chemicals	Freeport, TX Plaquemine, LA Stade, Germany	chlorine, ethylene dichloride, hydrochloric acid, methanol, RCls
Chlorinated organics solvents	Surface preparation, dry cleaning and pharmaceuticals	Freeport, TX Plaquemine, LA Stade, Germany	chlorine, ethylene dichloride, hydrochloric acid, RCls
Sodium hypochlorite (bleach)	Household cleaners, laundry bleaching, swimming pool sanitizers, semiconductors, water treatment, textiles, pulp & paper and food processing	Augusta, GA Becancour, Canada Charleston, TN Freeport, TX Henderson, NV Lemont, IL McIntosh, AL* Niagara Falls, NY*	caustic soda, chlorine

		Santa Fe Springs, CA Tracy, CA	
Hydrochloric acid	Steel, oil & gas, plastics, organic chemical synthesis, water & wastewater treatment, brine treatment, artificial sweeteners, pharmaceuticals, food processing and ore & mineral processing	Becancour, Canada Charleston, TN Freeport, TX McIntosh, AL Niagara Falls, NY	chlorine, hydrogen
Potassium hydroxide	Fertilizer manufacturing, soaps, detergents & cleaners, battery manufacturing, food processing chemicals and deicers	Charleston, TN	electricity, potassium chloride
Hydrogen	Fuel source, hydrogen peroxide and hydrochloric acid	Becancour, Canada Charleston, TN Freeport, TX McIntosh, AL Niagara Falls, NY Plaquemine, LA St. Gabriel, LA	electricity, salt

* Includes low salt, high strength bleach manufacturing.

Strategies

Strengthen Our Role as Preferred Supplier in North America. Take maximum advantage of our world-scale integrated facilities on the U.S. Gulf Coast, our geographically-advantaged plants across North America and our extensive logistics and terminal network to provide a reliable and preferred supply position to our North American customers.

Capitalize on Our Low Cost Position. Our advantaged cost position is derived from low-cost energy, scale, integration, and deep-water ports. We expect to maximize our low cost position to ship our products to customers worldwide.

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Optimize the Breadth of Products and Pursue Incremental Expansion Opportunities. Fully utilize the portfolio of co-products and integrated derivatives to continually upgrade chlorine and caustic soda to the highest value applications and provide expansion opportunities.

Epoxy

Products and Services

The Epoxy business was one of the first major manufacturers of epoxy products, and has continued to build on more than half a century of history through product innovation and technical excellence. According to data from IHS, the Epoxy segment is one of the largest fully integrated global producers of epoxy resins, curing agents and intermediates. The Epoxy segment has a favorable manufacturing cost position which is driven by a combination of scale and integration into low cost feedstocks (including chlorine, caustic soda, allylics and aromatics). With its advantaged cost position, the Epoxy segment is among the lowest cost producers in the world. The Epoxy segment produces and sells a full range of epoxy materials, including upstream products such as allyl chloride (Allyl) and epichlorohydrin (EPI), midstream products such as liquid epoxy resins (LER) and solid epoxy resins (SER) and downstream products such as differentiated epoxy resins and additives.

The Epoxy segment serves a diverse array of applications, including wind energy, electrical laminates, marine coatings, consumer goods and composites, as well as numerous applications in civil engineering and protective coatings. The Epoxy segment has important relationships with established customers, some of which span decades. The Epoxy segment's primary geographies are North America and Western Europe. The segment's product is delivered primarily by marine vessel, deep-water and coastal barge, railcar and truck.

Allyl is used not only as a feedstock in the production of EPI, but also as a chemical intermediate in multiple industries and applications, including water purification chemicals. EPI is primarily produced as a feedstock for use in the business's epoxy resins, and also sold to epoxy producers globally who produce their own resins for end use segments such as coatings and adhesives. LER is manufactured in liquid form and cures with the addition of a hardener into a thermoset solid material offering a distinct combination of strength, adhesion and chemical resistance that is well-suited to coatings and composites applications. SER is processed further with bisphenol (BisA) to meet specific end market applications. While LER and SER are sold externally, a significant portion of LER production is further converted into differentiated epoxy resins where value-added modifications produce higher margin resins.

Our Epoxy segment maintains strong relationships with DowDuPont as both a customer and supplier. These relationships are maintained through long-term cost based contracts that provide us with a reliable supply of key raw materials. Key products sold to DowDuPont include aromatics and key raw materials received from DowDuPont include benzene and propylene.

The Epoxy segment's production economics benefit from its integration into chlor alkali and aromatics which are key inputs in epoxy production. This fully integrated structure provides both access to low cost materials and significant operational flexibility. The Epoxy segment operates an integrated aromatics production chain producing cumene, phenol, acetone and BisA for internal consumption and external sale. The Epoxy segment's consumption of chlorine enables the Chlor Alkali Products and Vinyls segment to generate caustic soda production and sales. Chlorine used in our Epoxy segment is transferred at cost from the Chlor Alkali Products and Vinyls segment.

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The following table lists principal products and services of our Epoxy segment.

Products & Services	Major End Uses	Plants & Facilities	Major Raw Materials & Components for Products/Services
Allylics (allyl chloride and epichlorohydrin) & aromatics (acetone, bisphenol, cumene and phenol)	Manufacturers of polymers, resins and other plastic materials, water purification, and pesticides	Freeport, TX Stade, Germany Terneuzen, Netherlands	benzene, caustic soda, chlorine, propylene
Liquid epoxy resin/solid epoxy resin	Adhesives, paint and coatings, composites and flooring	Freeport, TX Guaruja, Brazil Stade, Germany	bisphenol, caustic soda, epichlorohydrin
Differentiated epoxy resins	Electrical laminates, paint and coatings, wind blades, electronics and construction	Baltringen, Germany Freeport, TX Guaruja, Brazil Gumi, South Korea Pisticci, Italy Rheinmunster, Germany Roberta, GA Stade, Germany Zhangjiagang, China	liquid epoxy resins, solid epoxy resins

Strategies

Continue to Focus on Capturing the Full Value of Our Asset Base. The Epoxy segment continues to focus on fully utilizing our integrated asset base. We expect to optimize our production capabilities allowing us to more fully benefit from our access to low-cost materials and significant operational flexibility.

Focus on Upgrading Our Sales Portfolio and Product Mix. The Epoxy segment will focus on improving product mix to drive more value-added product introductions and modifications that produce higher margin sales. This leverages our leading technology and quality positions.

Drive Productivity to Sustain Our Cost Advantage. The Epoxy segment continues to drive productivity cost improvements through the entire supply chain, enhancing reliability and delivering yield improvements.

Winchester

Products and Services

In 2019, Winchester is in its 153rd year of operation and its 89th year as part of Olin. Winchester is a premier developer and manufacturer of small caliber ammunition for sale to domestic and international retailers (commercial customers), law enforcement agencies and domestic and international militaries. We believe we are a leading U.S. producer of ammunition for recreational shooters, hunters, law enforcement agencies and the U.S. Armed Forces. Winchester also manufacturers industrial products that have various applications in the construction industry.

In December 2018, Winchester announced it submitted a proposal for the operation and maintenance of the Lake City Army Ammunition Plant. The Lake City Army Ammunition Plant is the U.S. Army's primary manufacturing location for small caliber ammunition. It is expected that a decision will be made during the third quarter of 2019 and, that after a one-year transition period, the selected contractor will assume responsibility for the plant on October 1, 2020. This represents a long-term opportunity for Winchester.

In September 2018, the U.S. Immigration and Customs Enforcement, Department of Homeland Security awarded Winchester a $12 million, five-year contract for 9mm "Readily Identifiable Training Ammunition."

In April 2018, Winchester was awarded a $5 million, five-year contract from the Federal Bureau of Investigation for 9mm duty and frangible training ammunition.

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In May 2017, Winchester was awarded, along with one other company, a shared contract to provide small caliber ammunition non-recurring engineering services for the U.S. Army. The contract has the potential to generate approximately $65 million of sales over the five-year contract.

In January 2017, SIG Sauer, Inc. was awarded a $580 million, ten-year contract for the modular handgun system pistol contract by the U.S. Army. Winchester will supply the pistol ammunition as a subcontractor to SIG Sauer, Inc.

In February 2016, Winchester was awarded a “Pistol Family Ammunition” contract for 9mm NATO, as well as .38 caliber and .45 caliber ammunition to be used by the U.S. Army. The contract has the potential to generate approximately $99 million of sales over the five-year contract.

In January 2016, Winchester was awarded a five-year contract for 5.56mm, 7.62mm and .50 caliber ammunition to be used by the U.S. Army. The contract has the potential to generate approximately $300 million of sales over the five-year contract.

Our legendary Winchester® product line includes all major gauges and calibers of shotgun shells, rimfire and centerfire ammunition for pistols and rifles, reloading components and industrial cartridges. We believe we are a leading U.S. supplier of small caliber commercial ammunition.

Winchester has strong relationships throughout the sales and distribution chain and strong ties to traditional dealers and distributors. Winchester has also built its business with key high-volume mass merchants and specialty sporting goods retailers. Winchester has consistently developed industry-leading ammunition, which is recognized in the industry for manufacturing excellence, design innovation and consumer value. Winchester’s new ammunition products continue to receive awards from major industry publications, with recent awards including: American Hunter magazine’s Golden Bullseye Award as “Ammunition Product of the Year” in 2018 and 2016; Guns & Ammo magazine’s “Ammunition of the Year” award in 2017; and American Rifleman magazine’s Golden Bullseye Award as “Ammunition Product of the Year” in 2017.

Winchester purchases raw materials such as copper-based strip and ammunition cartridge case cups and lead from vendors based on a conversion charge or premium. These conversion charges or premiums are in addition to the market prices for metal as posted on exchanges such as the Commodity Exchange, or COMEX, and London Metals Exchange, or LME. Winchester’s other main raw material is propellant, which is purchased predominantly from one of the U.S.’s largest propellant suppliers.

The following table lists principal products and services of our Winchester segment.

Products & Services	Major End Uses	Plants & Facilities	Major Raw Materials & Components for Products/Services
Winchester® sporting ammunition (shotshells, small caliber centerfire & rimfire ammunition)	Hunters & recreational shooters, law enforcement agencies	East Alton, IL Geelong, Australia Oxford, MS	brass, lead, steel, plastic, propellant, explosives
Small caliber military ammunition	Infantry and mounted weapons	East Alton, IL Oxford, MS	brass, lead, propellant, explosives

Industrial products (8 gauge loads & powder-actuated tool loads)	Maintenance applications in power & concrete industries, powder-actuated tools in construction industry	East Alton, IL Geelong, Australia Oxford, MS	brass, lead, plastic, propellant, explosives

Strategies

Maximize Existing Strengths. Winchester plans to seek new opportunities to fully utilize the legendary Winchester brand name and will continue to offer a full line of ammunition products to the markets we serve, with specific focus on investments that make Winchester ammunition the retail brand of choice.

Focus on Product Line Growth. With a long record of pioneering new product offerings, Winchester has built a strong reputation as an industry innovator. This includes the introduction of reduced-lead and non-lead products, which are growing in popularity for use in indoor shooting ranges and for outdoor hunting.

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Cost Reduction Strategy. Winchester plans to continue to focus on strategies that will lower our costs. During 2016, we completed the relocation of our centerfire pistol and rifle ammunition manufacturing operations from East Alton, IL to Oxford, MS. Our focus will continue to optimize the Oxford facility and maximize production output. During 2018, we initiated a cost reduction plan which will permanently close the ammunition assembly operations at our Winchester facility in Geelong, Australia.

INTERNATIONAL OPERATIONS

Olin has an international presence, including the geographic regions of Europe, Asia Pacific and Latin America. Approximately 43% of Olin's 2018 sales were generated outside of the U.S., including 35% of our Chlor Alkali Products and Vinyls 2018 segment sales, 68% of our Epoxy 2018 segment sales and 10% of our Winchester 2018 segment sales. See Note 21 "Segment Information" of the notes to consolidated financial statements contained in Item 8, for geographic segment data. We are incorporating our segment information from that Note into this section of our Form 10-K.

CUSTOMERS AND DISTRIBUTION

Products we sell to industrial or commercial users or distributors for use in the production of other products constitute a major part of our total sales. We sell some of our products, such as epoxy resins, caustic soda and sporting ammunition, to a large number of users or distributors, while we sell other products, such as chlorine and chlorinated organics, in substantial quantities to a relatively small number of industrial users. Olin has entered into or has significant relationships with a few customers including DowDuPont, who was our largest customer by revenue in 2018, representing approximately 14% of our total sales. We expect this relationship to continue to be significant to Olin and to represent more than 10% of our annual sales in the future. No other single customer accounted for more than 5% of sales. We discuss the customers for each of our three business segments in more detail above under "Products and Services."

We market most of our products and services primarily through our sales force and sell directly to various industrial customers, mass merchants, retailers, wholesalers, other distributors and the U.S. Government and its prime contractors.

Sales to all U.S. Government agencies and sales under U.S. Government contracting activities in total accounted for approximately 2% of sales in 2018. Because we engage in some government contracting activities and make sales to the U.S. Government, we are subject to extensive and complex U.S. Government procurement laws and regulations. These laws and regulations provide for ongoing government audits and reviews of contract procurement, performance and administration.
Failure to comply, even inadvertently, with these laws and regulations and with laws governing the export of munitions and other controlled products and commodities could subject us or one or more of our businesses to civil and criminal penalties, and under certain circumstances, suspension and debarment from future government contracts and the exporting of products for a specified period of time.

BACKLOG

The total amount of estimated backlog was approximately $224 million and $174 million as of January 31, 2019 and 2018, respectively. The backlog orders are associated with contractual orders in our Winchester business. Backlogs in our other businesses are not significant. Backlog is comprised of all open customer orders which have been received, but not yet shipped. The backlog was estimated based on expected volume to be shipped from firm contractual orders, which are subject to customary terms and conditions, including cancellation and modification

provisions. Approximately 59% of contracted backlog as of January 31, 2019 is expected to be fulfilled during 2019, with the remainder expected to be fulfilled during 2020.

COMPETITION

We are in active competition with businesses producing or distributing the same or similar products, as well as, in some instances, with businesses producing or distributing different products designed for the same uses.

Chlor alkali manufacturers in North America, with approximately 17 million tons of chlorine and 18 million tons of caustic soda capacity, accounted for approximately 17% of worldwide chlor alkali production capacity. In 2018, according to IHS, we have the largest chlor alkali capacity in North America and globally. While the technologies to manufacture and transport chlorine and caustic soda are widely available, the production facilities require large capital investments, and are subject to significant regulatory and permitting requirements. Approximately 76% of the total North American chlor alkali capacity is located in the U.S. Gulf Coast region. There is a worldwide market for caustic soda, which attracts imports and

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allows exports depending on market conditions. Other large chlor alkali producers in North America include The Occidental Petroleum Corporation (Oxy) and Westlake Chemical Corporation (Westlake).

We are also a leading integrated global producer of chlorinated organic products with a strong cost position due to our scale and access to chlor alkali feedstocks. This industry includes large diversified producers such as Oxy, Westlake and Solvay S.A., as well as multiple producers located in China.

We are a major global fully integrated epoxy producer, with access to key low cost feedstocks and a cost advantaged infrastructure. With its advantaged cost position, the Epoxy segment is among the lowest cost producers in the world. The markets in which our Epoxy segment operates are highly competitive and are dependent on significant capital investment, the development of proprietary technology and maintenance of product research and development. Among our competitors are Huntsman Corporation (Huntsman) and Hexion, Inc., as well as multiple producers located in Asia.

We are among the largest manufacturers in the U.S. of commercial small caliber ammunition based on independent market research sponsored by the National Shooting Sports Foundation (NSSF). Formed in 1961, NSSF has a membership of more than 12,000 manufacturers, distributors, firearms retailers, shooting ranges, sportsmen's organizations and publishers. According to NSSF, our Winchester business, Vista Outdoor Inc. (Vista), and Remington Outdoor Company, Inc. (Remington) are the three largest commercial ammunition manufacturers in the U.S. The ammunition industry is highly competitive with us, Vista, Remington, numerous smaller domestic manufacturers and foreign producers competing for sales to the commercial ammunition customers. Many factors influence our ability to compete successfully, including price, delivery, service, performance, product innovation and product recognition and quality, depending on the product involved.

EMPLOYEES

As of December 31, 2018, we had approximately 6,500 employees, with 5,400 working in the U.S. and 1,100 working in foreign countries. Various labor unions represent a significant number of our hourly-paid employees for collective bargaining purposes.

The following labor contract is scheduled to expire in 2019:

Location	Number of Employees	Expiration Date
McIntosh (Chlor Alkali Products and Vinyls)	197	April 2019

While we believe our relations with our employees and their various representatives are generally satisfactory, we cannot assure that we can conclude this labor contract or any other labor agreements without work stoppages and cannot assure that any work stoppages will not have a material adverse effect on our business, financial condition or results of operations.

RESEARCH ACTIVITIES; PATENTS

Our research activities are conducted on a product-group basis at a number of facilities. Company-sponsored research expenditures were $14.9 million in 2018, $14.5 million in 2017 and $10.9 million in 2016.

We own or license a number of patents, patent applications and trade secrets covering our products and processes. We believe that, in the aggregate, the rights under our patents and licenses are important to our operations, but we do not consider any individual patent, license or group of patents and licenses related to a specific process or product to be of material importance to our total business.

SEASONALITY

Our sales are affected by the cyclicality of the economy and the seasonality of several industries we serve, including building and construction, coatings, infrastructure, electronics, automotive, bleach, refrigerants and ammunition. The seasonality of the ammunition business is typically driven by the U.S. fall hunting season. Our chlor alkali businesses generally experience their highest level of activity during the spring and summer months, particularly when construction, refrigerants, coatings and infrastructure activity is higher. The chlor alkali industry is cyclical, both as a result of changes in demand for each of the co-produced products and as a result of the large increments in which new capacity is added and removed. Because chlorine and caustic soda are produced in a fixed ratio, the supply of one product can be constrained both by the physical capacity of the production facilities and/or by the ability to sell the co-produced product. Prices for both products respond rapidly to changes in supply and demand. The cyclicality of the chlor alkali industry has further impacts on

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downstream products. We have significant diversification of our chlorine outlets, which allow us to better manage the cyclical nature of the industry.

RAW MATERIALS AND ENERGY

Basic raw materials are processed through an integrated manufacturing process to produce a number of products that are sold at various points throughout the process. We purchase a portion of our raw material requirements and also utilize internal resources, co-products and finished goods as raw materials for downstream products. We believe we have reliable sources of supply for our raw materials under normal market conditions. However, we cannot predict the likelihood or impact of any future raw material shortages.

The principal basic raw materials for our production of Chlor Alkali Products and Vinyls' products are electricity, salt, ethylene and methanol. Electricity is the predominant energy source for our manufacturing facilities. Approximately 77% of our electricity is generated from natural gas or hydroelectric sources. We have long-term power supply contracts with DowDuPont in addition to utilizing our own power assets, which allow for cost differentiation at specific U.S. manufacturing sites. A portion of our purchases of raw materials, including ethylene, are made under long-term supply agreements, while approximately 69% of the salt used in our Chlor Alkali Products and Vinyls segment is produced from internal resources. Methanol is primarily sourced domestically and internationally from large producers.

The Epoxy segment's principal raw materials are chlorine, benzene, propylene and aromatics, which consist of cumene, phenol, acetone and BisA. A portion of our purchases of raw materials, including benzene, propylene and a portion of our aromatics requirements, are made under long-term supply agreements, while a portion of our aromatics requirements are produced from our integrated production chain. Chlorine is predominately sourced from our Chlor Alkali Products and Vinyls segment.

Lead, brass and propellant are the principal raw materials used in the Winchester business. We typically purchase our ammunition cartridge case cups and copper-based strip, and propellants pursuant to multi-year contracts.

We provide additional information with respect to specific raw materials in the tables set forth under "Products and Services."

ENVIRONMENTAL AND TOXIC SUBSTANCES CONTROLS

As is common in our industry, we are subject to environmental laws and regulations related to the use, storage, handling, generation, transportation, emission, discharge, disposal and remediation of, and exposure to, hazardous and non-hazardous substances and wastes in all of the countries in which we do business.

The establishment and implementation of national, state or provincial and local standards to regulate air, water and land quality affect substantially all of our manufacturing locations around the world. Laws providing for regulation of the manufacture, transportation, use and disposal of hazardous and toxic substances, and remediation of contaminated sites have imposed additional regulatory requirements on industry, particularly the chemicals industry. In addition, implementation of environmental laws has required and will continue to require new capital expenditures and will increase operating costs.

We are a party to various government and private environmental actions associated with former waste disposal sites and past manufacturing facilities. Charges to income for investigatory and remedial efforts were $7.3 million, $10.3 million and $9.2 million for the years ended December 31, 2018, 2017 and 2016, respectively. These charges may be material to operating results in future years. These charges do not include insurance recoveries for costs incurred and

expensed in prior periods.

In connection with the October 5, 2015 acquisition of DowDuPont's U.S. Chlor Alkali and Vinyl, Global Chlorinated Organics and Global Epoxy businesses, the prior owner of the businesses retained liabilities relating to releases of hazardous materials and violations of environmental law to the extent arising prior to October 5, 2015.

See our discussion of our environmental matters contained in Item 3—"Legal Proceedings" below, Note 22 "Environmental" of the notes to consolidated financial statements contained in Item 8 and Item 7—"Management's Discussion and Analysis of Financial Condition and Results of Operations."

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Item 1A. RISK FACTORS

In addition to the other information in this Form 10-K, the following factors should be considered in evaluating Olin and our business. All of our forward-looking statements should be considered in light of these factors. Additional risks and uncertainties that we are unaware of or that we currently deem immaterial also may become important factors that affect us.

Sensitivity to Global Economic Conditions and Cyclicality—Our operating results could be negatively affected during economic downturns.

The businesses of most of our customers, particularly our vinyls, urethanes and pulp and paper customers are, to varying degrees, cyclical and have historically experienced periodic downturns. These economic and industry downturns have been characterized by diminished product demand, excess manufacturing capacity and, in some cases, lower average selling prices. Therefore, any significant downturn in our customers' businesses or in global economic conditions could result in a reduction in demand for our products and could adversely affect our results of operations or financial condition.

Although a majority of our sales are within North America, a large part of our financial performance is dependent upon a healthy economy beyond North America because we have a significant amount of sales abroad and our customers sell their products abroad. As a result, our business is and will continue to be affected by general economic conditions and other factors in Europe, Asia Pacific, particularly China, and Latin America, including fluctuations in interest rates, customer demand, labor and energy costs, currency changes and other factors beyond our control. The demand for our products and our customers' products is directly affected by such fluctuations. In addition, our customers could decide to move some or all of their production to foreign locations, and this could reduce demand in North America for our products. We cannot assure you that events having an adverse effect on the industries in which we operate will not occur or continue, such as a downturn in the European, Asian Pacific, particularly Chinese, Latin American, or world economies, increases in interest rates or unfavorable currency fluctuations. Economic conditions in other regions of the world, predominantly Asia and Europe, can increase the amount of caustic soda produced and available for export to North America. The increased caustic soda supply can put downward pressure on our caustic soda prices, negatively impacting our profitability.

Cyclical Pricing Pressure—Our profitability could be reduced by declines in average selling prices of our products, particularly declines in ECU netbacks for chlorine and caustic soda.

Our historical operating results reflect the cyclical and sometimes volatile nature of the chemical and ammunition industries. We experience cycles of fluctuating supply and demand in each of our business segments, particularly in our Chlor Alkali Products and Vinyls segment, which result in changes in selling prices. Periods of high demand, tight supply and increasing operating margins tend to result in increases in capacity and production until supply exceeds demand, generally followed by periods of oversupply and declining prices. Another factor influencing demand and pricing for chlorine and caustic soda is the price of natural gas. Higher natural gas prices increase our customers' and competitors' manufacturing costs, and depending on the ratio of crude oil to natural gas prices, could make them less competitive in world markets.

In the chlor alkali industry, price is the major supplier selection criterion. We have little or no ability to influence prices in these large commodity markets. Decreases in the average selling prices of our products could have a material adverse effect on our profitability. While we strive to maintain or increase our profitability by reducing costs through improving production efficiency, emphasizing higher margin products and by controlling transportation, selling and administration expenses, we cannot assure you that these efforts will be sufficient to fully offset the effect of possible decreases in pricing on operating results.

Because of the cyclical nature of our businesses, we cannot assure you that pricing or profitability in the future will be comparable to any particular historical period, including the most recent period shown in our operating results. We cannot assure you that the chlor alkali industry will not experience adverse trends in the future, or that our business, financial condition and results of operations will not be adversely affected by them.

Our Winchester and Epoxy segments are also subject to changes in operating results as a result of cyclical pricing pressures, but to a lesser extent than our Chlor Alkali Products and Vinyls segment. Selling prices of ammunition and

epoxy materials are affected by changes in raw material costs and availability and customer demand, and declines in average selling prices of products of our Winchester and Epoxy segments could adversely affect our profitability.

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Suppliers—We rely on a limited number of third-party suppliers for specified feedstocks and services.
We obtain a significant portion of our raw materials from a few key suppliers. If any of these suppliers are unable to meet their obligations under present or any future supply agreements, we may be forced to pay higher prices to obtain the necessary raw materials. Any interruption of supply or any price increase of raw materials could have a material adverse effect on our business, financial condition and results of operations. We have entered into long-term agreements with DowDuPont to provide specified feedstocks and services for a number of our facilities. These facilities are dependent upon DowDuPont's infrastructure for services such as wastewater and ground water treatment. Any failure of DowDuPont to perform its obligations under those agreements could adversely affect the operation of the affected facilities and our business, financial condition and results of operations. Most of these agreements are automatically renewable after their initial terms, but may be terminated by us or DowDuPont after specified notice periods. If we are required to obtain an alternate source for these feedstocks or services, we may not be able to obtain pricing on as favorable terms. Additionally, we may be forced to pay additional transportation costs or to invest in capital projects for pipelines or alternate facilities to accommodate railcar or other delivery methods or to replace other services.
A vendor may choose, subject to existing contracts, to modify its relationship due to general economic concerns or concerns relating to the vendor or us, at any time. Any significant change in the terms that we have with our key suppliers could materially and adversely affect our business, financial condition and results of operations, as could significant additional requirements from suppliers that we provide them additional security in the form of prepayments or posting letters of credit.
Raw Materials—Availability of purchased feedstocks and energy, and the volatility of these costs, impact our operating costs and add variability to earnings.
Purchased feedstock and energy costs account for a substantial portion of our total production costs and operating expenses. We purchase certain raw materials as feedstocks.
Feedstock and energy costs generally follow price trends in crude oil and natural gas, which are sometimes volatile. Ultimately, the ability to pass on underlying cost increases is dependent on market conditions. Conversely, when feedstock and energy costs decline, selling prices generally decline as well. As a result, volatility in these costs could impact our business, financial condition and results of operations.
If the availability of any of our principal feedstocks is limited or we are unable to obtain natural gas or energy from any of our energy sources, we may be unable to produce some of our products in the quantities demanded by our customers, which could have a material adverse effect on plant utilization and our sales of products requiring such raw materials. We have long-term supply contracts with various third parties for certain raw materials, including ethylene, electricity, propylene and benzene. As these contracts expire, we may be unable to renew these contracts or obtain new long-term supply agreements on terms comparable or as favorable to us, depending on market conditions, which may have a material adverse effect on our business, financial condition and results of operations. In addition, many of our long-term contracts contain provisions that allow our suppliers to limit the amount of raw materials shipped to us below the contracted amount in force majeure circumstances. If we are required to obtain alternate sources for raw materials because our suppliers are unwilling or unable to perform under raw material supply agreements or if a supplier terminates its agreements with us, we may not be able to obtain these raw materials from alternative suppliers or obtain new long-term supply agreements on terms comparable or favorable to us.
Cost Control—Our profitability could be reduced if we experience increasing raw material, utility, transportation or logistics costs, or if we fail to achieve targeted cost reductions.
Our operating results and profitability are dependent upon our continued ability to control, and in some cases reduce, our costs. If we are unable to do so, or if costs outside of our control, particularly our costs of raw materials, utilities, transportation and similar costs, increase beyond anticipated levels, our profitability will decline.
For example, our chlor alkali product transportation costs, particularly railroad shipment costs, have been increasing over the past several years. If transportation costs continue to increase, and we are unable to control those costs or pass the increased costs on to customers, our profitability in our Chlor Alkali Products and Vinyls and Epoxy segments would be negatively affected. Similarly, costs of commodity metals and other materials used in our Winchester business, such as copper and lead, can vary. If we experience significant increases in these costs and are unable to

raise our prices to offset the higher costs, the profitability in our Winchester business would be negatively affected.

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Third-Party Transportation—We rely heavily on third-party transportation, which subjects us to risks and costs that we cannot control, and which risks and costs may have a material adverse effect on our financial position or results of operations.

We rely heavily on railroad, truck, marine vessel, barge and other shipping companies to transport finished products to customers and to transport raw materials to the manufacturing facilities used by each of our businesses. These transport operations are subject to various hazards and risks, including extreme weather conditions, work stoppages and operating hazards, as well as domestic and international transportation and maritime regulations. In addition, the methods of transportation we utilize, including shipping chlorine and other chemicals by railroad and by barge, may be subject to additional, more stringent and more costly regulations in the future. If we are delayed or unable to ship finished products or unable to obtain raw materials as a result of any such new regulations or public policy changes related to transportation safety, or these transportation companies' failure to operate properly, or if there are significant changes in the cost of these services due to new additional regulations, or otherwise, we may not be able to arrange efficient alternatives and timely means to obtain raw materials or ship goods, which could result in a material adverse effect on our business, financial position or results of operations. If any third-party railroad which we utilize to transport chlorine and other chemicals ceases to transport toxic-by-inhalation hazardous (TIH) materials, or if there are significant changes in the cost of shipping TIH materials by rail or otherwise, we may not be able to arrange efficient alternatives and timely means to deliver our products or at all, which could result in a material adverse effect on our business, financial position or results of operations.

Security and Chemicals Transportation—New regulations on the transportation of hazardous chemicals and/or the security of chemical manufacturing facilities and public policy changes related to transportation safety could result in significantly higher operating costs.

The transportation of our products and feedstocks, including transportation by pipeline, and the security of our chemical manufacturing facilities are subject to extensive regulation. Government authorities at the local, state and federal levels could implement new or stricter regulations that would impact the security of chemical plant locations and the transportation of hazardous chemicals. Our Chlor Alkali Products and Vinyls and Epoxy segments could be adversely impacted by the cost of complying with any new regulations. Our business also could be adversely affected if an incident were to occur at one of our facilities or while transporting products. The extent of the impact would depend on the requirements of future regulations and the nature of an incident, which are unknown at this time.

Production Hazards—Our facilities are subject to operating hazards, which may disrupt our business.

We are dependent upon the continued safe operation of our production facilities. Our production facilities are subject to hazards associated with the manufacture, handling, storage and transportation of chemical materials and products and ammunition, including leaks and ruptures, explosions, fires, inclement weather and natural disasters, unexpected utility disruptions or outages, unscheduled downtime, transportation interruptions, transportation accidents involving our chemical products, chemical spills and other discharges or releases of toxic or hazardous substances or gases and environmental hazards. From time to time in the past, we have had incidents that have temporarily shut down or otherwise disrupted our manufacturing, causing production delays and resulting in liability for workplace injuries and fatalities. Some of our products involve the manufacture and/or handling of a variety of explosive and flammable materials. Use of these products by our customers could also result in liability if an explosion, fire, spill or other accident were to occur. We cannot assure you that we will not experience these types of incidents in the future or that these incidents will not result in production delays or otherwise have a material adverse effect on our business, financial condition or results of operations. Major hurricanes have caused significant disruption in our operations on the U.S. Gulf Coast, logistics across the region and the supply of certain raw materials, which have had an adverse impact on volume and cost for some of our products. Due to the substantial presence we have on the U.S. Gulf Coast, similar severe weather conditions or other natural phenomena in the future could negatively affect our results of operations, for which we may not be fully insured.

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Integration of Information Technology Systems—Operation on multiple Enterprise Resource Planning (ERP) information systems, and the conversion to a new system, may negatively impact our operations.

We are highly dependent on our information systems infrastructure in order to process orders, track inventory, ship products in a timely manner, prepare invoices to our customers, maintain regulatory compliance and otherwise carry on our business in the ordinary course. We currently operate on multiple ERP information systems. Since we are required to process and reconcile our information from multiple systems, the chance of errors is greater. Inconsistencies in the information from multiple ERP systems could adversely impact our ability to manage our business efficiently and may result in heightened risk to our ability to maintain our books and records and comply with regulatory requirements. In 2017, we began a multi-year implementation of new enterprise resource planning, manufacturing, and engineering systems. The project includes the required information technology infrastructure (collectively, the Information Technology Project). The project is planned to standardize business processes across the chemicals businesses with the objective of maximizing cost effectiveness, efficiency and control across our global operations. The project is anticipated to be completed during 2020. The transition to a new ERP system involves numerous risks, including:

- diversion of management's attention away from normal daily business operations;
- loss of, or delays in accessing, data;
- increased demand on our operations support personnel;
- increased costs;
- initial dependence on unfamiliar systems while training personnel to use new systems; and
- increased operating expenses resulting from training, conversion and transition support activities.

Any of the foregoing could result in a material increase in information technology compliance or other related costs, and could materially and negatively impact our business, financial condition or results of operations.

Effects of Regulation—Changes in or failure to comply with legislation or government regulations or policies could have a material adverse effect on our financial position or results of operations.

Legislation or regulations that may be adopted or modified by U.S. or foreign governments, including import and export duties and quotas, anti-dumping regulations and related tariffs, and tax regulation could significantly affect the sales, costs and profitability of our business. The chemical and ammunition industries are subject to legislative and regulatory actions, which could have a material adverse effect on our business, financial position or results of operations. Existing and future government regulations and laws may reduce the demand for our products, including certain chlorinated organic products, such as dry cleaning solvents. Any decrease in the demand for chlorinated organic products could result in lower unit sales and lower selling prices for such chlorinated organic products, which would have a material adverse effect on our business, financial condition and results of operations.

Information Security—A failure of our information technology systems, or an interruption in their operation due to internal or external factors including cyber-attacks, could have a material adverse effect on our business, financial condition or results of operations.

Our operations are dependent on our ability to protect our information systems, computer equipment and information databases from systems failures. We rely on our information technology systems generally to manage the day-to-day operation of our business, operate elements of our manufacturing facilities, manage relationships with our customers, fulfill customer orders and maintain our financial and accounting records. Failure of our information technology systems could be caused by internal or external events, such as incursions by intruders or hackers, computer viruses, cyber-attacks, failures in hardware or software, or power or telecommunication fluctuations or failures. The failure of our information technology systems to perform as anticipated for any reason or any significant breach of security could disrupt our business and result in numerous adverse consequences, including reduced effectiveness and efficiency of operations, increased costs or loss of important information, any of which could have a material adverse effect on our business, financial condition or results of operations. We have technology and information security processes and disaster recovery plans in place to mitigate our risk to these vulnerabilities. However, these measures may not be adequate to ensure that our operations will not be disrupted, should such an event occur.

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Imbalance in Demand for Our Chlor Alkali Products—A loss of a substantial customer for our chlorine or caustic soda could cause an imbalance in customer demand for these products, which could have an adverse effect on our results of operations.

Chlorine and caustic soda are produced simultaneously and in a fixed ratio of 1.0 ton of chlorine to 1.1 tons of caustic soda. The loss of a substantial chlorine or caustic soda customer could cause an imbalance in customer demand for our chlorine and caustic soda products. An imbalance in customer demand may require Olin to reduce production of both chlorine and caustic soda or take other steps to correct the imbalance. Since Olin cannot store large quantities of chlorine, we may not be able to respond to an imbalance in customer demand for these products as quickly or efficiently as some of our competitors. If a substantial imbalance occurred, we would need to reduce prices or take other actions that could have a material adverse impact on our business, results of operations and financial condition.

Pension Plans—The impact of declines in global equity and fixed income markets on asset values and any declines in interest rates and/or improvements in mortality assumptions used to value the liabilities in our pension plans may result in higher pension costs and the need to fund the pension plans in future years in material amounts.

We sponsor domestic and foreign defined benefit pension plans for eligible employees and retirees. Substantially all domestic defined benefit pension plan participants are no longer accruing benefits. However, a portion of our bargaining hourly employees continue to participate in our domestic qualified defined benefit pension plans under a flat-benefit formula. Our funding policy for the qualified defined benefit pension plans is consistent with the requirements of federal laws and regulations. Our foreign subsidiaries maintain pension and other benefit plans, which are consistent with local statutory practices. The determinations of pension expense and pension funding are based on a variety of rules and regulations. Changes in these rules and regulations could impact the calculation of pension plan liabilities and the valuation of pension plan assets. They may also result in higher pension costs, additional financial statement disclosure, and the need to fund the pension plan.

At December 31, 2018, the projected benefit obligation of $2,661.9 million exceeded the market value of assets in our qualified defined benefit pension plans by $668.9 million, as calculated under Accounting Standards Codification (ASC) 715 “Compensation—Retirement Benefits” (ASC 715). During 2016, we made a discretionary cash contribution to our domestic qualified defined benefit pension plan of $6.0 million. Based on our plan assumptions and estimates, we will not be required to make any cash contributions to the domestic qualified defined benefit pension plan at least through 2019.

We also have several international qualified defined benefit pension plans to which we made cash contributions of $2.6 million in 2018, $1.7 million in 2017 and $1.3 million in 2016, and we anticipate less than $5 million of cash contributions to international qualified defined benefit pension plans in 2019.

The impact of declines in global equity and fixed income markets on asset values may result in higher pension costs and may increase and accelerate the need to fund the pension plans in future years. For example, holding all other assumptions constant, a 100-basis point decrease or increase in the assumed long-term rate of return on plan assets for our domestic qualified defined benefit pension plan would have decreased or increased, respectively, the 2018 defined benefit pension plan income by approximately $19.9 million. Holding all other assumptions constant for our domestic qualified defined benefit pension plan, a 50-basis point decrease in the discount rate used to calculate pension income for 2018 and the projected benefit obligation as of December 31, 2018 would have decreased pension income by $0.5 million and increased the projected benefit obligation by $137.0 million. A 50-basis point increase in the discount rate used to calculate pension income for 2018 and the projected benefit obligation as of December 31, 2018 for our domestic qualified defined benefit pension plan would have increased pension income by $0.7 million and decreased the projected benefit obligation by $125.0 million.

Litigation and Claims—We are subject to litigation and other claims, which could cause us to incur significant expenses. We are regularly a defendant in legal proceedings relating to our present and former operations. These include contract disputes, product liability claims, including ammunition and firearms, and proceedings alleging injurious exposure of plaintiffs to various chemicals and other substances (including proceedings based on alleged exposures to asbestos). Frequently, the proceedings alleging injurious exposure involve claims made by numerous plaintiffs against many defendants. Because of the inherent uncertainties of litigation, we are unable to predict the outcome of these proceedings and therefore cannot determine whether the financial impact, if any, will be material to our financial

position, cash flows or results of operations.

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International Sales and Operations—We are subject to risks associated with our international sales and operations that could have a material adverse effect on our business or results of operations.
Olin has an international presence, including the geographic regions of Europe, Asia Pacific and Latin America. In 2018, approximately 43% of our sales were generated outside of the United States. These international sales and operations expose us to risks, including:

- difficulties and costs associated with complying with complex and varied laws, treaties, and regulations;
- tariffs and trade barriers;
- changes in laws and regulations, including the imposition of economic or trade sanctions affecting international commercial transactions;
- risk of non-compliance with anti-bribery laws and regulations, such as the U.S. Foreign Corrupt Practices Act;
- restrictions on, or difficulties and costs associated with, the repatriation of cash from foreign countries to the United States;
- unfavorable currency fluctuations;
- changes in local economic conditions;
- unexpected changes in political or regulatory environments;
- labor compliance and costs associated with a global workforce;
- data privacy regulations;
- difficulties in maintaining overseas subsidiaries and international operations; and
- challenges in protecting intellectual property rights.

Any one or more of the above factors could have a material adverse effect on our business, financial condition or results of operations.
Credit Facility—Weak industry conditions could affect our ability to comply with the financial maintenance covenants in our senior credit facility.
Our senior credit facility includes certain financial maintenance covenants requiring us to not exceed a maximum leverage ratio and to maintain a minimum coverage ratio.
Depending on the magnitude and duration of chlor alkali cyclical downturns, including deterioration in prices and volumes, there can be no assurance that we will continue to be in compliance with these ratios. If we failed to comply with either of these covenants in a future period and were not able to obtain waivers from the lenders, we would need to refinance our current senior credit facility. However, there can be no assurance that such refinancing would be available to us on terms that would be acceptable to us or at all.

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Ability to Attract and Retain Qualified Employees—We must attract, retain and motivate key employees, and the failure to do so may adversely affect our business, financial condition or results of operations.

We feel our success depends on hiring, retaining and motivating key employees, including executive officers. We may have difficulty locating and hiring qualified personnel. In addition, we may have difficulty retaining such personnel once hired, and key people may leave and compete against us. The loss of key personnel or our failure to attract and retain other qualified and experienced personnel could disrupt or materially adversely affect our business, financial condition or results of operations. In addition, our operating results could be adversely affected by increased costs due to increased competition for employees or higher employee turnover, which may result in the loss of significant customer business or increased costs.

Indebtedness—Our indebtedness could adversely affect our financial condition.

As of December 31, 2018, we had $3,230.3 million of indebtedness outstanding. Outstanding indebtedness does not include amounts that could be borrowed under our $600.0 million senior revolving credit facility, under which $596.5 million was available for borrowing as of December 31, 2018 because we had issued $3.5 million of letters of credit. As of December 31, 2018, our indebtedness represented 53.3% of our total capitalization. At December 31, 2018, $125.9 million of our indebtedness was due within one year. Despite our level of indebtedness, we expect to continue to have the ability to borrow additional debt.

Our indebtedness could have important consequences, including but not limited to:

- limiting our ability to fund working capital, capital expenditures, and other general corporate purposes;
- limiting our ability to accommodate growth by reducing funds otherwise available for other corporate purposes and to compete, which in turn could prevent us from fulfilling our obligations under our indebtedness;
- limiting our operational flexibility due to the covenants contained in our debt agreements;
- to the extent that our debt is subject to floating interest rates, increasing our vulnerability to fluctuations in market interest rates;
- limiting our ability to pay cash dividends;
- limiting our flexibility for, or reacting to, changes in our business or industry or economic conditions, thereby limiting our ability to compete with companies that are not as highly leveraged; and
- increasing our vulnerability to economic downturns.

Our ability to generate sufficient cash flow from operations to make scheduled payments on our debt will depend on a range of economic, competitive and business factors, many of which are outside our control. There can be no assurance that our business will generate sufficient cash flow from operations to make these payments. If we are unable to meet our expenses and debt obligations, we may need to refinance all or a portion of our indebtedness before maturity, sell assets or issue additional equity. We may not be able to refinance any of our indebtedness, sell assets or issue 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 to satisfy our debt obligations, or to refinance our debt obligations on commercially reasonable terms, would have a material adverse effect on our business, financial condition and results of operations, as well as on our ability to satisfy our debt obligations.

Environmental Costs—We have ongoing environmental costs, which could have a material adverse effect on our financial position or results of operations.

Our operations and assets are subject to extensive environmental, health and safety regulations, including laws and regulations related to air emissions, water discharges, waste disposal and remediation of contaminated sites. The nature of our operations and products, including the raw materials we handle, exposes us to the risk of liabilities,

obligations or claims under these laws and regulations due to the production, storage, use, transportation and sale of materials that can adversely impact the environment or cause personal injury, including, in the case of chemicals, unintentional releases into the environment. Environmental laws may have a significant effect on the costs of use, transportation and storage of raw materials and finished products, as well as the costs of storage, transportation and disposal of wastes. In addition, we are party to various government and private environmental actions associated with past manufacturing facilities and former waste disposal sites. We have incurred, and expect to incur, significant costs and capital expenditures in complying with environmental laws and regulations.

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The ultimate costs and timing of environmental liabilities are difficult to predict. Liabilities under environmental laws relating to contaminated sites can be imposed retroactively and on a joint and several basis. One liable party could be held responsible for all costs at a site, regardless of fault, percentage of contribution to the site or the legality of the original disposal. We could incur significant costs, including clean-up costs, natural resource damages, civil or criminal fines and sanctions and third-party lawsuits claiming, for example, personal injury and/or property damage, as a result of past or future violations of, or liabilities under, environmental or other laws.

In addition, future events, such as changes to or more rigorous enforcement of environmental laws, could require us to make additional expenditures, modify or curtail our operations and/or install additional pollution control equipment. It is possible that regulatory agencies may enact new or more stringent clean-up standards for chemicals of concern, including chlorinated organic products that we manufacture. This could lead to expenditures for environmental remediation in the future that are additional to existing estimates.

Accordingly, it is possible that some of the matters in which we are involved or may become involved may be resolved unfavorably to us, which could materially and adversely affect our business, financial position, cash flows or results of operations. See “Environmental Matters” contained in Item 7—“Management’s Discussion and Analysis of Financial Condition and Results of Operations.”

Labor Matters—We cannot assure you that we can conclude future labor contracts or any other labor agreements without work stoppages.

Various labor unions represent a significant number of our hourly paid employees for collective bargaining purposes. The following labor contract is scheduled to expire in 2019:

Location	Number of Employees	Expiration Date
McIntosh (Chlor Alkali Products and Vinyls)	197	April 2019

While we believe our relations with our employees and their various representatives are generally satisfactory, we cannot assure that we can conclude any labor agreements without work stoppages and cannot assure that any work stoppages will not have a material adverse effect on our business, financial condition or results of operations.

Asset Impairment—If our goodwill, other intangible assets or property, plant and equipment become impaired in the future, we may be required to record non-cash charges to earnings, which could be significant.

The process of impairment testing for our goodwill involves a number of judgments and estimates made by management including future cash flows, discount rates, profitability assumptions and terminal growth rates with regards to our reporting units. Our internally generated long-range plan includes cyclical assumptions regarding pricing and operating forecasts for the chlor alkali industry. If the judgments and estimates used in our analysis are not realized or are affected by external factors, then actual results may not be consistent with these judgments and estimates, and we may be required to record a goodwill impairment charge in the future, which could be significant and have an adverse effect on our financial position and results of operations.

We review long-lived assets, including property, plant and equipment and identifiable amortizing intangible assets, for impairment whenever changes in circumstances or events may indicate that the carrying amounts are not recoverable. If the fair value is less than the carrying amount of the asset, an impairment is recognized for the difference. Factors which may cause an impairment of long-lived assets include significant changes in the manner of use of these assets, negative industry or market trends, a significant underperformance relative to historical or projected future operating results, extended period of idleness or a likely sale or disposal of the asset before the end of its estimated useful life. If our property, plant and equipment and identifiable amortizing intangible assets are determined to be impaired in the future, we may be required to record non-cash charges to earnings during the period in which the impairment is determined, which could be significant and have an adverse effect on our financial position and results of operations.

Credit and Capital Market Conditions—Adverse conditions in the credit and capital markets may limit or prevent our ability to borrow or raise capital.

While we believe we have facilities in place that should allow us to borrow funds as needed to meet our ordinary course business activities, adverse conditions in the credit and financial markets could prevent us from obtaining financing, if the need arises. Our ability to invest in our businesses and refinance or repay maturing debt obligations could require access to the credit and capital markets and sufficient bank credit lines to support cash requirements. If

we are unable to access the credit and capital markets on commercially reasonable terms, we could experience a material adverse effect on our business, financial position or results of operations.

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Item 1B. UNRESOLVED STAFF COMMENTS

Not applicable.

Item 2. PROPERTIES

Information concerning our principal locations from which our products and services are manufactured, distributed or marketed are included in the tables set forth under the caption "Products and Services" contained in Item 1—"Business." Generally, these facilities are well maintained, in good operating condition, and suitable and adequate for their use. Our two largest facilities are co-located with DowDuPont. The land in which these facilities are located is leased with a 99 year initial term that commenced in 2015. Additionally, we lease warehouses, terminals and distribution offices and space for executive and branch sales offices and service departments. We believe our current facilities are adequate to meet the requirements of our present operations.

Item 3. LEGAL PROCEEDINGS

Saltville

We have completed all work in connection with remediation of mercury contamination at the site of our former mercury cell chlor alkali plant in Saltville, VA required to date. In mid-2003, the Trustees for natural resources in the North Fork Holston River, the Main Stem Holston River and associated floodplains, located in Smyth and Washington Counties in Virginia and in Sullivan and Hawkins Counties in Tennessee notified us of, and invited our participation in, an assessment of alleged damages to natural resources resulting from the release of mercury. The Trustees also notified us that they have made a preliminary determination that we are potentially liable for natural resource damages in said rivers and floodplains. We agreed to participate in the assessment. We and the Trustees have entered into discussions concerning a resolution of this matter. In light of the ongoing discussions and inherent uncertainties of the assessment, we cannot at this time determine whether the financial impact, if any, of this matter will be material to our financial position or results of operations. See "Environmental Matters" contained in Item 7—"Management's Discussion and Analysis of Financial Condition and Results of Operations."

Other

As part of the continuing environmental investigation by federal, state and local governments of waste disposal sites, we have entered into a number of settlement agreements requiring us to participate in the investigation and cleanup of a number of sites. Under the terms of such settlements and related agreements, we may be required to manage or perform one or more elements of a site cleanup, or to manage the entire remediation activity for a number of parties, and subsequently seek recovery of some or all of such costs from other Potentially Responsible Parties (PRPs). In many cases, we do not know the ultimate costs of our settlement obligations at the time of entering into particular settlement agreements, and our liability accruals for our obligations under those agreements are often subject to significant management judgment on an ongoing basis. Those cost accruals are provided for in accordance with generally accepted accounting principles and our accounting policies set forth in "Environmental Matters" contained in Item 7—"Management's Discussion and Analysis of Financial Condition and Results of Operations."

We, and our subsidiaries, are defendants in various legal actions (including proceedings based on alleged exposures to asbestos) incidental to our past and current business activities. At December 31, 2018 and 2017, our consolidated balance sheets included liabilities for these legal actions of $15.6 million and $24.8 million, respectively. These liabilities do not include costs associated with legal representation and do not include $8.0 million of insurance recoveries included in receivables, net within the accompanying consolidated balance sheet as of December 31, 2017. Based on our analysis, and considering the inherent uncertainties associated with litigation, we do not believe

that it is reasonably possible that these legal actions will materially and adversely affect our financial position, cash flows or results of operations.

In connection with the October 5, 2015 acquisition of DowDuPont's U.S. Chlor Alkali and Vinyl, Global Chlorinated Organics and Global Epoxy businesses, the prior owner of the businesses retained liabilities relating to litigation, releases of hazardous materials and violations of environmental law to the extent arising prior to October 5, 2015.

Item 4. MINE SAFETY DISCLOSURES

Not applicable.

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PART II

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

As of January 31, 2019, we had 3,718 record holders of our common stock.

Our common stock is traded on the NYSE under the "OLN" ticker symbol.

A dividend of $0.20 per common share was paid during each of the four quarters in 2018 and 2017.

Issuer Purchases of Equity Securities

Period	Total Number of Shares (or Units) Purchased [1]	Average Price Paid per Share (or Unit)	Total Number of Shares (or Units) Purchased as Part of Publicly Announced Plans or Programs	Maximum Dollar Value of Shares (or Units) that May Yet Be Purchased Under the Plans or Programs
October 1-31, 2018	52,323	$ 25.27	52,323	
November 1-30, 2018	1,236,851	20.87	1,236,851	
December 1-31, 2018	301,481	20.13	301,481	
Total				$449,950,761 [1]

(1) On April 26, 2018, our board of directors authorized a share repurchase program for the purchase of shares of common stock at an aggregate price of up to $500.0 million. This program will terminate upon the purchase of $500.0 million of our common stock. Through December 31, 2018, 2,138,103 shares had been repurchased at a total value of $50,049,239 and $449,950,761 of common stock remained available for purchase under the program.

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Performance Graph

This graph compares the total shareholder return on our common stock with the cumulative total return of the Standard & Poor's 1000 Index (the S&P 1000 Index) and our current peer group of four companies comprised of: Huntsman, Trinseo S.A., Oxy and Westlake (collectively, the Peer Group).

COMPARISON OF FIVE YEAR CUMULATIVE TOTAL RETURN Among Olin Corporation, the S&P 1000 Index, and the Peer Group

	12/13	12/14	12/15	12/16	12/17	12/18
Olin Corporation	100	81	64	99	141	82
S&P 1000 Index	100	109	106	130	150	135
Peer Group	100	92	79	91	111	88

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Data is for the five-year period from December 31, 2013 through December 31, 2018. The cumulative return includes reinvestment of dividends. The Peer Group is weighted in accordance with market capitalization (closing stock price multiplied by the number of shares outstanding) as of the beginning of each of the five years covered by the performance graph. We calculated the weighted return for each year by multiplying (a) the percentage that each corporation's market capitalization represented of the total market capitalization for all corporations in the Peer Group for such year by (b) the total shareholder return for that corporation for such year.

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Item 6. SELECTED FINANCIAL DATA

FIVE-YEAR SUMMARY

	2018	2017	2016	2015	2014
Operations	($ and shares in millions, except per share data)				
Sales	$6,946	$6,268	$5,551	$2,854	$2,241
Cost of goods sold	5,822	5,555	4,945	2,499	1,863
Selling and administration	431	369	347	201	179
Restructuring charges	22	38	113	3	16
Acquisition-related costs	1	13	49	76	4
Other operating income	6	3	11	46	2
Earnings (losses) of non-consolidated affiliates	(20)	2	2	2	2
Interest expense	243	217	192	97	44
Interest income and other income	2	2	3	1	1
Non-operating pension income (expense)	22	34	45	(20)	23
Income (loss) before taxes from continuing operations	437	117	(34)	7	163
Income tax provision (benefit)	109	(432)	(30)	8	58
Income (loss) from continuing operations	328	549	(4)	(1)	105
Discontinued operations, net	—	—	—	—	1
Net income (loss)	$328	$549	$(4)	$(1)	$106
Financial position					
Cash and cash equivalents	$179	$218	$185	$392	$257
Working capital, excluding cash and cash equivalents	410	527	439	395	182
Property, plant and equipment, net	3,482	3,576	3,705	3,953	931
Total assets	8,997	9,218	8,763	9,289	2,689
Capitalization:					
Short-term debt	126	1	81	205	16
Long-term debt	3,104	3,611	3,537	3,644	650
Shareholders' equity	2,832	2,754	2,273	2,419	1,013
Total capitalization	$6,062	$6,366	$5,891	$6,268	$1,679
Per share data					
Basic:					
Continuing operations	$1.97	$3.31	$(0.02)	$(0.01)	$1.33
Discontinued operations, net	—	—	—	—	0.01
Net income (loss)	$1.97	$3.31	$(0.02)	$(0.01)	$1.34
Diluted:					
Continuing operations	$1.95	$3.26	$(0.02)	$(0.01)	$1.32
Discontinued operations, net	—	—	—	—	0.01
Net income (loss)	$1.95	$3.26	$(0.02)	$(0.01)	$1.33
Common cash dividends	0.80	0.80	0.80	0.80	0.80
Other					
Capital expenditures	$385	$294	$278	$131	$72
Depreciation and amortization	601	559	534	229	139
Common dividends paid	134	133	132	80	63
Repurchases of common stock	50	—	—	—	65
Current ratio	1.5	1.8	1.7	1.7	2.2
Total debt to total capitalization	53.3 %	56.7 %	61.4 %	61.4 %	39.7 %
Effective tax rate	25.0 %	(368.9)%	88.6 %	120.9 %	35.5 %

Average common shares outstanding - diluted	168.4	168.5	165.2	103.4	79.7
Shareholders	3,700	3,900	4,200	4,500	3,600
Employees	6,500	6,400	6,400	6,200	3,900

On October 5, 2015 (the Closing Date), we acquired from DowDuPont its U.S. Chlor Alkali and Vinyl, Global Chlorinated Organics and Global Epoxy businesses (collectively, the Acquired Business) using a Reverse Morris Trust Structure (collectively, the Acquisition). Since the Closing Date, our Selected Financial Data reflects the operating results of the Acquired Business. Our Selected Financial Data also reflects the adoption of Accounting Standards Update (ASU) 2017-07, “Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost” which required retrospective application. See Note 3 “Recent Accounting Pronouncements” of the notes to consolidated financial statements contained in Item 8. For the year ended December 31, 2015, non-operating pension income (expense) included $47.1 million of costs incurred as a result of the change in control which created a mandatory acceleration of expenses under our domestic non-qualified pension plan as a result of the Acquisition. These costs were previously included in acquisition-related costs.

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

BUSINESS BACKGROUND

We are a leading vertically-integrated global manufacturer and distributor of chemical products and a leading U.S. manufacturer of ammunition. Our operations are concentrated in three business segments: Chlor Alkali Products and Vinyls, Epoxy and Winchester. All of our business segments are capital intensive manufacturing businesses. Chlor Alkali Products and Vinyls operating rates are closely tied to the general economy. Each segment has a commodity element to it, and therefore, our ability to influence pricing is quite limited on the portion of the segment's business that is strictly commodity.

Our Chlor Alkali Products and Vinyls segment is a commodity business where all supplier products are similar and price is the major supplier selection criterion. We have little or no ability to influence prices in the large, global commodity markets. Our Chlor Alkali Products and Vinyls segment produces some of the most widely used chemicals in the world that can be upgraded into a wide variety of downstream chemical products used in many end-markets. Cyclical price swings, driven by changes in supply/demand, can be abrupt and significant and, given capacity in our Chlor Alkali Products and Vinyls segment, can lead to significant changes in our overall profitability.

The Epoxy segment consumes products manufactured by the Chlor Alkali Products and Vinyls segment. The Epoxy segment's upstream and midstream products are predominately commodity markets. We have little or no ability to influence prices in these large, global commodity markets. While competitive differentiation exists through downstream customization and product development opportunities, pricing is extremely competitive with a broad range of competitors across the globe.

Winchester also has a commodity element to its business, but a majority of Winchester ammunition is sold as a branded consumer product where there are opportunities to differentiate certain offerings through innovative new product development and enhanced product performance. While competitive pricing versus other branded ammunition products is important, it is not the only factor in product selection.

RECENT DEVELOPMENTS AND HIGHLIGHTS

2018 Overview

Net income was $327.9 million for the year ended December 31, 2018 compared to $549.5 million for 2017. Net income for the year ended December 31, 2017 reflects a tax benefit of $437.9 million from the U.S. Tax Cuts & Jobs Act (the 2017 Tax Act). After adjusting for the provisional benefit of the 2017 Tax Act, the increase in results from the prior year was due to improved Chlor Alkali Products and Vinyls and Epoxy segment results, primarily due to higher product prices. Net income for the year ended December 31, 2018 also included insurance recoveries for environmental costs incurred and expensed in prior periods of $111.0 million. These increases were partially offset by lower Winchester segment results and increased costs associated with the Information Technology Project. In 2017, we began a multi-year implementation of new enterprise resource planning, manufacturing and engineering systems, and related infrastructure (collectively, the Information Technology Project). Net income for the year ended December 31, 2018 also included a $21.5 million non-cash impairment charge associated with our investment in a non-consolidated affiliate and an $8.0 million pretax gain from an insurance recovery resulting from a second quarter 2017 Freeport, TX vinyl chloride monomer facility business interruption claim.

In 2018, Chlor Alkali Products and Vinyls generated segment income of $637.1 million compared to $405.8 million for 2017. Chlor Alkali Products and Vinyls segment income was higher than in the prior year due to increased pricing

for caustic soda, EDC, chlorine and other chlorine-derivatives. Chlor Alkali Products and Vinyls 2018 segment income was negatively impacted by lower caustic soda volumes, a less favorable product mix and higher costs, including raw material and freight costs, maintenance to improve reliability and depreciation and amortization expense, partially offset by lower ethylene costs associated with the acquisition of additional cost-based ethylene from DowDuPont in late September 2017. Chlor Alkali Products and Vinyls 2018 segment income for the year ended December 31, 2018 was negatively impacted by the $21.5 million non-cash impairment charge associated with our investment in a non-consolidated affiliate. Chlor Alkali Products and Vinyls 2017 segment income was negatively impacted by incremental costs to continue operations and unabsorbed fixed manufacturing costs associated with Hurricane Harvey of $27.0 million. Chlor Alkali Products and Vinyls segment income included depreciation and amortization expense of $473.1 million and $432.2 million in 2018 and 2017, respectively.

For the year ended December 31, 2018, Chlor Alkali Products and Vinyls recorded a $21.5 million non-cash impairment charge related to an adjustment to the value of our 9.1% limited partnership interest in Bay Gas Storage Company, Ltd. (Bay Gas). Bay Gas owns, leases and operates underground gas storage and related pipeline facilities which are used to provide

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storage in the McIntosh, AL area and delivery of natural gas. The general partner, Sempra Energy (Sempra), announced in the second quarter of 2018 its plan to sell several assets including its 90.9% interest in Bay Gas. In connection with this decision, Sempra recorded an impairment charge related to Bay Gas adjusting the related assets' carrying values to an estimated fair value. We recorded a reduction in our investment in the non-consolidated affiliate for the proportionate share of the non-cash impairment charge. Olin has no other non-consolidated affiliates. On January 1, 2019, we entered into an agreement to sell our 9.1% limited partnership interest in Bay Gas for approximately $20 million. The sale closed on February 7, 2019 which resulted in a gain of approximately $11 million which will be included in first quarter 2019 results.

During 2017, North America caustic soda price contract indices increased $140 per ton and the caustic soda export price indices increased approximately $260 per metric ton creating positive pricing momentum entering 2018. During 2018, North America caustic soda price contract indices increased an additional $40 per ton while the caustic soda export price indices decreased $270 per metric ton. However, during the second half of 2018 both domestic and export price indices experienced declines.

In 2018, Epoxy generated segment income of $52.8 million compared to a segment loss of $11.8 million for 2017. Epoxy segment results were higher than the prior year primarily due to higher product prices, partially offset by increased raw material costs, primarily benzene and propylene, and lower volumes and a less favorable product mix. Epoxy segment results for the year ended December 31, 2018 were negatively impacted by $23.1 million of additional maintenance costs and unabsorbed fixed manufacturing costs associated with maintenance turnarounds, which were primarily associated with an approximately two-month planned maintenance turnaround at our production facilities in Freeport, TX. Epoxy 2017 segment results were negatively impacted by incremental costs to continue operations and unabsorbed fixed manufacturing costs associated with Hurricane Harvey of $27.7 million. Epoxy segment income included depreciation and amortization expense of $102.4 million and $94.3 million in 2018 and 2017, respectively.

Winchester reported segment income of $38.4 million for 2018 compared to $72.4 million for 2017. Winchester segment income declined from the prior year primarily due to increased commodity and other material costs and decreased demand for commercial ammunition resulting in lower commercial sales volumes and lower product pricing. Winchester segment income included depreciation and amortization expense of $20.0 million and $19.5 million in 2018 and 2017, respectively.

During 2018, we settled certain disputes with respect to insurance coverage for costs at various environmental remediation sites for $121.0 million. We recorded a pretax gain of $111.0 million to the environmental provision, which was net of estimated liabilities of $10.0 million associated with claims by subsequent owners of certain of the settled environmental sites. We incurred legal fees of $21.5 million for the year ended December 31, 2018 associated with these recovery actions.

For the year ended December 31, 2018, we made long-term debt repayments, net of long-term debt borrowings, of $376.1 million. On January 19, 2018, Olin issued $550.0 million aggregate principal amount of 5.00% senior notes due February 1, 2030 (2030 Notes), which were registered under the Securities Act of 1933, as amended. Proceeds from the 2030 Notes were used to redeem $550.0 million of debt under the $1,375.0 million Term Loan Facility. This prepayment of the Term Loan Facility eliminated the required quarterly installments under the $1,375.0 million Term Loan Facility.

On April 26, 2018, our board of directors authorized a share repurchase program for the purchase of shares of common stock at an aggregate price of up to $500.0 million. This program will terminate upon the purchase of $500.0 million of our common stock. For the year ended December 31, 2018, 2.1 million shares were repurchased and retired at a cost of $50.0 million.

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CONSOLIDATED RESULTS OF OPERATIONS

	Years ended December 31,		
	2018	2017	2016
	($ in millions, except per share data)		
Sales	$6,946.1	$6,268.4	$5,550.6
Cost of goods sold	5,822.1	5,554.9	4,944.5
Gross margin	1,124.0	713.5	606.1
Selling and administration	430.6	369.8	347.2
Restructuring charges	21.9	37.6	112.9
Acquisition-related costs	1.0	12.8	48.8
Other operating income	6.4	3.3	10.6
Operating income	676.9	296.6	107.8
Earnings (losses) of non-consolidated affiliates	(19.7)	1.8	1.7
Interest expense	243.2	217.4	191.9
Interest income	1.6	1.8	3.4
Non-operating pension income	21.7	34.4	44.8
Income (loss) before taxes	437.3	117.2	(34.2)
Income tax provision (benefit)	109.4	(432.3)	(30.3)
Net income (loss)	$327.9	$549.5	$(3.9)
Net income (loss) per common share:			
Basic	$1.97	$3.31	$(0.02)
Diluted	$1.95	$3.26	$(0.02)

2018 Compared to 2017

Sales for 2018 were $6,946.1 million compared to $6,268.4 million in 2017, an increase of $677.7 million, or 11%. Chlor Alkali Products and Vinyls sales increased by $485.9 million primarily due to increased pricing for caustic soda, EDC, chlorine and other chlorine-derivatives, partially offset by lower caustic soda volumes and a less favorable product mix. Epoxy sales increased by $216.7 million primarily due to higher product prices, partially offset by lower volumes and a less favorable product mix. Winchester sales decreased by $24.9 million primarily due to lower sales to commercial customers, partially offset by higher sales to military customers and law enforcement agencies.

Gross margin increased $410.5 million, or 58%, from 2017. Gross margin was positively impacted by insurance recoveries for environmental costs incurred and expensed in prior periods of $111.0 million. Chlor Alkali Products and Vinyls gross margin increased by $263.8 million, primarily due to higher product pricing partially offset by increased costs, lower caustic soda volumes and a less favorable product mix. Epoxy gross margin increased $78.3 million primarily due to higher product prices partially offset by increased raw material costs, primarily benzene and propylene. Epoxy gross margin was also negatively impacted by the cost of an approximately two-month planned maintenance turnaround at our production facilities in Freeport, TX, which also reduced volumes. Both Chlor Alkali Products and Vinyls and Epoxy 2017 gross margins were negatively impacted by incremental costs to continue operations and unabsorbed fixed manufacturing costs associated with Hurricane Harvey. Winchester gross margin decreased $34.0 million primarily due to increased commodity and other material costs, lower commercial sales volumes and a less favorable product mix and lower selling prices. Gross margin as a percentage of sales increased to 16% in 2018 from 11% in 2017.

Selling and administration expenses in 2018 increased $60.8 million, or 16%, from 2017. The increase was primarily due to higher costs associated with the Information Technology Project of $31.2 million, higher legal and legal-related

settlement expenses of $15.6 million, primarily associated with environmental recovery actions, increased incentive compensation expense of $11.6 million, an unfavorable foreign currency impact of $10.9 million and higher consulting and contract services of $10.4 million, which include transition service fees from DowDuPont. These increased costs were partially offset by lower stock-based compensation expense of $15.0 million, which includes mark-to-market adjustments. Selling and administration expenses as a percentage of sales were 6% in both 2018 and 2017.

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Restructuring charges in 2018 and 2017 were primarily associated with the March 2016 closure of 433,000 tons of chlor alkali capacity across three separate locations. Restructuring charges in 2018 were also associated with a December 2018 decision to permanently close the ammunition assembly operations at our Winchester facility in Geelong, Australia.

Acquisition-related costs for the years ended December 31, 2018 and 2017 were related to the integration of the Acquired Business, and consisted of advisory, legal, accounting and other professional fees.

Other operating income for the year ended December 31, 2018 included an $8.0 million insurance recovery for a second quarter 2017 business interruption at our Freeport, TX vinyl chloride monomer facility partially offset by a $1.7 million loss on the sale of land. Other operating income for the year ended December 31, 2017 included a gain of $3.3 million from the sale of a former manufacturing facility.

Earnings (losses) of non-consolidated affiliates decreased by $21.5 million for the year ended December 31, 2018, which reflect a $21.5 million non-cash impairment charge recorded during 2018.

Interest expense increased by $25.8 million for the year ended December 31, 2018 primarily due to higher interest rates and an increase of $12.1 million of accretion expense related to the 2020 ethylene payment discount, partially offset by a lower level of debt outstanding for the year ended December 31, 2018 compared to 2017.

Non-operating pension income includes all components of pension and other postretirement income (costs) other than service costs. Non-operating pension income was lower for the year ended December 31, 2018, primarily due to an increase in the amortization of actuarial losses and higher Pension Benefit Guaranty Corporation fees associated with our domestic qualified defined benefit pension plan.

The effective tax rate for 2018 included benefits associated with the 2017 Tax Act, stock-based compensation, changes in tax contingencies, a foreign dividend payment, changes associated with prior year tax positions and the remeasurement of deferred taxes due to a decrease in our state effective tax rates. The effective tax rate also included expenses associated with a net increase in the valuation allowance related to deferred tax assets in foreign jurisdictions and the remeasurement of deferred taxes due to changes in our foreign tax rates. These factors resulted in a net $2.9 million tax benefit, of which $3.8 million related to the increase of the 2017 Tax Act benefit. After giving consideration to these items, the effective tax rate for 2018 of 25.7% was higher than the 21% U.S. federal statutory rate primarily due to state and foreign income taxes, foreign income inclusions and a net increase in the valuation allowance related to current year losses in foreign jurisdictions, partially offset by favorable permanent salt depletion deductions. The effective tax rate for 2017 included benefits associated with the 2017 Tax Act, an agreement with the Internal Revenue Service on prior period tax examinations, stock based compensation, U.S. federal tax credits, changes to prior year tax positions and a reduction to the deferred tax liability on unremitted foreign earnings. The effective tax rate also included an expense associated with a net increase in the valuation allowance, primarily related to foreign net operating losses and remeasurement of deferred taxes due to an increase in our state effective tax rates. These factors resulted in a net $452.3 million tax benefit, of which $437.9 million was a provisional benefit from the 2017 Tax Act. After giving consideration to these items, the effective tax rate for 2017 of 17.1% was lower than the 35% U.S. federal statutory rate, primarily due to favorable permanent salt depletion deductions.

2017 Compared to 2016

Sales for 2017 were $6,268.4 million compared to $5,550.6 million in 2016, an increase of $717.8 million, or 13%. Chlor Alkali Products and Vinyls sales increased by $501.5 million primarily due to higher caustic soda and EDC product prices and increased volumes. Epoxy sales increased by $264.4 million primarily due to higher product prices and increased volumes. Both Chlor Alkali Products and Vinyls and Epoxy sales volumes were negatively

impacted by Hurricane Harvey. Winchester sales decreased by $48.1 million primarily due to decreased shipments to commercial customers, partially offset by increased shipments to military customers and law enforcement agencies.

Gross margin in 2017 increased $107.4 million, or 18%, from 2016. Chlor Alkali Products and Vinyls gross margin increased by $183.6 million, primarily due to higher caustic soda and EDC product prices and increased volumes. Partially offsetting these increases were higher electricity costs, primarily driven by higher natural gas prices, compared to 2016. Epoxy gross margin decreased $26.6 million primarily due to increased raw material costs, primarily benzene and propylene, partially offset by higher product prices and increased volumes. Both Chlor Alkali Products and Vinyls and Epoxy gross margins were also negatively impacted by higher maintenance costs, unabsorbed fixed manufacturing costs and reduced profit from lost sales associated with turnarounds and outages and Hurricane Harvey. Winchester gross margin decreased $52.9 million primarily due to lower commercial volumes, a less favorable product mix and increased commodity and other material costs. Gross margin as a percentage of sales were 11% in both 2017 and 2016.

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Selling and administration expenses in 2017 increased $22.6 million, or 7%, from 2016. The increase was primarily due to higher consulting and contract services of $10.5 million, which include transition service fees from DowDuPont, and higher stock-based compensation expense of $8.2 million, which includes mark-to-market adjustments. Selling and administration expenses for 2017 also included costs associated with the Information Technology Project of $5.3 million. Selling and administration expenses as a percentage of sales were 6% in both 2017 and 2016.

Restructuring charges in 2017 and 2016 were primarily associated with the March 2016 closure of 433,000 tons of chlor alkali capacity across three separate locations. For the year ended December 31, 2016, $76.6 million of these charges were non-cash asset impairment charges for equipment and facilities. Restructuring charges for the years ended December 31, 2017 and 2016 were also associated with permanently closing a portion of the Becancour, Canada chlor alkali facility in 2014 and the relocation of our Winchester centerfire ammunition manufacturing operations from East Alton, IL to Oxford, MS which was completed during 2016.

Acquisition-related costs for the years ended December 31, 2017 and 2016 were related to the integration of the Acquired Business, and consisted of advisory, legal, accounting and other professional fees.

Other operating income for the year ended December 31, 2017 included a gain of $3.3 million from the sale of a former manufacturing facility. Other operating income for the year ended December 31, 2016 included an $11.0 million insurance recovery for property damage and business interruption related to a 2008 chlor alkali facility incident.

Interest expense increased by $25.5 million in 2017 from 2016 primarily due to higher interest rates, $3.9 million of accretion expense related to the 2020 ethylene payment discount and the write-off of unamortized deferred debt issuance costs of $2.7 million associated with the redemption of the Sumitomo Credit Facility and a portion of the $1,850.0 million senior credit facility.

Non-operating pension income includes all components of pension and other postretirement income (costs) other than service costs. Non-operating pension income was lower for the year ended December 31, 2017, primarily due to an increase in the amortization of actuarial losses.

The effective tax rate for 2017 included benefits associated with the 2017 Tax Act, an agreement with the Internal Revenue Service on prior period tax examinations, stock based compensation, U.S. federal tax credits, changes to prior year tax positions and a reduction to the deferred tax liability on unremitted foreign earnings. The effective tax rate also included an expense associated with a net increase in the valuation allowance, primarily related to foreign net operating losses and remeasurement of deferred taxes due to an increase in our state effective tax rates. These factors resulted in a net $452.3 million tax benefit, of which $437.9 million was a provisional benefit from the 2017 Tax Act. After giving consideration to these items, the effective tax rate for 2017 of 17.1% was lower than the 35% U.S. federal statutory rate, primarily due to favorable permanent salt depletion deductions. The effective tax rate for 2016 included benefits associated with return to provision adjustments, primarily related to salt depletion and non-deductible acquisition costs, and the remeasurement of deferred taxes due to a decrease in our state effective tax rates. The effective tax rate also included an expense associated with a change in prior year uncertain tax positions. These factors resulted in a net $3.9 million tax benefit. After giving consideration to these items, the effective tax rate for 2016 of 77.2% was higher than the 35% U.S. federal statutory rate, primarily due to favorable permanent salt depletion deductions in combination with a pretax loss.

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SEGMENT RESULTS

We define segment results as income (loss) before interest expense, interest income, other operating income (expense), non-operating pension income and income taxes, and includes the operating results of non-consolidated affiliates. Consistent with the guidance in ASC 280 "Segment Reporting," we have determined it is appropriate to include the operating results of non-consolidated affiliates in the relevant segment financial results. We have three operating segments: Chlor Alkali Products and Vinyls, Epoxy and Winchester. The three operating segments reflect the organization used by our management for purposes of allocating resources and assessing performance. Chlorine used in our Epoxy segment is transferred at cost from the Chlor Alkali Products and Vinyls segment. Sales and profits are recognized in the Chlor Alkali Products and Vinyls segment for all caustic soda generated and sold by Olin.

	Years ended December 31,		
	2018	2017	2016
Sales:	($ in millions)		
Chlor Alkali Products and Vinyls	$3,986.7	$3,500.8	$2,999.3
Epoxy	2,303.1	2,086.4	1,822.0
Winchester	656.3	681.2	729.3
Total sales	$6,946.1	$6,268.4	$5,550.6
Income (loss) before taxes:			
Chlor Alkali Products and Vinyls[1]	$637.1	$405.8	$224.9
Epoxy	52.8	(11.8)	15.4
Winchester	38.4	72.4	120.9
Corporate/Other:			
Environmental income (expense)[2]	103.7	(8.5)	(9.2)
Other corporate and unallocated costs[3]	(158.3)	(112.4)	(91.4)
Restructuring charges[4]	(21.9)	(37.6)	(112.9)
Acquisition-related costs[5]	(1.0)	(12.8)	(48.8)
Other operating income[6]	6.4	3.3	10.6
Interest expense[7]	(243.2)	(217.4)	(191.9)
Interest income	1.6	1.8	3.4
Non-operating pension income[8]	21.7	34.4	44.8
Income (loss) before taxes	$437.3	$117.2	$(34.2)

(1) Earnings (losses) of non-consolidated affiliates are included in the Chlor Alkali Products and Vinyls segment results consistent with management's monitoring of the operating segment. The losses of non-consolidated affiliates were $19.7 million for the year ended December 31, 2018, which reflect a $21.5 million non-cash impairment charge recorded during 2018. The earnings of non-consolidated affiliates were $1.8 million and $1.7 million for the years ended December 31, 2017 and 2016, respectively.

(2) Environmental income (expense) for the year ended December 31, 2018 included insurance recoveries for environmental costs incurred and expensed in prior periods of $111.0 million. Environmental income (expense) is included in cost of goods sold in the consolidated statements of operations.

(3) Other corporate and unallocated costs for the years ended December 31, 2018 and 2017 included costs associated with the implementation of the Information Technology Project of $36.5 million and $5.3 million, respectively.

(4) Restructuring charges for the year ended December 31, 2018 included costs associated with permanently closing the ammunition assembly operations at our Geelong, Australia facility in December 2018. Restructuring charges for the years ended December 31, 2018, 2017 and 2016 were primarily associated with the March 2016 closure of

433,000 tons of chlor alkali capacity across three separate locations and permanently closing a portion of the Becancour, Canada chlor alkali facility in 2014. For the year ended December 31, 2016, $76.6 million of these charges were non-cash asset impairment charges for equipment and facilities. Restructuring charges for the years ended December 31, 2017 and 2016 also included costs associated with the relocation of our Winchester centerfire ammunition manufacturing operations from East Alton, IL to Oxford, MS which was completed during 2016.

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(5) Acquisition-related costs for the years ended December 31, 2018, 2017 and 2016 were related to the integration of the Acquired Business and consisted of advisory, legal, accounting and other professional fees.

(6) Other operating income for the year ended December 31, 2018 included an $8.0 million insurance recovery for a second quarter 2017 business interruption at our Freeport, TX vinyl chloride monomer facility partially offset by a $1.7 million loss on the sale of land. Other operating income for the year ended December 31, 2017 included a gain of $3.3 million from the sale of a former manufacturing facility. Other operating income for the year ended December 31, 2016 included an $11.0 million insurance recovery for property damage and business interruption related to a 2008 chlor alkali facility incident.

(7) Interest expense for the years ended December 31, 2018 and 2017 included $16.0 million and $3.9 million, respectively, of accretion expense related to the 2020 ethylene payment discount. Interest expense was reduced by capitalized interest of $6.0 million, $3.0 million and $1.9 million for the years ended December 31, 2018, 2017 and 2016, respectively.

(8) Non-operating pension income reflects the adoption of ASU 2017-07 and includes all components of pension and other postretirement income (costs) other than service costs, which are allocated to the operating segments based on their respective estimated census data. Operating segment results for 2017 and 2016 have been restated to reflect this accounting change.

Chlor Alkali Products and Vinyls

2018 Compared to 2017

Chlor Alkali Products and Vinyls sales for 2018 were $3,986.7 million compared to $3,500.8 million for 2017, an increase of $485.9 million, or 14%. The sales increase was primarily due to increased caustic soda, EDC, chlorine and other chlorine-derivatives pricing. The higher product prices were partially offset by lower caustic soda volumes and a less favorable product mix. Chlor Alkali Products and Vinyls 2017 sales volumes were negatively impacted by lost sales associated with Hurricane Harvey.

Chlor Alkali Products and Vinyls generated segment income of $637.1 million for 2018 compared to $405.8 million for 2017, an increase of $231.3 million, or 57%. The increase in Chlor Alkali Products and Vinyls segment income was primarily due to higher product prices ($502.9 million) and lower ethylene costs associated with the acquisition of additional cost-based ethylene from DowDuPont in late September 2017, partially offset by higher ethane prices ($8.0 million). Partially offsetting these benefits were higher raw material and freight costs ($147.5 million), lower volumes, primarily caustic soda, and a less favorable product mix ($71.1 million), increased depreciation and amortization expense ($40.9 million) and increased operating costs ($25.6 million), primarily maintenance to improve reliability. Chlor Alkali Products and Vinyls 2018 segment income was also negatively impacted by a non-cash impairment charge associated with our investment in a non-consolidated affiliate ($21.5 million). Chlor Alkali Products and Vinyls 2017 segment income was negatively impacted by incremental costs to continue operations and unabsorbed fixed manufacturing costs associated with Hurricane Harvey ($27.0 million). Chlor Alkali Products and Vinyls segment income included depreciation and amortization expense of $473.1 million and $432.2 million in 2018 and 2017, respectively.

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2017 Compared to 2016

Chlor Alkali Products and Vinyls sales for 2017 were $3,500.8 million compared to $2,999.3 million for 2016, an increase of $501.5 million, or 17%. The sales increase was primarily due to higher product prices and increased volumes. The higher product prices and increased volumes were primarily related to caustic soda and EDC. Chlor Alkali Products and Vinyls sales volumes were negatively impacted by Hurricane Harvey.

Chlor Alkali Products and Vinyls generated segment income of $405.8 million for 2017 compared to $224.9 million for 2016, an increase of $180.9 million, or 80%. Chlor Alkali Products and Vinyls segment income was higher due to higher product prices ($385.5 million) and increased volumes and a more favorable product mix ($8.7 million). The higher product prices and increased volumes were primarily related to caustic soda and EDC. These increases were partially offset by higher maintenance costs, unabsorbed fixed manufacturing costs and reduced profit from lost sales associated with turnarounds and outages ($102.5 million) and incremental costs to continue operations, unabsorbed fixed manufacturing costs and reduced profit from lost sales associated with Hurricane Harvey ($27.0 million). Electricity costs, primarily driven by higher natural gas prices ($51.6 million), and operating costs ($32.2 million) were also higher compared to 2016. Chlor Alkali Products and Vinyls segment income included depreciation and amortization expense of $432.2 million and $418.1 million in 2017 and 2016, respectively.

Epoxy
2018 Compared to 2017

Epoxy sales were $2,303.1 million for 2018 compared to $2,086.4 million for 2017, an increase of $216.7 million, or 10%. The sales increase was primarily due to higher product prices ($322.4 million) and a favorable effect of foreign currency translation ($48.2 million), partially offset by lower volumes ($153.9 million). Epoxy 2018 sales volumes were negatively impacted by lost sales associated with planned maintenance turnarounds, while 2017 Epoxy sales volumes were negatively impacted by Hurricane Harvey.

Epoxy reported segment income of $52.8 million for 2018 compared to a segment loss of $11.8 million for 2017, an increase of $64.6 million. The increase in Epoxy segment results was primarily due to higher product prices ($322.4 million) partially offset by higher raw material costs ($190.8 million), primarily benzene and propylene. Epoxy results were also negatively impacted by lower volumes and a less favorable product mix ($42.2 million), higher maintenance costs and unabsorbed fixed manufacturing costs associated with turnarounds and outages ($23.1 million), increased operating costs, including utilities ($21.3 million) and higher depreciation and amortization expense ($8.1 million). Additionally, Epoxy 2017 segment results were negatively impacted by incremental costs to continue operations and unabsorbed fixed manufacturing costs associated with Hurricane Harvey ($27.7 million). Epoxy segment results included depreciation and amortization expense of $102.4 million and $94.3 million in 2018 and 2017, respectively.

2017 Compared to 2016

Epoxy sales were $2,086.4 million for 2017 compared to $1,822.0 million for 2016, an increase of $264.4 million, or 15%. The sales increase was primarily due to higher product prices ($211.7 million) and increased volumes and a more favorable product mix ($52.7 million). Epoxy sales volumes were negatively impacted by Hurricane Harvey.

Epoxy reported a segment loss of $11.8 million for 2017 compared to segment income of $15.4 million for 2016, a decrease of $27.2 million. Epoxy segment results were negatively impacted by incremental costs to continue operations, unabsorbed fixed manufacturing costs and reduced profit from lost sales associated with Hurricane Harvey ($27.7 million) and higher maintenance costs, unabsorbed fixed manufacturing costs and reduced profit from lost sales associated with turnarounds and outages ($15.3 million). Epoxy segment results were also impacted by increased raw material costs ($227.8 million), primarily benzene and propylene, and higher operating costs ($1.7 million). These

decreases impacting segment results were partially offset by higher product prices ($211.7 million) and increased volumes and a more favorable product mix ($33.6 million). Epoxy segment results included depreciation and amortization expense of $94.3 million and $90.0 million in 2017 and 2016, respectively.

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Winchester

2018 Compared to 2017

Winchester sales were $656.3 million for 2018 compared to $681.2 million for 2017, a decrease of $24.9 million, or 4%. The sales decrease was primarily due to lower ammunition sales to commercial customers ($43.4 million), partially offset by higher sales to military customers and law enforcement agencies ($18.5 million).

Winchester reported segment income of $38.4 million for 2018 compared to $72.4 million for 2017, a decrease of $34.0 million, or 47%. The decrease in segment income was due to higher commodity and other material costs ($19.6 million), lower commercial sales volumes and a less favorable product mix ($9.4 million) and lower product prices ($8.0 million). These decreases were partially offset by lower operating costs ($3.0 million), including depreciation and amortization expense. Winchester segment income included depreciation and amortization expense of $20.0 million and $19.5 million in 2018 and 2017, respectively.

2017 Compared to 2016

Winchester sales were $681.2 million for 2017 compared to $729.3 million for 2016, a decrease of $48.1 million, or 7%. The sales decrease was primarily due to lower ammunition sales to commercial customers ($89.4 million), partially offset by increased shipments to military customers and law enforcement agencies ($41.3 million). The decrease in commercial sales primarily reflects lower demand in shotshell, pistol and rifle ammunition.

Winchester reported segment income of $72.4 million for 2017 compared to $120.9 million for 2016, a decrease of $48.5 million, or 40%. The decrease in segment income in 2017 compared to 2016 was due to lower volumes and a less favorable product mix ($35.0 million), increased commodity and other material costs ($10.6 million) and lower product prices ($8.0 million). These decreases were partially offset by the impact of lower operating costs ($5.1 million). Winchester segment income included depreciation and amortization expense of $19.5 million and $18.5 million in 2017 and 2016, respectively.

Corporate/Other

2018 Compared to 2017

Credits to income for environmental investigatory and remedial activities were $103.7 million for 2018, which include $111.0 million of insurance recoveries for environmental costs incurred and expensed in prior periods. Without these recoveries, charges to income for environmental investigatory and remedial activities would have been $7.3 million for the year ended December 31, 2018 compared with $8.5 million for the year ended December 31, 2017. These charges related primarily to expected future investigatory and remedial activities associated with past manufacturing operations and former waste disposal sites.

For 2018, other corporate and unallocated costs were $158.3 million compared to $112.4 million for 2017, an increase of $45.9 million, or 41%. The increase was primarily due to higher costs associated with the Information Technology Project of $31.2 million, higher legal and legal-related settlement expenses of $18.0 million and an unfavorable foreign currency impact of $10.6 million. The increases were partially offset by lower stock-based compensation expense of $15.0 million, which includes mark-to-market adjustments. The higher legal and legal-related settlement expenses were primarily due to legal fees associated with environmental recovery actions.

2017 Compared to 2016

Charges to income for environmental investigatory and remedial activities were $8.5 million for 2017 compared to $9.2 million for 2016. These charges related primarily to expected future investigatory and remedial activities associated with past manufacturing operations and former waste disposal sites.

For 2017, other corporate and unallocated costs were $112.4 million compared to $91.4 million for 2016, an increase of $21.0 million, or 23%. The increase was primarily due to higher stock-based compensation expense of $8.2 million, which includes mark-to-market adjustments, increased consulting charges of $7.3 million and costs associated with the implementation of the Information Technology Project of $5.3 million.

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Restructurings

On December 10, 2018, we announced that we had made the decision to permanently close the ammunition assembly operations at our Winchester facility in Geelong, Australia. Subsequent to the facility's closure, product for customers in the region will be sourced from Winchester manufacturing facilities located in the United States. For the year ended December 31, 2018, we recorded pretax restructuring charges of $4.1 million for the write-off of equipment and facility costs, employee severance and related benefit costs and lease and other contract termination costs related to this action. We expect to incur additional restructuring charges through 2019 of approximately $1 million related to this closure.

On March 21, 2016, we announced that we had made the decision to close a combined total of 433,000 tons of chlor alkali capacity across three separate locations. Associated with this action, we have permanently closed our Henderson, NV chlor alkali plant with 153,000 tons of capacity and have reconfigured the site to manufacture bleach and distribute caustic soda and hydrochloric acid. Also, the capacity of our Niagara Falls, NY chlor alkali plant has been reduced from 300,000 tons to 240,000 tons and the chlor alkali capacity at our Freeport, TX facility was reduced by 220,000 tons. This 220,000 ton reduction was entirely from diaphragm cell capacity. For the years ended December 31, 2018, 2017 and 2016, we recorded pretax restructuring charges of $15.7 million, $32.6 million and $111.3 million, respectively, for the write-off of equipment and facility costs, lease and other contract termination costs, employee severance and related benefit costs, employee relocation costs and facility exit costs related to these actions. We expect to incur additional restructuring charges through 2019 of approximately $10 million related to these capacity reductions.

2019 OUTLOOK

Net income in 2019 is projected to be approximately $1.60 per diluted share, which includes estimated pretax information technology integration project costs and restructuring costs totaling approximately $80 million. Net income in 2018 was $1.95 per diluted share, which includes pretax insurance recoveries for environmental costs incurred and expensed in prior periods of $111.0 million, pretax information technology integration project costs and restructuring costs of $58.4 million and a pretax non-cash impairment charge associated with our investment in a non-consolidated affiliate of $21.5 million.

We currently expect the first quarter of 2019 to have the lowest quarterly earnings per diluted share in 2019. We expect the first quarter of 2019 earnings per diluted share to be sequentially lower than fourth quarter 2018 levels but higher than first quarter 2018 levels. The year over year increase reflects improved pricing for chlorine, ethylene dichloride and chlorine derivatives and lower planned maintenance turnaround costs in the Epoxy business partially offset by the lower year over year caustic soda prices.

Chlor Alkali Products and Vinyls 2019 segment income is expected to be comparable to 2018 segment income of $637.1 million reflecting improved chlorine, EDC and chlorine-derivatives pricing, which are expected to be offset by lower caustic soda pricing, higher freight and logistics costs, and higher ethylene costs, due to increased ethane pricing.

Epoxy 2019 segment results are expected to improve from the 2018 segment income of $52.8 million as increased volumes, lower raw material costs, primarily benzene and propylene, and lower planned maintenance turnaround costs are expected to more than offset lower product pricing.

Winchester 2019 segment income is expected to be similar to the 2018 segment income of $38.4 million primarily due to expected lower commodity and other material costs and lower operating costs offset by declines in commercial

demand. Military and other government sales are expected to be consistent with 2018.

Other Corporate and Unallocated costs in 2019 are expected to be higher than 2018 Other Corporate and Unallocated costs of $158.3 million due to higher costs associated with the Information Technology Project and higher stock based compensation costs partially offset by lower legal and legal-related settlement expenses. Costs associated with the Information Technology Project are estimated to increase approximately $30 million in 2019 compared to 2018, which reflects duplicative costs incurred to maintain legacy systems while transitioning to new systems.

During 2019, we anticipate environmental expenses in the $15 million to $20 million range compared to $7.3 million, excluding the $111.0 million of insurance recoveries, in 2018. We do not believe that there will be additional recoveries of environmental costs incurred and expensed in prior periods during 2019.

We expect non-operating pension income in 2019 to be in the $15 million to $20 million range compared to $21.7 million in 2018. We expect higher amortization of deferred pension actuarial losses. Based on our plan assumptions and

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estimates, we will not be required to make any cash contributions to our domestic qualified defined benefit pension plan in 2019. We have several international qualified defined benefit pension plans for which we anticipate cash contributions of less than $5 million in 2019.

In 2019, we currently expect our capital spending to be in the $375 million to $425 million range, including the investment associated with the Information Technology Project of approximately $80 million. We expect 2019 depreciation and amortization expense to be in the $590 million to $610 million range.

We currently believe that both the 2019 effective tax rate and the cash tax rate will be approximately 25%.

PENSION AND POSTRETIREMENT BENEFITS

Under ASC 715, we recorded an after-tax charge of $74.9 million ($98.5 million pretax) to shareholders' equity as of December 31, 2018 for our pension and other postretirement plans. This charge primarily reflected unfavorable performance on plan assets during 2018, partially offset by a 60-basis point increase in the domestic pension plans' discount rate. In 2017, we recorded an after-tax charge of $21.6 million ($27.3 million pretax) to shareholders' equity as of December 31, 2017 for our pension and other postretirement plans. This charge primarily reflected a 50-basis point decrease in the domestic pension plans' discount rate, partially offset by favorable performance on plan assets during 2017. In 2016, we recorded an after-tax charge of $37.5 million ($61.0 million pretax) to shareholders' equity as of December 31, 2016 for our pension and other postretirement plans. This charge primarily reflected a 30-basis point decrease in the domestic pension plans' discount rate, partially offset by favorable performance on plan assets during 2016. These non-cash charges to shareholders' equity do not affect our ability to borrow under our senior credit facility.

During 2016, we made a discretionary cash contribution to our domestic qualified defined benefit pension plan of $6.0 million. Based on our plan assumptions and estimates, we will not be required to make any cash contributions to the domestic qualified defined benefit pension plan at least through 2019.

In connection with international qualified defined benefit pension plans, we made cash contributions of $2.6 million, $1.7 million and $1.3 million in 2018, 2017 and 2016, respectively, and we anticipate less than $5 million of cash contributions to international qualified defined benefit pension plans in 2019.

At December 31, 2018, the projected benefit obligation of $2,661.9 million exceeded the market value of assets in our qualified defined benefit pension plans by $668.9 million, as calculated under ASC 715.

Components of net periodic benefit (income) costs were:

	Years ended December 31,		
	2018	2017	2016
	($ in millions)		
Pension benefits	$(14.5)	$(26.4)	$(37.1)
Other postretirement benefit costs	5.2	2.5	2.5

The service cost component of net periodic benefit (income) costs related to employees of the operating segments are allocated to the operating segments based on their respective estimated census data.

ENVIRONMENTAL MATTERS

Years ended December 31,

	2018	2017	2016
Cash outlays:	($ in millions)		
Remedial and investigatory spending (charged to reserve)	$13.0	$16.5	$10.3
Capital spending	2.3	1.7	3.5
Plant operations (charged to cost of goods sold)	197.6	199.7	192.6
Total cash outlays	$212.9	$217.9	$206.4

Cash outlays for remedial and investigatory activities associated with former waste sites and past operations were not charged to income but instead were charged to reserves established for such costs identified and expensed to income in prior

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years. Cash outlays for normal plant operations for the disposal of waste and the operation and maintenance of pollution control equipment and facilities to ensure compliance with mandated and voluntarily imposed environmental quality standards were charged to income.

Total environmental-related cash outlays for 2019 are estimated to be approximately $220 million, of which approximately $17 million is expected to be spent on investigatory and remedial efforts, approximately $3 million on capital projects and approximately $200 million on normal plant operations. Remedial and investigatory spending is anticipated to be higher in 2019 than 2018 due to the timing of continuing remedial action plans and investigations. Historically, we have funded our environmental capital expenditures through cash flow from operations and expect to do so in the future.

Annual environmental-related cash outlays for site investigation and remediation, capital projects and normal plant operations are expected to range between $200 million to $220 million over the next several years, $15 million to $25 million of which is for investigatory and remedial efforts, which are expected to be charged against reserves recorded on our consolidated balance sheet. While we do not anticipate a material increase in the projected annual level of our environmental-related cash outlays for site investigation and remediation, there is always the possibility that such an increase may occur in the future in view of the uncertainties associated with environmental exposures.

Our liabilities for future environmental expenditures were as follows:

	December 31,		
	2018	2017	2016
	($ in millions)		
Beginning balance	$131.6	$137.3	$138.1
Charges to income	7.3	10.3	9.2
Remedial and investigatory spending	(13.0)	(16.5)	(10.3)
Foreign currency translation adjustments	(0.3)	0.5	0.3
Ending balance	$125.6	$131.6	$137.3

As is common in our industry, we are subject to environmental laws and regulations related to the use, storage, handling, generation, transportation, emission, discharge, disposal and remediation of, and exposure to, hazardous and non-hazardous substances and wastes in all of the countries in which we do business.

The establishment and implementation of national, state or provincial and local standards to regulate air, water and land quality affect substantially all of our manufacturing locations around the world. Laws providing for regulation of the manufacture, transportation, use and disposal of hazardous and toxic substances, and remediation of contaminated sites, have imposed additional regulatory requirements on industry, particularly the chemicals industry. In addition, implementation of environmental laws has required and will continue to require new capital expenditures and will increase plant operating costs. We employ waste minimization and pollution prevention programs at our manufacturing sites.

In connection with the October 5, 2015 acquisition of DowDuPont's U.S. Chlor Alkali and Vinyl, Global Chlorinated Organics and Global Epoxy businesses, the prior owner of the businesses retained liabilities relating to releases of hazardous materials and violations of environmental law to the extent arising prior to October 5, 2015.

We are party to various government and private environmental actions associated with past manufacturing facilities and former waste disposal sites. Associated costs of investigatory and remedial activities are provided for in accordance with generally accepted accounting principles governing probability and the ability to reasonably estimate future costs. Our ability to estimate future costs depends on whether our investigatory and remedial activities are in preliminary or advanced stages. With respect to unasserted claims, we accrue liabilities for costs that, in our

experience, we expect to incur to protect our interests against those unasserted claims. Our accrued liabilities for unasserted claims amounted to $8.6 million at December 31, 2018. With respect to asserted claims, we accrue liabilities based on remedial investigation, feasibility study, remedial action and operation, maintenance and monitoring (OM&M) expenses that, in our experience, we expect to incur in connection with the asserted claims. Required site OM&M expenses are estimated and accrued in their entirety for required periods not exceeding 30 years, which reasonably approximates the typical duration of long-term site OM&M.

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Environmental provisions (credited) charged to income, which are included in cost of goods sold, were as follows:

	Years ended December 31,		
	2018	2017	2016
	($ in millions)		
Provisions charged to income	$7.3	$10.3	$9.2
Insurance recoveries for costs incurred and expensed	(111.0)	(1.8)	—
Environmental (income) expense	$(103.7)	$8.5	$9.2

During 2018, we settled certain disputes with respect to insurance coverage for costs at various environmental remediation sites for $121.0 million. Environmental (income) expense for the year ended December 31, 2018 includes insurance recoveries for environmental costs incurred and expensed in prior periods of $111.0 million. The recoveries are reduced by estimated liabilities of $10.0 million associated with claims by subsequent owners of certain of the settled environmental sites.

These charges relate primarily to remedial and investigatory activities associated with past manufacturing operations and former waste disposal sites and may be material to operating results in future years.

Our total estimated environmental liability at the end of 2018 was attributable to 60 sites, 14 of which were United States Environmental Protection Agency National Priority List sites. Nine sites accounted for 79% of our environmental liability and, of the remaining 51 sites, no one site accounted for more than 3% of our environmental liability. At three of the nine sites, part of the site is subject to a remedial investigation and another part is in the long-term OM&M stage. At two of the nine sites, a remedial action plan is being developed for part of the site and at another part a remedial design is being developed. At one of the nine sites, part of the site is subject to a remedial investigation and another part a remedial design is being developed. At one of the nine sites, a remedial action plan is being developed for part of the site and another part is in the long-term OM&M stage. The two remaining sites are in long-term OM&M. All nine sites are either associated with past manufacturing operations or former waste disposal sites. None of the nine largest sites represents more than 22% of the liabilities reserved on our consolidated balance sheet at December 31, 2018 for future environmental expenditures.

Our consolidated balance sheets included liabilities for future environmental expenditures to investigate and remediate known sites amounting to $125.6 million at December 31, 2018, and $131.6 million at December 31, 2017, of which $108.6 million and $111.6 million, respectively, were classified as other noncurrent liabilities. Our environmental liability amounts do not take into account any discounting of future expenditures or any consideration of insurance recoveries or advances in technology. These liabilities are reassessed periodically to determine if environmental circumstances have changed and/or remediation efforts and our estimate of related costs have changed. As a result of these reassessments, future charges to income may be made for additional liabilities. Of the $125.6 million included on our consolidated balance sheet at December 31, 2018 for future environmental expenditures, we currently expect to utilize $68.9 million of the reserve for future environmental expenditures over the next 5 years, $14.1 million for expenditures 6 to 10 years in the future, and $42.6 million for expenditures beyond 10 years in the future. These estimates are subject to a number of risks and uncertainties, as described in “Environmental Costs” contained in Item 1A—“Risk Factors.”

Environmental exposures are difficult to assess for numerous reasons, including the identification of new sites, developments at sites resulting from investigatory studies, advances in technology, changes in environmental laws and regulations and their application, changes in regulatory authorities, the scarcity of reliable data pertaining to identified sites, the difficulty in assessing the involvement and financial capability of other PRPs, our ability to obtain contributions from other parties and the lengthy time periods over which site remediation occurs. It is possible that

some of these matters (the outcomes of which are subject to various uncertainties) may be resolved unfavorably to us, which could materially adversely affect our financial position or results of operations. At December 31, 2018, we estimate it is reasonably possible that we may have additional contingent environmental liabilities of $60 million in addition to the amounts for which we have already recorded as a reserve.

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LEGAL MATTERS AND CONTINGENCIES

We are party to a dispute relating to a contract at our Plaquemine, LA facility. The other party to the contract has filed a demand for arbitration alleging, among other things, that Olin breached the related agreement and claiming damages in excess of the amount Olin believes it is obligated to pay under the contract. The arbitration hearing is scheduled for the fourth quarter 2019. Any additional losses related to this contract dispute are not currently estimable because of unresolved questions of fact and law but, if resolved unfavorably to Olin, they could have a material adverse effect on our financial position, cash flows or results of operations.

We, and our subsidiaries, are defendants in various other legal actions (including proceedings based on alleged exposures to asbestos) incidental to our past and current business activities. We describe some of these matters in Item 3—"Legal Proceedings." At December 31, 2018 and 2017, our consolidated balance sheets included liabilities for these legal actions of $15.6 million and $24.8 million, respectively. These liabilities do not include costs associated with legal representation and do not include $8.0 million of insurance recoveries included in receivables, net within the accompanying consolidated balance sheet as of December 31, 2017. Based on our analysis, and considering the inherent uncertainties associated with litigation, we do not believe that it is reasonably possible that these legal actions will materially and adversely affect our financial position, cash flows or results of operations. In connection with the October 5, 2015 acquisition of DowDuPont's U.S. Chlor Alkali and Vinyl, Global Chlorinated Organics and Global Epoxy businesses, the prior owner of the businesses retained liabilities related to litigation to the extent arising prior to October 5, 2015.

During the ordinary course of our business, contingencies arise resulting from an existing condition, situation or set of circumstances involving an uncertainty as to the realization of a possible gain contingency. In certain instances such as environmental projects, we are responsible for managing the clean-up and remediation of an environmental site. There exists the possibility of recovering a portion of these costs from other parties. We account for gain contingencies in accordance with the provisions of ASC 450 "Contingencies" and therefore do not record gain contingencies and recognize income until it is earned and realizable.

For the year ended December 31, 2018, we recognized an insurance recovery of $8.0 million in other operating income for a second quarter 2017 business interruption at our Freeport, TX vinyl chloride monomer facility. For the year ended December 31, 2016, we recognized an insurance recovery of $11.0 million in other operating income for property damage and business interruption related to a 2008 chlor alkali facility incident.

LIQUIDITY, INVESTMENT ACTIVITY AND OTHER FINANCIAL DATA

Cash Flow Data

	Years ended December 31,		
	2018	2017	2016
Provided by (used for)	($ in millions)		
Net operating activities	$907.8	$648.8	$603.2
Capital expenditures	(385.2)	(294.3)	(278.0)
Business acquired and related transactions, net of cash acquired	—	—	(69.5)
Payments under long-term supply contracts	—	(209.4)	(175.7)
Proceeds from sale/leaseback of equipment	—	—	40.4
Net investing activities	(382.3)	(498.5)	(473.5)
Long-term debt repayments, net	(376.1)	(2.4)	(205.3)
Common stock repurchased and retired	(50.0)	—	—
Stock options exercised	3.4	29.8	0.5

Debt issuance costs	(8.5)	(11.2)	(1.0)
Net financing activities	(564.8)	(116.8)	(337.5)

Operating Activities

For 2018, cash provided by operating activities increased by $259.0 million from 2017, primarily due to an increase in operating results, partially offset by an increase in working capital. For 2018, working capital increased $71.6 million compared to a decrease of $9.8 million in 2017. Receivables increased from December 31, 2017 by $46.3 million primarily as

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a result of higher sales in the fourth quarter of 2018 compared to the fourth quarter of 2017 and a decrease in receivables sold under the accounts receivable factoring arrangement. In 2018, inventories increased by $35.5 million and accounts payable and accrued liabilities increased by $14.5 million. The increases in inventories and accounts payable were primarily due to higher raw material costs. The increase in accrued liabilities was primarily related to the Information Technology Project.

For 2017, cash provided by operating activities increased by $45.6 million from 2016, primarily due to an increase in our operating results. For 2017, working capital decreased $9.8 million compared to a decrease of $80.9 million in 2016. Receivables increased from December 31, 2016 by $49.9 million primarily as a result of higher sales in the fourth quarter of 2017 compared to the fourth quarter of 2016, partially offset by additional receivables sold under the accounts receivable factoring arrangement. In 2017, inventories increased by $37.8 million and accounts payable and accrued liabilities increased by $100.0 million. The increase in inventories and accounts payable and accrued liabilities were primarily due to an increase in raw material costs, primarily benzene and propylene.

Capital Expenditures

Capital spending was $385.2 million, $294.3 million and $278.0 million in 2018, 2017 and 2016, respectively. Capital spending was 64%, 63% and 64% of depreciation in 2018, 2017 and 2016, respectively.

During 2017, we began a multi-year implementation of the Information Technology Project. The project is planned to standardize business processes across the chemicals businesses with the objective of maximizing cost effectiveness, efficiency and control across our global operations. The project is anticipated to be completed during 2020. Total capital spending is forecast to be $250 million and associated expenses are forecast to be $100 million. Our results for the years ended December 31, 2018 and 2017 include $84.5 million and $35.8 million, respectively, of capital spending and $36.5 million and $5.3 million, respectively, of expenses associated with this project.

In 2019, we expect our capital spending to be in the $375 million to $425 million range, which includes approximately $80 million of capital spending related to the Information Technology Project.

Investing Activities

In 2017, a payment of $209.4 million was made associated with long-term supply contracts to reserve additional ethylene at producer economics. In 2016, payments of $175.7 million were made related to arrangements for the long-term supply of low cost electricity.

In 2016, payments of $69.5 million were made related to the Acquisition for certain acquisition-related liabilities including the final working capital adjustment.

In 2016, we entered into sale/leaseback transactions for railcars that we acquired in connection with the Acquisition. We received proceeds from the sales of $40.4 million.

In 2016, we received $8.8 million from the October 2013 sale of a bleach joint venture.

Financing Activities

For the year ended December 31, 2018, our long-term debt repayments, net of long-term debt borrowings, were $376.1 million, which included $780.4 million related to the $1,375.0 million Term Loan Facility, $124.7 million related to the Receivables Financing Agreement and $20.0 million related to the $600.0 million Senior Revolving Credit Facility.

On January 19, 2018, Olin issued $550.0 million aggregate principal amount of 5.00% senior notes due February 1, 2030 (2030 Notes), which were registered under the Securities Act of 1933, as amended. Interest on the 2030 Notes began accruing from January 19, 2018 and is paid semi-annually beginning on August 1, 2018. Proceeds from the 2030 Notes were used to redeem $550.0 million of debt under the $1,375.0 million Term Loan Facility.

In 2018, we repurchased and retired 2.1 million shares with a total value of $50.0 million under the share repurchase program approved by our board of directors on April 26, 2018.

For the year ended December 31, 2017, our long-term debt repayments, net of long-term debt borrowings, were $2.4 million, which included $51.6 million under the required quarterly installments of the $1,375.0 million term loan facility and the remaining $12.2 million due under the $97.5 million Series O and $97.5 million Series G SunBelt notes (SunBelt Notes).

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On March 9, 2017, we entered into a new five-year, $1,975.0 million senior credit facility (Senior Credit Facility) consisting of a $600.0 million senior revolving credit facility (Senior Revolving Credit Facility), which replaced our previous $500.0 million senior revolving credit facility, and a $1,375.0 million term loan facility (Term Loan Facility). We recognized interest expense of $1.2 million for the write-off of unamortized deferred debt issuance costs related to this action during 2017. The proceeds of the $1,375.0 million Term Loan Facility were used to redeem the remaining balance of the existing $1,350.0 million term loan facility and a portion of the $800.0 million Sumitomo credit facility (Sumitomo Credit Facility). The Senior Credit Facility will mature in March 2022.

On March 9, 2017, Olin issued $500.0 million aggregate principal amount of 5.125% senior notes due September 15, 2027 (2027 Notes), which were registered under the Securities Act of 1933, as amended. Interest on the 2027 Notes began accruing from March 9, 2017 and is paid semi-annually beginning on September 15, 2017. Proceeds from the 2027 Notes were used to redeem the remaining balance of the Sumitomo Credit Facility.

On December 20, 2016, we entered into a three-year, $250.0 million Receivables Financing Agreement with PNC Bank, National Association, as administrative agent (Receivables Financing Agreement). Under the Receivables Financing Agreement, our eligible trade receivables are used for collateralized borrowings and continue to be serviced by us. In addition, the Receivables Financing Agreement incorporates the leverage and coverage covenants that are contained in the Senior Revolving Credit Facility. As of December 31, 2018 and 2017, we had $125.0 million and $249.7 million, respectively, drawn under the agreement. For the year ended December 31, 2017, we borrowed $40.0 million under the Receivables Financing Agreement and used the proceeds to fund a portion of the payment to DowDuPont associated with a long-term ethylene supply contract to reserve additional ethylene at producer economics. For the year ended December 31, 2016, the proceeds of the Receivables Financing Agreement were used to repay $210.0 million of the Sumitomo Credit Facility.

During 2016, we repaid $67.5 million under the required quarterly installments of the $1,350.0 million term loan facility. We also repaid $210.0 million under the Sumitomo Credit Facility using proceeds from the Receivables Financing Agreement during 2016. During 2017, the remaining balance of $590.0 million was repaid using proceeds from the Senior Credit Facility and the 2027 Notes. We recognized interest expense of $1.5 million related to the write-off of unamortized deferred debt issuance costs related to this action in 2017.

In December 2017 and 2016, we repaid $12.2 million due under the annual requirements of the SunBelt Notes. At December 31, 2017, all amounts due under the SunBelt Notes have been repaid.

In June 2016, we also repaid $125.0 million of 6.75% senior notes (2016 Notes), which became due.

In 2018, 2017 and 2016, we issued 0.2 million, 1.7 million and 0.3 million shares, respectively, with a total value of $3.4 million, $32.4 million and $4.1 million, respectively, representing stock options exercised.

In 2018, we paid debt issuance costs of $8.5 million relating to the 2030 Notes. In 2017, we paid debt issuance costs of $11.2 million relating to the Senior Credit Facility and the 2027 Notes. In 2016, we paid debt issuance costs of $1.0 million for the registration of the $720.0 million aggregate principal amount of 9.75% senior notes due October 15, 2023 and $500.0 million aggregate principal amount of 10.00% senior notes due October 15, 2025 under the Securities Act of 1933.

The percent of total debt to total capitalization decreased to 53.3% at December 31, 2018 compared to 56.7% at December 31, 2017, resulting from higher shareholders' equity primarily due to our operating results, partially offset by the payment of dividends, and a lower level of debt outstanding. The percent of total debt to total capitalization decreased to 56.7% at December 31, 2017 compared to 61.4% at December 31, 2016, resulting from higher

shareholders' equity primarily due to our operating results partially offset by the payment of dividends.

Dividends per common share were $0.80 in 2018, 2017 and 2016. Total dividends paid on common stock amounted to $133.6 million, $133.0 million and $132.1 million in 2018, 2017 and 2016, respectively. On January 25, 2019, our board of directors declared a dividend of $0.20 per share on our common stock, payable on March 11, 2019 to shareholders of record on February 11, 2019.

The payment of cash dividends is subject to the discretion of our board of directors and will be determined in light of then-current conditions, including our earnings, our operations, our financial condition, our capital requirements and other factors deemed relevant by our board of directors. In the future, our board of directors may change our dividend policy, including the frequency or amount of any dividend, in light of then-existing conditions.

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LIQUIDITY AND OTHER FINANCING ARRANGEMENTS

Our principal sources of liquidity are from cash and cash equivalents, cash flow from operations and short-term borrowings under our Senior Revolving Credit Facility, accounts receivable factoring arrangement and Receivables Financing Agreement. Additionally, we believe that we have access to the debt and equity markets.

The overall cash decrease of $39.6 million in 2018 primarily reflects our capital spending and long-term debt repayments, net, partially offset by our operating results. We believe, based on current and projected levels of cash flow from our operations, together with our cash and cash equivalents on hand and the availability to borrow under our Senior Revolving Credit Facility and Receivables Financing Agreement, we have sufficient liquidity to meet our short-term and long-term needs to make required payments of interest on our debt, fund our operating needs, fund working capital and capital expenditure requirements and comply with the financial ratios in our debt agreements.

On April 26, 2018, our board of directors authorized a share repurchase program for the purchase of shares of common stock at an aggregate price of up to $500.0 million. This program will terminate upon the purchase of $500.0 million of our common stock. For the year ended December 31, 2018, 2.1 million shares were repurchased and retired at a cost of $50.0 million. As of December 31, 2018, $450.0 million of common stock remained authorized to be repurchased.

On January 19, 2018, Olin issued $550.0 million aggregate principal amount of 5.00% senior notes due February 1, 2030, which were registered under the Securities Act of 1933, as amended. Interest on the 2030 Notes began accruing from January 19, 2018 and is paid semi-annually beginning on August 1, 2018. Proceeds from the 2030 Notes were used to redeem $550.0 million of debt under the $1,375.0 million Term Loan Facility. This prepayment of the Term Loan Facility eliminates the required quarterly installments under the Term Loan Facility.

For the year ended December 31, 2018, long-term debt repayments included $780.4 million related to the $1,375.0 million Term Loan Facility, $124.7 million related to the Receivables Financing Agreement and $20.0 million related to the $600.0 million Senior Revolving Credit Facility.

On March 9, 2017, we entered into the $1,975.0 million Senior Credit Facility, which amended and restated the existing $1,850.0 million senior credit facility. Pursuant to the agreement, the aggregate principal amount under the Term Loan Facility was increased to $1,375.0 million, and the aggregate commitments under the Senior Revolving Credit Facility were increased from $500.0 million to $600.0 million. At December 31, 2018, we had $596.5 million available under our $600.0 million Senior Revolving Credit Facility because we had issued $3.5 million of letters of credit. In March 2017, we drew the entire $1,375.0 million term loan and used the proceeds to redeem the remaining balance of the existing $1,350.0 million term loan facility of $1,282.5 million and a portion of the $800.0 million Sumitomo Credit Facility. The maturity date for the Senior Credit Facility was extended from October 5, 2020 to March 9, 2022. The $600.0 million Senior Revolving Credit Facility includes a $100.0 million letter of credit subfacility. The Term Loan Facility included amortization payable in equal quarterly installments at a rate of 5.0% per annum for the first two years, increasing to 7.5% per annum for the following year and to 10.0% per annum for the last two years. However, in connection with the $550.0 million prepayment of the Term Loan Facility in January 2018, the required quarterly installments of the Term Loan Facility were eliminated. For the years ended December 31, 2017 and 2016, we repaid $51.6 million and $67.5 million, respectively, under the required quarterly installments of the term loan facilities.

Under the Senior Credit Facility, we may select various floating rate borrowing options. The actual interest rate paid on borrowings under the Senior Credit Facility is based on a pricing grid which is dependent upon the leverage ratio as calculated under the terms of the applicable facility for the prior fiscal quarter. The facility includes various customary restrictive covenants, including restrictions related to the ratio of debt to earnings before interest expense,

taxes, depreciation and amortization (leverage ratio) and the ratio of earnings before interest expense, taxes, depreciation and amortization to interest expense (coverage ratio). Compliance with these covenants is determined quarterly based on the operating cash flows. We were in compliance with all covenants and restrictions under all our outstanding credit agreements as of December 31, 2018 and 2017, and no event of default had occurred that would permit the lenders under our outstanding credit agreements to accelerate the debt if not cured. In the future, our ability to generate sufficient operating cash flows, among other factors, will determine the amounts available to be borrowed under these facilities. As of December 31, 2018, there were no covenants or other restrictions that would have limited our ability to borrow under these facilities.

On March 9, 2017, Olin issued $500.0 million aggregate principal amount of 5.125% senior notes due September 15, 2027, which were registered under the Securities Act of 1933, as amended. Interest on the 2027 Notes began accruing from March 9, 2017 and is paid semi-annually beginning on September 15, 2017. Proceeds from the 2027 Notes were used to redeem the remaining balance of the Sumitomo Credit Facility.

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In connection with the Acquisition, Olin and DowDuPont entered into arrangements for the long-term supply of ethylene by DowDuPont to Olin, pursuant to which, among other things, Olin made upfront payments of $433.5 million on the Closing Date in order to receive ethylene at producer economics and for certain reservation fees and for the option to obtain additional ethylene at producer economics. During 2017, we made an additional payment of $209.4 million in connection with our option to reserve additional ethylene supply at producer economics from DowDuPont. On February 27, 2017, we also exercised the remaining option to obtain additional ethylene at producer economics from DowDuPont. In connection with the exercise of this option, we also secured a long-term customer arrangement. As a result, an additional payment will be made to DowDuPont of between $440 million and $465 million on or about the fourth quarter of 2020.

During 2016, Olin entered into arrangements to increase our supply of low cost electricity. These arrangements improve manufacturing flexibility at our Freeport, TX and Plaquemine, LA facilities, reduce our overall electricity cost and accelerate the realization of cost synergies available from the Acquired Business. In conjunction with these arrangements, Olin made payments of $175.7 million during 2016.

On December 20, 2016, we entered into a three-year, $250.0 million Receivables Financing Agreement with PNC Bank, National Association, as administrative agent. Under the Receivables Financing Agreement, our eligible trade receivables are used for collateralized borrowings and continue to be serviced by us. In addition, the Receivables Financing Agreement incorporates the leverage and coverage covenants that are contained in the Senior Revolving Credit Facility. As of December 31, 2018 and 2017, we had $125.0 million and $249.7 million, respectively, drawn under the agreement. As of December 31, 2018, we had $125.0 million of additional borrowing capacity under the Receivables Financing Agreement. For the year ended December 31, 2017, we borrowed $40.0 million under the Receivables Financing Agreement and used the proceeds to fund a portion of the payment to DowDuPont associated with a long-term ethylene supply contract to reserve additional ethylene at producer economics. For the year ended December 31, 2016, the proceeds of the Receivables Financing Agreement were used to repay $210.0 million of the Sumitomo Credit Facility.

Olin also has trade accounts receivable factoring arrangements (AR Facilities) and pursuant to the terms of the AR Facilities, certain of our subsidiaries may sell their accounts receivable up to a maximum of $315.0 million. We will continue to service the outstanding accounts sold. These receivables qualify for sales treatment under ASC 860 “Transfers and Servicing” and, accordingly, the proceeds are included in net cash provided by operating activities in the consolidated statements of cash flows. The gross amount of receivables sold for the years ended December 31, 2018, 2017 and 2016 totaled $1,372.3 million, $1,655.2 million and $533.6 million, respectively. The factoring discount paid under the AR Facilities is recorded as interest expense on the consolidated statements of operations. The factoring discount for the years ended December 31, 2018, 2017 and 2016 was $4.3 million, $3.7 million and $1.1 million, respectively. The agreements are without recourse and therefore no recourse liability has been recorded as of December 31, 2018. As of December 31, 2018, 2017 and 2016, $132.4 million, $182.3 million and $126.1 million, respectively, of receivables qualifying for sales treatment were outstanding and will continue to be serviced by us.

We finalized our purchase price allocation of the Acquisition during the third quarter of 2016. During 2016, payments of $69.5 million were made related to certain acquisition related liabilities including the final working capital adjustment.

During 2016, $210.0 million was repaid under the Sumitomo Credit Facility using proceeds from the Receivables Financing Agreement. During 2017, the remaining balance of $590.0 million was repaid using proceeds from the Senior Credit Facility and the 2027 Notes.

Cash flow from operations is variable as a result of both the seasonal and the cyclical nature of our operating results, which have been affected by seasonal and economic cycles in many of the industries we serve, such as the vinyls, urethanes, bleach, ammunition and pulp and paper. Cash flow from operations is affected by changes in chlorine, caustic soda and EDC selling prices caused by the changes in the supply/demand balance of these products, resulting in the Chlor Alkali Products and Vinyls segment having significant leverage on our earnings and cash flow. For example, assuming all other costs remain constant, internal consumption remains approximately the same and we are operating at full capacity, a $10 selling price change per ton of chlorine equates to an approximate $10 million annual change in our revenues and pretax profit, a $10 selling price change per ton of caustic soda equates to an approximate $30 million annual change in our revenues and pretax profit, and a $0.01 selling price change per pound of EDC equates to an approximate $20 million annual change in our revenues and pretax profit.

For 2018, cash provided by operating activities increased by $259.0 million from 2017, primarily due to an increase in operating results, partially offset by an increase in working capital. For 2018, working capital increased $71.6 million compared to a decrease of $9.8 million in 2017. Receivables increased from December 31, 2017 by $46.3 million primarily as

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a result of higher sales in the fourth quarter of 2018 compared to the fourth quarter of 2017 and a decrease in receivables sold under the accounts receivable factoring arrangement. In 2018, inventories increased by $35.5 million and accounts payable and accrued liabilities increased by $14.5 million. The increases in inventories and accounts payable were primarily due to higher raw material costs. The increase in accrued liabilities was primarily related to the Information Technology Project.

Capital spending was $385.2 million, $294.3 million and $278.0 million in 2018, 2017 and 2016, respectively. Capital spending was 64%, 63% and 64% of depreciation in 2018, 2017 and 2016, respectively.

During 2017, we began a multi-year implementation of the Information Technology Project. The project is planned to standardize business processes across the chemicals businesses with the objective of maximizing cost effectiveness, efficiency and control across our global operations. The project is anticipated to be completed during 2020. Total capital spending is forecast to be $250 million and associated expenses are forecast to be $100 million. Our results for the years ended December 31, 2018 and 2017 include $84.5 million and $35.8 million, respectively, of capital spending and $36.5 million and $5.3 million, respectively, of expenses associated with this project.

In 2019, we expect our capital spending to be in the $375 million to $425 million range, which includes approximately $80 million of capital spending related to the Information Technology Project.

In December 2017 and 2016, $12.2 million was repaid on the SunBelt Notes. At December 31, 2017, all amounts due under the SunBelt Notes had been repaid.

In June 2016, we repaid $125.0 million of the 2016 Notes, which became due.

At December 31, 2018, we had total letters of credit of $74.7 million outstanding, of which $3.5 million were issued under our Senior Revolving Credit Facility. The letters of credit were used to support certain long-term debt, certain workers compensation insurance policies, certain plant closure and post-closure obligations and certain international pension funding requirements.

Our current debt structure is used to fund our business operations. As of December 31, 2018, we had long-term borrowings, including the current installment and capital lease obligations, of $3,230.3 million, of which $823.9 million was at variable rates. Annual maturities of long-term debt, including capital lease obligations, are $125.9 million in 2019, $1.8 million in 2020, $0.5 million in 2021, $743.4 million in 2022, $720.3 million in 2023 and a total of $1,706.2 million thereafter. Commitments from banks under our Senior Revolving Credit Facility and AR Facilities are an additional source of liquidity. Included within the $3,230.3 million of long-term borrowings on the consolidated balance sheet as of December 31, 2018 were deferred debt issuance costs and deferred losses on fair value interest rate swaps of $67.8 million.

In April 2016, we entered into three tranches of forward starting interest rate swaps whereby we agreed to pay fixed rates to the counterparties who, in turn, pay us floating rates on $1,100.0 million, $900.0 million, and $400.0 million of our underlying floating-rate debt obligations. Each tranche's term length is for twelve months beginning on December 31, 2016, December 31, 2017, and December 31, 2018, respectively. The counterparties to the agreements are SMBC Capital Markets, Inc., Wells Fargo Bank, N.A. (Wells Fargo), PNC Bank, National Association and Toronto-Dominion Bank. These counterparties are large financial institutions; however, the risk of loss to us in the event of nonperformance by a counterparty could be significant to our financial position or results of operations. We have designated the swaps as cash flow hedges of the risk of changes in interest payments associated with our variable-rate borrowings. Accordingly, the remaining swap agreement has been recorded at its fair market value of $5.3 million and is included in other current assets on the accompanying consolidated balance sheet, with the corresponding gain deferred as a component of other comprehensive loss. For the years ended December 31, 2018 and

2017, $8.9 million and $3.1 million, respectively, of income was recorded to interest expense on the accompanying consolidated statements of operations related to these swap agreements.

In April 2016, we entered into interest rate swaps on $250.0 million of our underlying fixed-rate debt obligations, whereby we agreed to pay variable rates to the counterparties who, in turn, pay us fixed rates. The counterparties to these agreements are Toronto-Dominion Bank and SMBC Capital Markets, Inc., both of which are major financial institutions.

In October 2016, we entered into interest rate swaps on an additional $250.0 million of our underlying fixed-rate debt obligations, whereby we agreed to pay variable rates to the counterparties who, in turn, pay us fixed rates. The counterparties to these agreements are PNC Bank, National Association and Wells Fargo, both of which are major financial institutions.

We have designated the April 2016 and October 2016 interest rate swap agreements as fair value hedges of the risk of changes in the value of fixed rate debt due to changes in interest rates for a portion of our fixed rate borrowings. Accordingly,

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the swap agreements have been recorded at their fair market value of $33.7 million and are included in other long-term liabilities on the accompanying consolidated balance sheet, with a corresponding decrease in the carrying amount of the related debt. For the year ended December 31, 2018, $2.1 million of expense has been recorded to interest expense on the accompanying consolidated statements of operations related to these swap agreements. For the years ended December 31, 2017 and 2016, $2.9 million and $2.6 million, respectively, of income has been recorded to interest expense on the accompanying consolidated statements of operations related to these swap agreements.

We have registered an undetermined amount of securities with the SEC, so that, from time-to-time, we may issue debt securities, preferred stock and/or common stock and associated warrants in the public market under that registration statement.

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OFF-BALANCE SHEET ARRANGEMENTS

Our operating lease commitments are primarily for railroad cars, but also include logistics, manufacturing, office and storage facilities and equipment, information technology equipment and land. Virtually none of our lease agreements contain escalation clauses or step rent provisions.

Our long-term contractual commitments, including the on and off-balance sheet arrangements, consisted of the following:

	Payments Due by Period				
	Total	Less than 1 Year	1-3 Years	3-5 Years	More than 5 Years
Contractual Obligations	($ in millions)				
Debt obligations, including capital lease obligations[1]	$3,298.1	$125.9	$2.3	$1,463.7	$1,706.2
Interest payments under debt obligations and interest rate swap agreements[2]	1,421.4	213.8	431.8	383.4	392.4
Contingent tax liability	34.6	0.4	7.6	4.3	22.3
Domestic qualified pension plan contributions[3]	—	—	—	—	—
International qualified pension plan contributions[4]	232.8	4.3	11.3	14.2	203.0
Non-qualified pension plan payments	5.9	0.5	1.4	0.7	3.3
Postretirement benefit payments	47.0	3.9	6.7	5.9	30.5
Long-term supply contracts	441.0	—	441.0	—	—
Off-Balance Sheet Commitments:					
Non-cancelable operating leases	345.4	82.2	105.6	55.0	102.6
Purchasing commitments:					
Raw materials	7,920.7	676.2	1,369.6	1,450.0	4,424.9
Capital expenditures	1.9	1.9	—	—	—
Utilities	1.0	0.4	0.6	—	—
Total	$13,749.8	$1,109.5	$2,377.9	$3,377.2	$6,885.2

(1) Excludes debt issuance costs and deferred losses on fair value interest rate swaps of $67.8 million at December 31, 2018.

(2) For the purposes of this table, we have assumed for all periods presented that there are no changes in the rates from those in effect at December 31, 2018 which ranged from 2.52% to 10.00% and excludes $31.9 million of remaining accretion expense related to the 2020 ethylene payment discount.

(3) Given the inherent uncertainty as to actual minimum funding requirements for qualified defined benefit pension plans, no amounts are included in this table for any period beyond one year. Based on the current funding requirements, we will not be required to make any cash contributions to the domestic qualified defined benefit pension plan at least through 2019. During 2016, we made a discretionary cash contribution to our domestic qualified defined benefit pension plan of $6.0 million.

(4) These amounts are only estimated payments assuming for our foreign qualified pension plans a weighted average annual expected rate of return on pension plan assets of 5.2% and a discount rate on pension plan obligations of 2.2%. These estimated payments are subject to significant variation and the actual payments may be more than the amounts estimated. In connection with international qualified defined benefit pension plans we made cash contributions of $2.6 million, $1.7 million and $1.3 million in 2018, 2017 and 2016, respectively, and we anticipate

less than $5 million of cash contributions to international qualified defined benefit pension plans in 2019.

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Non-cancelable operating leases and purchasing commitments are utilized in our normal course of business for our projected needs. We have supply contracts with various third parties for certain raw materials, including ethylene, electricity, propylene and benzene. These contracts have initial terms ranging from several to 20 years. For losses that we believe are probable and which are estimable, we have accrued for such amounts in our consolidated balance sheets. In addition to the table above, we have various commitments and contingencies including: defined benefit and postretirement healthcare plans (as described below), environmental matters (see discussion above under "Environmental Matters") and litigation claims (see Item 3—"Legal Proceedings").

We have several defined benefit pension and defined contribution plans, as described in Note 14 "Pension Plans" and Note 18 "Contributing Employee Ownership Plan" in the notes to consolidated financial statements contained in Item 8. We fund the defined benefit pension plans based on the minimum amounts required by law plus such amounts we deem appropriate. We have postretirement healthcare plans that provide health and life insurance benefits to certain retired employees and their beneficiaries, as described in Note 15 "Postretirement Benefits" in the notes to consolidated financial statements contained in Item 8. The defined contribution and other postretirement plans are not pre-funded and expenses are paid by us as incurred.

We also have standby letters of credit of $74.7 million of which $3.5 million have been issued through our Senior Revolving Credit Facility. At December 31, 2018, we had $596.5 million available under our Senior Revolving Credit Facility because we had issued $3.5 million of letters of credit.

CRITICAL ACCOUNTING POLICIES AND ESTIMATES

Our discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, sales and expenses, and related disclosure of contingent assets and liabilities. Significant estimates in our consolidated financial statements include goodwill recoverability, environmental, restructuring and other unusual items, litigation, income tax reserves including deferred tax asset valuation allowances, pension, postretirement and other benefits and allowance for doubtful accounts. We base our estimates on prior experience, current facts and circumstances and other assumptions. Actual results may differ from these estimates.

We believe the following critical accounting policies affect the more significant judgments and estimates used in the preparation of the consolidated financial statements.

Goodwill

Goodwill is not amortized, but is reviewed for impairment annually in the fourth quarter and/or when circumstances or other events indicate that impairment may have occurred. ASC 350 "Intangibles—Goodwill and Other" (ASC 350) permits entities to make a qualitative assessment of whether it is more likely than not that a reporting unit's fair value is less than its carrying amount before applying the two-step goodwill impairment test. Circumstances that are considered as part of the qualitative assessment and could trigger the two-step impairment test include, but are not limited to: a significant adverse change in the business climate; a significant adverse legal judgment; adverse cash flow trends; an adverse action or assessment by a government agency; unanticipated competition; decline in our stock price; and a significant restructuring charge within a reporting unit. We define reporting units at the business segment level or one level below the business segment level. For purposes of testing goodwill for impairment, goodwill has been allocated to our reporting units to the extent it relates to each reporting unit. Based upon our qualitative assessment, it is more likely than not that the fair value of our reporting units are greater than their carrying amounts as of December 31, 2018. No impairment charges were recorded for 2018, 2017 or 2016.

It is our practice, at a minimum, to perform a quantitative goodwill impairment test in the fourth quarter every three years. In the fourth quarter of 2016, we performed our triennial quantitative goodwill impairment test for our reporting units. We use a discounted cash flow approach to develop the estimated fair value of a reporting unit when a quantitative review is performed. Management judgment is required in developing the assumptions for the discounted cash flow model. We also corroborate our discounted cash flow analysis by evaluating a market-based approach that considers earnings before interest, taxes, depreciation and amortization (EBITDA) multiples from a representative sample of comparable public companies. As a further indicator that each reporting unit has been valued appropriately using a discounted cash flow model, the aggregate fair value of all reporting units is reconciled to the total market value of Olin. An impairment would be recorded if the carrying amount of a reporting unit exceeded the estimated fair value. Based on the aforementioned analysis, the estimated fair value of our reporting units substantially exceeded the carrying value of the reporting units.

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The discount rate, profitability assumptions and terminal growth rate of our reporting units and the cyclical nature of the chlor alkali industry were the material assumptions utilized in the discounted cash flow model used to estimate the fair value of each reporting unit. The discount rate reflects a weighted-average cost of capital, which is calculated based on observable market data. Some of this data (such as the risk free or treasury rate and the pretax cost of debt) are based on the market data at a point in time. Other data (such as the equity risk premium) are based upon market data over time for a peer group of companies in the chemical manufacturing or distribution industries with a market capitalization premium added, as applicable.

The discounted cash flow analysis requires estimates, assumptions and judgments about future events. Our analysis uses our internally generated long-range plan. Our discounted cash flow analysis uses the assumptions in our long-range plan about terminal growth rates, forecasted capital expenditures and changes in future working capital requirements to determine the implied fair value of each reporting unit. The long-range plan reflects management judgment, supplemented by independent chemical industry analyses which provide multi-year chlor alkali industry operating and pricing forecasts.

We believe the assumptions used in our goodwill impairment analysis are appropriate and result in reasonable estimates of the implied fair value of each reporting unit. However, given the economic environment and the uncertainties regarding the impact on our business, there can be no assurance that our estimates and assumptions, made for purposes of our goodwill impairment testing, will prove to be an accurate prediction of the future. If our assumptions regarding future performance are not achieved, we may be required to record goodwill impairment charges in future periods. It is not possible at this time to determine if any such future impairment charge would result or, if it does, whether such charge would be material.

Environmental

Accruals (charges to income) for environmental matters are recorded when it is probable that a liability has been incurred and the amount of the liability can be reasonably estimated, based upon current law and existing technologies. These amounts, which are not discounted and are exclusive of claims against third parties, are adjusted periodically as assessments and remediation efforts progress or additional technical or legal information becomes available. Environmental costs are capitalized if the costs increase the value of the property and/or mitigate or prevent contamination from future operations. Environmental costs and recoveries are included in costs of goods sold.

Environmental exposures are difficult to assess for numerous reasons, including the identification of new sites, developments at sites resulting from investigatory studies, advances in technology, changes in environmental laws and regulations and their application, changes in regulatory authorities, the scarcity of reliable data pertaining to identified sites, the difficulty in assessing the involvement and financial capability of other PRPs and our ability to obtain contributions from other parties and the lengthy time periods over which site remediation occurs. It is possible that some of these matters (the outcomes of which are subject to various uncertainties) may be resolved unfavorably to us, which could materially adversely affect our financial position, cash flows or results of operations.

NEW ACCOUNTING PRONOUNCEMENTS

In August 2018, the Financial Accounting Standards Board (FASB) issued ASU 2018-14, “Disclosure Framework—Changes to the Disclosure Requirements for Defined Benefit Plans” which amends ASC 715. This update includes adding, clarifying and removing various disclosure requirements related to defined benefit pension and other postretirement plans. This update is effective for fiscal years beginning after December 15, 2020, with earlier application permitted. The guidance in this update is applied on a retrospective basis to all periods presented. We adopted this update on December 31, 2018. The adoption of this update did not have a material impact on our consolidated financial statements.

In August 2018, the FASB issued ASU 2018-13, “Disclosure Framework—Changes to the Disclosure Requirements for Fair Value Measurement” which amends ASC 820 “Fair Value Measurements.” This update includes adding, modifying and removing various disclosure requirements related to fair value measurements. This update is effective for fiscal years beginning after December 15, 2019, and interim periods within those fiscal years, with earlier application permitted. This update will be applied on a prospective basis for certain changes and retrospectively for other changes. We adopted this update on December 31, 2018. The adoption of this update did not have a material impact on our consolidated financial statements.

In March 2018, the FASB issued ASU 2018-05, “Amendments to SEC Paragraphs Pursuant to SEC Staff Accounting Bulletin No. 118” (SAB 118) which amends ASC 740 “Income Taxes.” This update codifies the guidance in SAB 118. SAB 118, “Income Tax Accounting Implications of the Tax Cuts and Jobs Act,” provided guidance for companies that have not completed their accounting for the income tax effects of the U.S. Tax Cuts and Jobs Act (2017 Tax Act) in the period of enactment, allowing for a measurement period of up to one year after the enactment date to finalize the recording of the related tax impacts. During 2017, we recognized a provisional deferred tax benefit of $437.9 million, which was included as a

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component of income tax (benefit) provision. At December 31, 2018, we have completed our accounting for the tax effects of enactment of the 2017 Tax Act. During 2018, we increased the deferred tax benefit by $3.9 million as a result of filing the 2017 U.S. and foreign tax returns and decreased the deferred tax benefit by $0.1 million as a result of additional guidance issued by the Internal Revenue Service.

In February 2018, FASB issued ASU 2018-02, “Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income” which amends ASC 220 “Income Statement—Reporting Comprehensive Income.” This update allows a reclassification from accumulated other comprehensive loss to retained earnings for the stranded tax effects resulting from the 2017 Tax Act during each fiscal year or quarter in which the effect of the lower tax rate is recorded. The update is effective for fiscal years beginning after December 15, 2018, and interim periods within those fiscal years, with earlier application permitted. We adopted this update in March 2018 and reclassified $85.9 million related to the deferred gain resulting from the 2017 Tax Act from accumulated other comprehensive loss to retained earnings.

In August 2017, the FASB issued ASU 2017-12, “Targeted Improvements to Accounting for Hedge Activities” which amends ASC 815 “Derivatives and Hedging” (ASC 815). This update is intended to more closely align hedge accounting with companies’ risk management strategies, simplify the application of hedge accounting guidance, and increase transparency as to the scope and results of hedge programs. The update is effective for fiscal years beginning after December 15, 2018, and interim periods within those fiscal years, with earlier application permitted. We adopted this update on January 1, 2018. The adoption of this update did not have a material impact on our consolidated financial statements.

In March 2017, the FASB issued ASU 2017-07, “Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost” which amends ASC 715. This update requires the presentation of the service cost component of net periodic benefit (income) costs in the same income statement line item as other employee compensation costs arising from services rendered during the period. The update requires the presentation of the other components of the net periodic benefit (income) costs separately from the line item that includes the service cost and outside of any subtotal of operating income. The update is effective for fiscal years beginning after December 15, 2017, and interim periods within those fiscal years. The guidance in this update is applied on a retrospective basis with earlier application permitted. We adopted this update on January 1, 2018 using the retrospective method. The adoption of ASU 2017-07 resulted in a change in our net periodic benefit (income) costs within operating income, which was offset by a corresponding change in non-operating pension income to reflect the impact of presenting the interest cost, expected return on plan assets and amortization of prior service cost and net actuarial loss components of net periodic benefit (income) costs outside of operating income. For the years ended December 31, 2017 and 2016, the adoption of ASU 2017-07 resulted in a reclassification of $15.3 million and $20.8 million, respectively, from cost of goods sold, and $19.1 million and $24.0 million, respectively, from selling and administration expenses to non-operating pension income reflecting the aforementioned reclassification on our consolidated statements of operations. The service cost component of net periodic benefit (income) costs continues to be included in the same income statement line item as other employee compensation costs arising from services rendered during the period.

In January 2017, the FASB issued ASU 2017-04, “Simplifying the Test for Goodwill Impairment” which amends ASC 350. This update will simplify the measurement of goodwill impairment by eliminating Step 2 from the goodwill impairment test. This update will require an entity to perform its annual, or interim, goodwill impairment test by comparing the fair value of a reporting unit with its carrying amount and recognize an impairment charge for the amount by which the carrying amount exceeds the reporting unit’s fair value. The update does not modify the option to perform the qualitative assessment for a reporting unit to determine if the quantitative impairment test is necessary. This update is effective for fiscal years beginning after December 15, 2019, and interim periods within those fiscal years. The guidance in this update is applied on a prospective basis with earlier application permitted. We plan to adopt this update on January 1, 2020 and do not expect the update to have a material impact on our consolidated

financial statements.

In August 2016, the FASB issued ASU 2016-15, “Classification of Certain Cash Receipts and Cash Payments” which amends ASC 230 “Statement of Cash Flows.” This update will make eight targeted changes to how cash receipts and cash payments are presented and classified in the statement of cash flows. The update is effective for fiscal years beginning after December 15, 2017. The update will require adoption on a retrospective basis unless it is impracticable to apply, in which case it would be required to apply the amendments prospectively as of the earliest date practicable. We adopted this update on January 1, 2018. In connection with this update, we made an accounting policy election to apply the nature of the distribution approach when determining the proper classification of distributions received from equity method investments. The adoption of this update did not have a material impact on our consolidated financial statements.

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In February 2016, the FASB issued ASU 2016-02 “Leases,” (ASU 2016-02) which supersedes ASC 840 “Leases” and creates a new topic, ASC 842 “Leases.” Subsequent to the issuance of ASU 2016-02, ASC 842 was amended by various updates that amend and clarify the impact and implementation of the aforementioned update. These updates require lessees to recognize a lease liability and a lease asset for all leases, including operating leases, with a term greater than 12 months on its balance sheet. Upon initial application, the provisions of these updates are required to be applied using the modified retrospective method which requires retrospective adoption to each prior reporting period presented with the cumulative effect of adoption recorded to the earliest reporting period presented. An optional transition method can be utilized which requires retrospective adoption beginning on the date of adoption with the cumulative effect of initially applying these updates recognized at the date of initial adoption. These updates also expand the required quantitative and qualitative disclosures surrounding leases. These updates are effective for fiscal years beginning after December 15, 2018 and interim periods within those fiscal years, with earlier application permitted. We adopted these updates on January 1, 2019 using the optional transition method. Adoption of these updates resulted in the recording of additional operating lease assets and lease liabilities on our consolidated balance sheet of between approximately $275 million and $325 million as of January 1, 2019. Our assets and liabilities for finance leases remained unchanged. We also recognized the cumulative effect of applying these updates as an adjustment to retained earnings of between approximately $10 million and $15 million, net of the deferred tax impact, primarily related to the recognition of previously deferred sale/leaseback gains. Our consolidated statements of operations and cash flows were not impacted by this adoption. These updates also impacted our accounting policies, internal controls and disclosures related to leases.

In May 2014, the FASB issued ASU 2014-09 “Revenue from Contracts with Customers” (ASU 2014-09), which amends ASC 605 “Revenue Recognition” and creates a new topic, ASC 606 “Revenue from Contracts with Customers” (ASC 606). Subsequent to the issuance of ASU 2014-09, ASC 606 was amended by various updates that amend and clarify the impact and implementation of the aforementioned update. These updates provide guidance on how an entity should recognize revenue to depict the transfer of control of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. Upon initial application, the provisions of these updates are required to be applied retrospectively to each prior reporting period presented or retrospectively with the cumulative effect of initially applying this update recognized at the date of initial application. These updates also expand the disclosure requirements surrounding revenue recorded from contracts with customers. These updates are effective for fiscal years, and interim periods within those years, beginning after December 15, 2017. We adopted these updates on January 1, 2018 using the modified retrospective transition method. The cumulative effect of applying the updates did not have a material impact on our consolidated financial statements. The most significant impact the updates had was on our accounting policies and disclosures on revenue recognition. Expanded disclosures regarding revenue recognition are included within our notes to consolidated financial statements.

DERIVATIVE FINANCIAL INSTRUMENTS

We are exposed to market risk in the normal course of our business operations due to our purchases of certain commodities, our ongoing investing and financing activities and our operations that use foreign currencies. The risk of loss can be assessed from the perspective of adverse changes in fair values, cash flows and future earnings. We have established policies and procedures governing our management of market risks and the use of financial instruments to manage exposure to such risks. ASC 815 requires an entity to recognize all derivatives as either assets or liabilities in the consolidated balance sheets and measure those instruments at fair value. In accordance with ASC 815, we designate derivative contracts as cash flow hedges of forecasted purchases of commodities and forecasted interest payments related to variable-rate borrowings and designate certain interest rate swaps as fair value hedges of fixed-rate borrowings. We do not enter into any derivative instruments for trading or speculative purposes.

Energy costs, including electricity and natural gas, and certain raw materials used in our production processes are subject to price volatility. Depending on market conditions, we may enter into futures contracts, forward contracts, commodity swaps and put and call option contracts in order to reduce the impact of commodity price fluctuations. The majority of our commodity derivatives expire within one year.

For derivative instruments that are designated and qualify as a cash flow hedge, the change in fair value of the derivative is recognized as a component of other comprehensive income (loss) until the hedged item is recognized into earnings. Gains and losses on the derivatives representing hedge ineffectiveness are recognized currently in earnings.

We use cash flow hedges for certain raw material and energy costs such as copper, zinc, lead, ethane, electricity and natural gas to provide a measure of stability in managing our exposure to price fluctuations associated with forecasted purchases of raw materials and energy used in our manufacturing process. Settlements on derivative contracts resulted in gains of $5.4 million and $1.5 million in 2018 and 2017, respectively, and losses of $5.8 million in 2016 which were included in cost

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of goods sold. At December 31, 2018, we had open derivative notional contract positions through 2022 totaling $116.5 million (2017—$92.8 million). If all open futures contracts had been settled on December 31, 2018, we would have recognized a pretax loss of $2.6 million.

If commodity prices were to remain at December 31, 2018 levels, approximately $2.3 million of deferred losses, net of tax, would be reclassified into earnings during the next twelve months. The actual effect on earnings will be dependent on actual commodity prices when the forecasted transactions occur.

We use interest rate swaps as a means of minimizing cash flow fluctuations that may arise from volatility in interest rates of our variable-rate borrowings. In April 2016, we entered into three tranches of forward starting interest rate swaps whereby we agreed to pay fixed rates to the counterparties who, in turn, pay us floating rates on $1,100.0 million, $900.0 million and $400.0 million of our underlying floating-rate debt obligations. Each tranche's term length is for twelve months beginning on December 31, 2016, December 31, 2017 and December 31, 2018, respectively. The counterparties to the agreements are SMBC Capital Markets, Inc., Wells Fargo, PNC Bank, National Association, and Toronto-Dominion Bank. These counterparties are large financial institutions; however, the risk of loss to us in the event of nonperformance by a counterparty could be significant to our financial position or results of operations. We have designated the swaps as cash flow hedges of the risk of changes in interest payments associated with our variable-rate borrowings. Accordingly, the remaining swap agreement has been recorded at its fair market value of $5.3 million and is included in other current assets on the accompanying consolidated balance sheet, with the corresponding gain deferred as a component of other comprehensive loss. For the years ended December 31, 2018 and 2017, $8.9 million and $3.1 million, respectively, of income was recorded to interest expense on the accompanying consolidated statements of operations related to these swap agreements. If all open interest rate swap contracts had been settled on December 31, 2018, we would have recognized a pretax gain of $5.3 million.

If interest rates were to remain at December 31, 2018 levels, $5.3 million of deferred gains would be reclassified into earnings during the next twelve months. The actual effect on earnings will be dependent on actual interest rates when the forecasted transactions occur.

We also use interest rate swaps as a means of managing interest expense and floating interest rate exposure to optimal levels. For derivative instruments that are designated and qualify as a fair value hedge, the gain or loss on the derivative as well as the offsetting loss or gain on the hedged item attributable to the hedged risk are recognized in current earnings. We include the gain or loss on the hedged items (fixed-rate borrowings) in the same line item, interest expense, as the offsetting loss or gain on the related interest rate swaps. As of both December 31, 2018 and 2017, the total notional amounts of our interest rate swaps designated as fair value hedges were $500.0 million.

We have designated these interest rate swap agreements as fair value hedges of the risk of changes in the value of fixed-rate debt due to changes in interest rates for a portion of our fixed-rate borrowings. Accordingly, the swap agreements have been recorded at their fair market value of $33.7 million and are included in other long-term liabilities on the accompanying consolidated balance sheet, with a corresponding decrease in the carrying amount of the related debt. For the year ended December 31, 2018, $2.1 million of expense has been recorded to interest expense on the accompanying consolidated statements of operations related to these swap agreements. For the years ended December 31, 2017 and 2016, $2.9 million and $2.6 million, respectively, of income has been recorded to interest expense on the accompanying consolidated statements of operations related to these swap agreements.

We actively manage currency exposures that are associated with net monetary asset positions, currency purchases and sales commitments denominated in foreign currencies and foreign currency denominated assets and liabilities created in the normal course of business. We enter into forward sales and purchase contracts to manage currency to offset our net exposures, by currency, related to the foreign currency denominated monetary assets and liabilities of our operations. At December 31, 2018, we had outstanding forward contracts to buy foreign currency with a notional

value of $123.7 million and to sell foreign currency with a notional value of $82.6 million. All of the currency derivatives expire within one year and are for U.S. dollar (USD) equivalents. The counterparties to the forward contracts are large financial institutions; however, the risk of loss to us in the event of nonperformance by a counterparty could be significant to our financial position or results of operations. At December 31, 2017, we had outstanding forward contracts to buy foreign currency with a notional value of $135.5 million and to sell foreign currency with a notional value of $97.7 million.

Our foreign currency forward contracts and certain commodity derivatives did not meet the criteria to qualify for hedge accounting. The effect on operating results of items not qualifying for hedge accounting was a (loss) gain of $(5.4) million, $1.8 million and $(11.5) million in 2018, 2017 and 2016, respectively.

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The fair value of our derivative asset and liability balances were:

	December 31, 2018	2017
	($ in millions)	
Other current assets	$5.7	$19.2
Other assets	0.7	3.6
Total derivative asset	$6.4	$22.8
Accrued liabilities	$3.5	$3.8
Other liabilities	34.1	28.1
Total derivative liability	$37.6	$31.9

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

We are exposed to market risk in the normal course of our business operations due to our purchases of certain commodities, our ongoing investing and financing activities and our operations that use foreign currencies. The risk of loss can be assessed from the perspective of adverse changes in fair values, cash flows and future earnings. We have established policies and procedures governing our management of market risks and the use of financial instruments to manage exposure to such risks.

Energy costs, including electricity and natural gas, and certain raw materials used in our production processes are subject to price volatility. Depending on market conditions, we may enter into futures contracts, forward contracts, commodity swaps and put and call option contracts in order to reduce the impact of commodity price fluctuations. As of December 31, 2018, we maintained open positions on commodity contracts with a notional value totaling $116.5 million ($92.8 million at December 31, 2017). Assuming a hypothetical 10% increase in commodity prices, which are currently hedged, as of December 31, 2018, we would experience an $11.7 million ($9.3 million at December 31, 2017) increase in our cost of inventory purchased, which would be substantially offset by a corresponding increase in the value of related hedging instruments.

We transact business in various foreign currencies other than the USD which exposes us to movements in exchange rates which may impact revenue and expenses, assets and liabilities and cash flows. Our significant foreign currency exposure is denominated with European currencies, primarily the Euro, although exposures also exist in other currencies of Asia Pacific, Latin America, Middle East and Africa. For all derivative positions, we evaluated the effects of a 10% shift in exchange rates between those currencies and the USD, holding all other assumptions constant. Unfavorable currency movements of 10% would negatively affect the fair values of the derivatives held to hedge currency exposures by $19.7 million. These unfavorable changes would generally have been offset by favorable changes in the values of the underlying exposures.

We are exposed to changes in interest rates primarily as a result of our investing and financing activities. Our current debt structure is used to fund business operations, and commitments from banks under our Senior Revolving Credit Facility and Receivables Financing Agreement are sources of liquidity. As of December 31, 2018, we had long-term borrowings, including current installments of long-term debt and capital lease obligations, of $3,230.3 million ($3,612.0 million at December 31, 2017) of which $823.9 million ($1,749.0 million at December 31, 2017) was issued at variable rates.

In April 2016, we entered into three tranches of forward starting interest rate swaps whereby we agreed to pay fixed rates to the counterparties who, in turn, pay us floating rates on $1,100.0 million, $900.0 million and $400.0 million of our underlying floating-rate debt obligations. Each tranche’s term length is for twelve months beginning on December

31, 2016, December 31, 2017 and December 31, 2018, respectively. The counterparties to the agreements are SMBC Capital Markets, Inc., Wells Fargo, PNC Bank, National Association, and Toronto-Dominion Bank. These counterparties are large financial institutions; however, the risk of loss to us in the event of nonperformance by a counterparty could be significant to our financial position or results of operations.

In April 2016, we entered into interest rate swaps on $250.0 million of our underlying fixed-rate debt obligations, whereby we agreed to pay variable rates to the counterparties, who, in turn, pay us fixed rates. The counterparties to these agreements are Toronto-Dominion Bank and SMBC Capital Markets, Inc., both of which are major financial institutions.

In October 2016, we entered into interest rate swaps on an additional $250.0 million of our underlying fixed-rate debt obligations, whereby we agreed to pay variable rates to the counterparties who, in turn, pay us fixed rates. The counterparties to these agreements are PNC Bank, National Association and Wells Fargo, both of which are major financial institutions.

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Assuming no changes in the $823.9 million of variable-rate debt levels from December 31, 2018, we estimate that a hypothetical change of 100-basis points in the LIBOR interest rates from 2018 would impact annual interest expense by $8.2 million. A portion of this hypothetical change would be offset by our interest rate swaps.

Our interest rate swaps reduced interest expense by $6.8 million, $6.1 million and $3.7 million in 2018, 2017 and 2016, respectively.

If the actual changes in commodities, foreign currency, or interest pricing is substantially different than expected, the net impact of commodity risk, foreign currency risk, or interest rate risk on our cash flow may be materially different than that disclosed above.

We do not enter into any derivative financial instruments for speculative purposes.

CAUTIONARY STATEMENT ABOUT FORWARD-LOOKING STATEMENTS

This report includes forward-looking statements. These statements relate to analyses and other information that are based on management's beliefs, certain assumptions made by management, forecasts of future results and current expectations, estimates and projections about the markets and economy in which we and our various segments operate. The statements contained in this report that are not statements of historical fact may include forward-looking statements that involve a number of risks and uncertainties.

We have used the words "anticipate," "intend," "may," "expect," "believe," "should," "plan," "estimate," "project," "forecast," and variations of such words and similar expressions in this report to identify such forward-looking statements. These 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. Therefore, actual outcomes and results may differ materially from those matters expressed or implied in such forward-looking statements. We undertake no obligation to update publicly any forward-looking statements, whether as a result of future events, new information or otherwise.

The risks, uncertainties, and assumptions involved in our forward-looking statements include those discussed under Item 1A—"Risk Factors." You should consider all of our forward-looking statements in light of these factors. In addition, other risks and uncertainties not presently known to us or that we consider immaterial could affect the accuracy of our forward-looking statements.

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Item 8. CONSOLIDATED FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

MANAGEMENT REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

The management of Olin Corporation is responsible for establishing and maintaining adequate internal control over financial reporting. Olin's internal control system was designed to provide reasonable assurance to the company's management and board of directors regarding the preparation and fair presentation of published financial statements.

All internal control systems, no matter how well designed, have inherent limitations. Therefore, even those systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation, and may not prevent or detect all misstatements.

The management of Olin Corporation has assessed the effectiveness of the company's internal control over financial reporting as of December 31, 2018. In making this assessment, we used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in Internal Control - Integrated Framework (2013) to guide our analysis and assessment. Based on our assessment as of December 31, 2018, the company's internal control over financial reporting was effective based on those criteria.

Our independent registered public accountants, KPMG LLP, have audited and issued a report on our internal control over financial reporting, which appears in this Form 10-K.

/s/ John E. Fischer
Chairman, President and Chief Executive Officer

/s/ Todd A. Slater
Vice President and Chief Financial Officer

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Shareholders and Board of Directors of Olin Corporation:

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated balance sheets of Olin Corporation and subsidiaries (the Company) as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive income (loss), shareholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and the related notes (collectively, 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.

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 years in the three-year period ended December 31, 2018, in conformity with U.S. generally accepted accounting principles. 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 Committee of Sponsoring Organizations of the Treadway Commission.

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 Report on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion 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 (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

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

/s/ KPMG LLP

We have served as the Company's auditor since 1954.

St. Louis, Missouri
February 25, 2019

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CONSOLIDATED BALANCE SHEETS
December 31
(In millions, except per share data)

Assets	2018	2017
Current assets:		
Cash and cash equivalents	$178.8	$218.4
Receivables, net	776.3	733.2
Income taxes receivable	5.9	16.9
Inventories, net	711.4	682.6
Other current assets	35.0	48.1
Total current assets	1,707.4	1,699.2
Property, plant and equipment, net	3,482.1	3,575.8
Deferred income taxes	26.3	36.4
Other assets	1,150.4	1,208.4
Intangible assets, net	511.6	578.5
Goodwill	2,119.6	2,120.0
Total assets	$8,997.4	$9,218.3
Liabilities and Shareholders' Equity		
Current liabilities:		
Current installments of long-term debt	$125.9	$0.7
Accounts payable	636.5	669.8
Income taxes payable	22.6	9.4
Accrued liabilities	333.3	274.4
Total current liabilities	1,118.3	954.3
Long-term debt	3,104.4	3,611.3
Accrued pension liability	674.3	635.9
Deferred income taxes	518.9	511.2
Other liabilities	749.3	751.9
Total liabilities	6,165.2	6,464.6
Commitments and contingencies		
Shareholders' equity:		
Common stock, par value $1 per share:		
Authorized, 240.0 shares;		
Issued and outstanding, 165.3 shares (167.1 in 2017)	165.3	167.1
Additional paid-in capital	2,247.4	2,280.9
Accumulated other comprehensive loss	(651.0)	(484.6)
Retained earnings	1,070.5	790.3
Total shareholders' equity	2,832.2	2,753.7
Total liabilities and shareholders' equity	$8,997.4	$9,218.3

The accompanying notes to consolidated financial statements are an integral part of the consolidated financial statements.

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CONSOLIDATED STATEMENTS OF OPERATIONS
Years ended December 31
(In millions, except per share data)

	2018	2017	2016
Sales	$6,946.1	$6,268.4	$5,550.6
Operating expenses:			
Cost of goods sold	5,822.1	5,554.9	4,944.5
Selling and administration	430.6	369.8	347.2
Restructuring charges	21.9	37.6	112.9
Acquisition-related costs	1.0	12.8	48.8
Other operating income	6.4	3.3	10.6
Operating income	676.9	296.6	107.8
Earnings (losses) of non-consolidated affiliates	(19.7)	1.8	1.7
Interest expense	243.2	217.4	191.9
Interest income	1.6	1.8	3.4
Non-operating pension income	21.7	34.4	44.8
Income (loss) before taxes	437.3	117.2	(34.2)
Income tax provision (benefit)	109.4	(432.3)	(30.3)
Net income (loss)	$327.9	$549.5	$(3.9)
Net income (loss) per common share:			
Basic	$1.97	$3.31	$(0.02)
Diluted	$1.95	$3.26	$(0.02)
Average common shares outstanding:			
Basic	166.8	166.2	165.2
Diluted	168.4	168.5	165.2

The accompanying notes to consolidated financial statements are an integral part of the consolidated financial statements.

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CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME (LOSS)
Years ended December 31
(In millions)

	2018	2017	2016
Net income (loss)	$327.9	$549.5	$(3.9)
Other comprehensive (loss) income, net of tax:			
Foreign currency translation adjustments, net	(22.2)	31.7	(12.0)
Unrealized (losses) gains on derivative contracts, net	(11.7)	(1.7)	19.7
Pension and postretirement liability adjustments, net	(74.9)	(21.6)	(37.5)
Amortization of prior service costs and actuarial losses, net	28.3	17.0	12.3
Total other comprehensive (loss) income, net of tax	(80.5)	25.4	(17.5)
Comprehensive income (loss)	$247.4	$574.9	$(21.4)

The accompanying notes to consolidated financial statements are an integral part of the consolidated financial statements.

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CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY
(In millions, except per share data)

	Common Stock		Additional Paid-In Capital	Accumulated Other Comprehensive Loss	Retained Earnings	Total Shareholders' Equity
	Shares Issued	Par Value				
Balance at January 1, 2016	165.1	$165.1	$2,236.4	$ (492.5)	$509.8	$ 2,418.8
Net loss	—	—	—	—	(3.9)	(3.9)
Other comprehensive loss	—	—	—	(17.5)	—	(17.5)
Dividends paid:						
Common stock ($0.80 per share)	—	—	—	—	(132.1)	(132.1)
Common stock issued for:						
Stock options exercised	0.3	0.3	3.8	—	—	4.1
Other transactions	—	—	(0.8)	—	—	(0.8)
Stock-based compensation	—	—	4.4	—	—	4.4
Balance at December 31, 2016	165.4	$165.4	$2,243.8	$ (510.0)	$373.8	$ 2,273.0
Net income	—	—	—	—	549.5	549.5
Other comprehensive income	—	—	—	25.4	—	25.4
Dividends paid:						
Common stock ($0.80 per share)	—	—	—	—	(133.0)	(133.0)
Common stock issued for:						
Stock options exercised	1.7	1.7	30.7	—	—	32.4
Other transactions	—	—	(0.9)	—	—	(0.9)
Stock-based compensation	—	—	7.3	—	—	7.3
Balance at December 31, 2017	167.1	$167.1	$2,280.9	$ (484.6)	$790.3	$ 2,753.7
Income tax reclassification adjustment	—	—	—	(85.9)	85.9	—
Net income	—	—	—	—	327.9	327.9
Other comprehensive loss	—	—	—	(80.5)	—	(80.5)
Dividends paid:						
Common stock ($0.80 per share)	—	—	—	—	(133.6)	(133.6)
Common stock repurchased and retired	(2.1)	(2.1)	(47.9)	—	—	(50.0)
Common stock issued for:						
Stock options exercised	0.2	0.2	3.2	—	—	3.4
Other transactions	0.1	0.1	2.0	—	—	2.1
Stock-based compensation	—	—	9.2	—	—	9.2
Balance at December 31, 2018	165.3	$165.3	$2,247.4	$ (651.0)	$1,070.5	$ 2,832.2

The accompanying notes to consolidated financial statements are an integral part of the consolidated financial statements.

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CONSOLIDATED STATEMENTS OF CASH FLOWS
Years ended December 31
(In millions)

	2018	2017	2016
Operating Activities			
Net income (loss)	$327.9	$549.5	$(3.9)
Adjustments to reconcile net income (loss) to net cash and cash equivalents provided by (used for) operating activities:			
Losses (earnings) of non-consolidated affiliates	19.7	(1.8)	(1.7)
Losses (gains) on disposition of property, plant and equipment	2.0	(3.1)	0.7
Stock-based compensation	12.0	9.1	7.5
Depreciation and amortization	601.4	558.9	533.5
Deferred income taxes	35.6	(452.7)	(32.7)
Write-off of equipment and facility included in restructuring charges	2.6	1.4	76.6
Qualified pension plan contributions	(2.6)	(1.7)	(7.3)
Qualified pension plan income	(15.0)	(26.9)	(37.5)
Change in assets and liabilities:			
Receivables	(46.3)	(49.9)	38.5
Income taxes receivable/payable	24.5	9.6	10.7
Inventories	(35.5)	(37.8)	23.9
Other current assets	0.2	(12.1)	20.9
Accounts payable and accrued liabilities	(14.5)	100.0	(13.1)
Other assets	(2.6)	5.8	(4.3)
Other noncurrent liabilities	4.3	(5.9)	(12.1)
Other operating activities	(5.9)	6.4	3.5
Net operating activities	907.8	648.8	603.2
Investing Activities			
Capital expenditures	(385.2)	(294.3)	(278.0)
Business acquired and related transactions, net of cash acquired	—	—	(69.5)
Payments under long-term supply contracts	—	(209.4)	(175.7)
Proceeds from sale/leaseback of equipment	—	—	40.4
Proceeds from disposition of property, plant and equipment	2.9	5.2	0.5
Proceeds from disposition of affiliated companies	—	—	8.8
Net investing activities	(382.3)	(498.5)	(473.5)
Financing Activities			
Long-term debt:			
Borrowings	570.0	2,035.5	230.0
Repayments	(946.1)	(2,037.9)	(435.3)
Common stock repurchased and retired	(50.0)	—	—
Stock options exercised	3.4	29.8	0.5
Excess tax benefits from stock-based compensation	—	—	0.4
Dividends paid	(133.6)	(133.0)	(132.1)
Debt issuance costs	(8.5)	(11.2)	(1.0)
Net financing activities	(564.8)	(116.8)	(337.5)
Effect of exchange rate changes on cash and cash equivalents	(0.3)	0.4	0.3
Net (decrease) increase in cash and cash equivalents	(39.6)	33.9	(207.5)
Cash and cash equivalents, beginning of year	218.4	184.5	392.0
Cash and cash equivalents, end of year	$178.8	$218.4	$184.5
Cash paid for interest and income taxes:			

Interest, net	$208.8	$200.9	$200.8
Income taxes, net of refunds	$52.9	$18.0	$(2.6)

The accompanying notes to consolidated financial statements are an integral part of the consolidated financial statements.

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NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

NOTE 1. DESCRIPTION OF BUSINESS

Olin Corporation (Olin) is a Virginia corporation, incorporated in 1892, having its principal executive offices in Clayton, MO. We are a manufacturer concentrated in three business segments: Chlor Alkali Products and Vinyls, Epoxy and Winchester. The Chlor Alkali Products and Vinyls segment manufactures and sells chlorine and caustic soda, ethylene dichloride and vinyl chloride monomer, methyl chloride, methylene chloride, chloroform, carbon tetrachloride, perchloroethylene, trichloroethylene and vinylidene chloride, hydrochloric acid, hydrogen, bleach products and potassium hydroxide. The Epoxy segment produces and sells a full range of epoxy materials, including allyl chloride, epichlorohydrin, liquid epoxy resins, solid epoxy resins and downstream products such as differentiated epoxy resins and additives. The Winchester segment produces and sells sporting ammunition, reloading components, small caliber military ammunition and components, and industrial cartridges.

NOTE 2. ACCOUNTING POLICIES

The preparation of the consolidated financial statements requires estimates and assumptions that affect amounts reported and disclosed in the financial statements and related notes. Actual results could differ from those estimates.

Basis of Presentation

The consolidated financial statements include the accounts of Olin and all majority-owned subsidiaries. Investment in our affiliates are accounted for on the equity method. Accordingly, we include only our share of earnings or losses of these affiliates in consolidated net income (loss). Certain reclassifications were made to prior year amounts to conform to the 2018 presentation.

Revenue Recognition

In May 2014, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) 2014-09, “Revenue from Contracts with Customers” (ASU 2014-09), which amends Accounting Standards Codification (ASC) 605 “Revenue Recognition” and creates a new topic, ASC 606 “Revenue from Contracts with Customers” (ASC 606). Subsequent to the issuance of ASU 2014-09, ASC 606 was amended by various updates that amend and clarify the impact and implementation of the aforementioned update. We adopted these updates on January 1, 2018 using the modified retrospective transition method. The cumulative effect of applying the updates did not have a material impact on our consolidated financial statements. The most significant impact the updates had was on our accounting policies and disclosures on revenue recognition.

We derive our revenues primarily from the manufacturing and delivery of goods to customers. Revenues are recognized on sales of goods at the time when control of those goods is transferred to our customers at an amount that reflects the consideration to which we expect to be entitled in exchange for those goods. We primarily sell our goods directly to customers, and to a lesser extent, through distributors. Payment terms are typically 30 to 90 days from date of invoice. Our contracts do not typically have a significant financing component. Right to payment is determined at the point in time in which control has transferred to the customer.

A performance obligation is a promise in a contract to transfer a distinct good to the customer. At contract inception, we assess the goods promised in our contracts with customers and identify a performance obligation for each promise to transfer to the customer a good (or bundle of goods) that is distinct. A contract’s transaction price is based on the price stated in the contract and allocated to each distinct performance obligation and revenue is recognized when the performance obligation is satisfied. Substantially all of our contracts have a single distinct performance obligation or

multiple performance obligations which are distinct and represent individual promises within the contract. Substantially all of our performance obligations are satisfied at a single point in time, when control is transferred, which is generally upon shipment or delivery as stated in the contract terms.

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All taxes assessed by governmental authorities that are both imposed on and concurrent with our revenue-producing transactions and collected from our customers are excluded from the measurement of the transaction price. Shipping and handling fees billed to customers are included in revenue and are considered activities to fulfill the promise to transfer the good. Allowances for estimated returns, discounts and rebates are considered variable consideration, which may be constrained, and are estimated and recognized when sales are recorded. The estimates are based on various market data, historical trends and information from customers. Actual returns, discounts and rebates have not been materially different from estimates. For all contracts that have a duration of one year or less at contract inception, we do not adjust the promised amount of consideration for the effects of a significant financing component.

Substantially all of our revenue is derived from contracts with an original expected length of time of one year or less and for which we recognize revenue for the amount in which we have the right to invoice at the point in time in which control has transferred to the customer. However, a portion of our revenue is derived from long-term contracts which have contract periods that vary between one to multi-year. Certain of these contracts represent contracts with minimum purchase obligations, which can be substantially different than the actual revenue recognized. Such contracts consist of varying types of products across our chemical businesses. Certain contracts include variable volumes and/or variable pricing with pricing provisions tied to commodity, consumer price or other indices. The transaction price allocated to the remaining performance obligations related to our contracts was excluded from the disclosure of our remaining performance obligations based on the following practical expedients that we elected to apply: (i) contracts with index-based pricing or variable volume attributes in which such variable consideration is allocated entirely to a wholly unsatisfied performance obligation; and (ii) contracts with an original expected duration of one year or less.

Refer to Note 21 “Segment Information” for information regarding the disaggregation of revenue by primary geographical markets and major product lines.

Cost of Goods Sold and Selling and Administration Expenses

Cost of goods sold includes the costs of inventory sold, related purchasing, distribution and warehousing costs, costs incurred for shipping and handling, depreciation and amortization expense related to these activities and environmental remediation costs and recoveries. Selling and administration expenses include personnel costs associated with sales, marketing and administration, research and development, legal and legal-related costs, consulting and professional services fees, advertising expenses, depreciation expense related to these activities, foreign currency translation and other similar costs.

Acquisition-related Costs

Acquisition-related costs include advisory, legal, accounting and other professional fees incurred in connection with the purchase and integration of our acquisitions. Acquisition-related costs also may include costs which arise as a result of acquisitions, including contractual change in control provisions, contract termination costs, compensation payments related to the acquisition or pension and other postretirement benefit plan settlements.

Other Operating Income

Other operating income consists of miscellaneous operating income items, which are related to our business activities, and gains (losses) on disposition of property, plant and equipment.

Included in other operating income were the following:

	Years Ended December 31,

	2018	2017	2016
	($ in millions)		
Gains (losses) on disposition of property, plant and equipment, net	$(2.0)	$3.1	$(0.7)
Gains on insurance recoveries	8.0	—	11.0
Other	0.4	0.2	0.3
Other operating income	$6.4	$3.3	$10.6

Other operating income for 2018 included an $8.0 million insurance recovery for a second quarter 2017 business interruption at our Freeport, TX vinyl chloride monomer facility partially offset by a $1.7 million loss on the sale of land. The gains on disposition of property, plant and equipment in 2017 included a gain of $3.3 million from the sale of a former

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manufacturing facility. The gains on insurance recoveries in 2016 included insurance recoveries for property damage and business interruption related to a 2008 Henderson, NV chlor alkali facility incident.

Other Income (Expense)

Other income (expense) consists of non-operating income and expense items which are not related to our primary business activities.

Foreign Currency Translation

Our worldwide operations utilize the U.S. dollar (USD) or local currency as the functional currency, where applicable. For foreign entities where the USD is the functional currency, gains and losses resulting from balance sheet translations are included in selling and administration. For foreign entities where the local currency is the functional currency, assets and liabilities denominated in local currencies are translated into USD at end-of-period exchange rates and the resultant translation adjustments are included in accumulated other comprehensive loss. Assets and liabilities denominated in other than the local currency are remeasured into the local currency prior to translation into USD and the resultant exchange gains or losses are included in income in the period in which they occur. Income and expenses are translated into USD using an approximation of the average rate prevailing during the period. We change the functional currency of our separate and distinct foreign entities only when significant changes in economic facts and circumstances indicate clearly that the functional currency has changed.

Cash and Cash Equivalents

All highly liquid investments, with a maturity of three months or less at the date of purchase, are considered to be cash equivalents.

Short-Term Investments

We classify our marketable securities as available-for-sale, which are reported at fair market value with unrealized gains and losses included in accumulated other comprehensive loss, net of applicable taxes. The fair value of marketable securities is determined by quoted market prices. Realized gains and losses on sales of investments, as determined on the specific identification method, and declines in value of securities judged to be other-than-temporary are included in other income (expense) in the consolidated statements of operations. Interest and dividends on all securities are included in interest income and other income (expense), respectively. As of December 31, 2018 and 2017, we had no short-term investments recorded on our consolidated balance sheets.

Allowance for Doubtful Accounts Receivable

We evaluate the collectibility of accounts receivable based on a combination of factors. We estimate an allowance for doubtful accounts as a percentage of net sales based on historical bad debt experience. This estimate is periodically adjusted when we become aware of a specific customer’s inability to meet its financial obligations (e.g., bankruptcy filing) or as a result of changes in the overall aging of accounts receivable. While we have a large number of customers that operate in diverse businesses and are geographically dispersed, a general economic downturn in any of the industry segments in which we operate could result in higher than expected defaults, and, therefore, the need to revise estimates for the provision for doubtful accounts could occur.

Inventories

Inventories are valued at the lower of cost and net realizable value. For U.S. inventories, inventory costs are determined principally by the last-in, first-out (LIFO) method of inventory accounting while for international inventories, inventory costs are determined principally by the first-in, first-out (FIFO) method of inventory accounting. Costs for other inventories have been determined principally by the average-cost method (primarily operating supplies, spare parts and maintenance parts). Elements of costs in inventories include raw materials, direct labor and manufacturing overhead.

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Property, Plant and Equipment

Property, plant and equipment are recorded at cost. Depreciation is computed on a straight-line basis over the estimated useful lives of the related assets. Interest costs incurred to finance expenditures for major long-term construction projects are capitalized as part of the historical cost and included in property, plant and equipment and are depreciated over the useful lives of the related assets. Leasehold improvements are amortized over the term of the lease or the estimated useful life of the improvement, whichever is shorter. Start-up costs are expensed as incurred. Expenditures for maintenance and repairs are charged to expense when incurred while the costs of significant improvements, which extend the useful life of the underlying asset, are capitalized.

Property, plant and equipment are reviewed for impairment when conditions indicate that the carrying values of the assets may not be recoverable. Such impairment conditions include an extended period of idleness or a plan of disposal. If such impairment indicators are present or other factors exist that indicate that the carrying amount of an asset may not be recoverable, we determine whether impairment has occurred through the use of an undiscounted cash flow analysis at the lowest level for which identifiable cash flows exist. For our Chlor Alkali Products and Vinyls, Epoxy and Winchester segments, the lowest level for which identifiable cash flows exist is the operating facility level or an appropriate grouping of operating facilities level. The amount of impairment loss, if any, is measured by the difference between the net book value of the assets and the estimated fair value of the related assets.

Asset Retirement Obligations

We record the fair value of an asset retirement obligation associated with the retirement of a tangible long-lived asset as a liability in the period incurred. The liability is measured at discounted fair value and is adjusted to its present value in subsequent periods as accretion expense is recorded. The corresponding asset retirement costs are capitalized as part of the carrying amount of the related long-lived asset and depreciated over the asset's useful life. Asset retirement obligations are reviewed annually in the fourth quarter and/or when circumstances or other events indicate that changes underlying retirement assumptions may have occurred.

The activities of our asset retirement obligations were as follows:

	December 31,	
	2018	2017
	($ in millions)	
Beginning balance	$54.3	$55.4
Accretion	3.2	3.0
Spending	(8.0)	(8.8)
Foreign currency translation adjustments	(0.2)	0.2
Adjustments	10.9	4.5
Ending balance	$60.2	$54.3

At December 31, 2018 and 2017, our consolidated balance sheets included an asset retirement obligation of $49.6 million and $43.8 million, respectively, which were classified as other noncurrent liabilities.

In 2018, we had net adjustments that increased the asset retirement obligation by $10.9 million which was primarily related to additional asset retirement obligations for leased assets.

In 2017, we had net adjustments that increased the asset retirement obligation by $4.5 million which was primarily comprised of increases in estimated costs for certain assets.

Comprehensive Income (Loss)

Accumulated other comprehensive loss consists of foreign currency translation adjustments, pension and postretirement liability adjustments, pension and postretirement amortization of prior service costs and actuarial losses and net unrealized (losses) gains on derivative contracts.

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Goodwill

Goodwill is not amortized, but is reviewed for impairment annually in the fourth quarter and/or when circumstances or other events indicate that impairment may have occurred. Accounting Standards Codification (ASC) 350 “Intangibles—Goodwill and Other” (ASC 350) permits entities to make a qualitative assessment of whether it is more likely than not that a reporting unit’s fair value is less than its carrying amount before applying the two-step goodwill impairment test. Circumstances that are considered as part of the qualitative assessment and could trigger the two-step impairment test include, but are not limited to: a significant adverse change in the business climate; a significant adverse legal judgment; adverse cash flow trends; an adverse action or assessment by a government agency; unanticipated competition; decline in our stock price; and a significant restructuring charge within a reporting unit. We define reporting units at the business segment level or one level below the business segment level. For purposes of testing goodwill for impairment, goodwill has been allocated to our reporting units to the extent it relates to each reporting unit. Based upon our qualitative assessment, it is more likely than not that the fair value of our reporting units are greater than their carrying amounts as of December 31, 2018. No impairment charges were recorded for 2018, 2017 or 2016.

It is our practice, at a minimum, to perform a quantitative goodwill impairment test in the fourth quarter every three years. In the fourth quarter of 2016, we performed our triennial quantitative goodwill impairment test for our reporting units. We use a discounted cash flow approach to develop the estimated fair value of a reporting unit when a quantitative test is performed. Management judgment is required in developing the assumptions for the discounted cash flow model. We also corroborate our discounted cash flow analysis by evaluating a market-based approach that considers earnings before interest, taxes, depreciation and amortization (EBITDA) multiples from a representative sample of comparable public companies. As a further indicator that each reporting unit has been valued appropriately using a discounted cash flow model, the aggregate fair value of all reporting units is reconciled to the total market value of Olin. An impairment would be recorded if the carrying amount of a reporting unit exceeded the estimated fair value. Based on the aforementioned analysis, the estimated fair value of our reporting units substantially exceeded the carrying value of the reporting units.

The discount rate, profitability assumptions and terminal growth rate of our reporting units and the cyclical nature of the chlor alkali industry were the material assumptions utilized in the discounted cash flow model used to estimate the fair value of each reporting unit. The discount rate reflects a weighted-average cost of capital, which is calculated based on observable market data. Some of this data (such as the risk free or treasury rate and the pretax cost of debt) are based on the market data at a point in time. Other data (such as the equity risk premium) are based upon market data over time for a peer group of companies in the chemical manufacturing or distribution industries with a market capitalization premium added, as applicable.

The discounted cash flow analysis requires estimates, assumptions and judgments about future events. Our analysis uses our internally generated long-range plan. Our discounted cash flow analysis uses the assumptions in our long-range plan about terminal growth rates, forecasted capital expenditures and changes in future working capital requirements to determine the implied fair value of each reporting unit. The long-range plan reflects management judgment, supplemented by independent chemical industry analyses which provide multi-year industry operating and pricing forecasts.

We believe the assumptions used in our goodwill impairment analysis are appropriate and result in reasonable estimates of the implied fair value of each reporting unit. However, given the economic environment and the uncertainties regarding the impact on our business, there can be no assurance that our estimates and assumptions, made for purposes of our goodwill impairment testing, will prove to be an accurate prediction of the future. If our assumptions regarding future performance are not achieved, we may be required to record goodwill impairment charges in future periods. It is not possible at this time to determine if any such future impairment charge would result

or, if it does, whether such charge would be material.

Intangible Assets

In conjunction with our acquisitions, we have obtained access to the customer contracts and relationships, trade names, acquired technology and other intellectual property of the acquired companies. These relationships are expected to provide economic benefit for future periods. Amortization expense is recognized on a straight-line basis over the estimated lives of the related assets. The amortization period of customer contracts and relationships, trade names, acquired technology and other intellectual property represents our best estimate of the expected usage or consumption of the economic benefits of the acquired assets, which is based on the company's historical experience.

Intangible assets with finite lives are reviewed for impairment when conditions indicate that the carrying values of the assets may not be recoverable. Circumstances that are considered as part of the qualitative assessment and could trigger a quantitative impairment test include, but are not limited to: a significant adverse change in the business climate; a significant adverse legal judgment including asset specific factors; adverse cash flow trends; an adverse action or assessment by a

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government agency; unanticipated competition; decline in our stock price; and a significant restructuring charge within a reporting unit. Based upon our qualitative assessment, it is more likely than not that the fair value of our intangible assets are greater than the carrying amount as of December 31, 2018. No impairment of our intangible assets were recorded in 2018, 2017 or 2016.

Environmental Liabilities and Expenditures

Accruals (charges to income) for environmental matters are recorded when it is probable that a liability has been incurred and the amount of the liability can be reasonably estimated, based upon current law and existing technologies. These amounts, which are not discounted and are exclusive of claims against third parties, are adjusted periodically as assessment and remediation efforts progress or additional technical or legal information becomes available. Environmental costs are capitalized if the costs increase the value of the property and/or mitigate or prevent contamination from future operations.

Income Taxes

Deferred taxes are provided for differences between the financial statement and tax basis of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. A valuation allowance is provided to offset deferred tax assets if, based on the available evidence, it is more likely than not that some or all of the value of the deferred tax assets will not be realized.

Derivative Financial Instruments

We are exposed to market risk in the normal course of our business operations due to our purchases of certain commodities, our ongoing investing and financing activities and our operations that use foreign currencies. The risk of loss can be assessed from the perspective of adverse changes in fair values, cash flows and future earnings. We have established policies and procedures governing our management of market risks and the use of financial instruments to manage exposure to such risks. We use hedge accounting treatment for a significant amount of our business transactions whose risks are covered using derivative instruments. The hedge accounting treatment provides for the deferral of gains or losses on derivative instruments until such time as the related transactions occur.

Concentration of Credit Risk

Accounts receivable is the principal financial instrument which subjects us to a concentration of credit risk. Credit is extended based upon the evaluation of a customer’s financial condition and, generally, collateral is not required. Concentrations of credit risk with respect to receivables are somewhat limited due to our large number of customers, the diversity of these customers’ businesses and the geographic dispersion of such customers. Our accounts receivable are predominantly derived from sales denominated in USD or the Euro. We maintain an allowance for doubtful accounts based upon the expected collectibility of all trade receivables.

Fair Value

Fair value is defined as the price at which an asset could be exchanged in a current transaction between knowledgeable, willing parties or the amount that would be paid to transfer a liability to a new obligor, not the amount that would be paid to settle the liability with the creditor. Where available, fair value is based on observable market prices or parameters or derived from such prices or parameters. Where observable prices or inputs are not available, valuation models are applied. These valuation techniques involve some level of management estimation and judgment, the degree of which is dependent on the price transparency for the instruments or market and the instruments’ complexity.

Assets and liabilities recorded at fair value in the consolidated balance sheets are categorized based upon the level of judgment associated with the inputs used to measure their fair value. Hierarchical levels, defined by ASC 820 “Fair Value Measurement” (ASC 820), and directly related to the amount of subjectivity associated with the inputs to fair valuation of these assets and liabilities, are as follows:

Level 1 — Inputs were unadjusted, quoted prices in active markets for identical assets or liabilities at the measurement date.

Level 2 — Inputs (other than quoted prices included in Level 1) were either directly or indirectly observable for the asset or liability through correlation with market data at the measurement date and for the duration of the instrument’s anticipated life.

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Level 3 — Inputs reflected management's best estimate of what market participants would use in pricing the asset or liability at the measurement date. Consideration was given to the risk inherent in the valuation technique and the risk inherent in the inputs to the model.

Retirement-Related Benefits

We account for our defined benefit pension plans and non-pension postretirement benefit plans using actuarial models required by ASC 715 "Compensation—Retirement Benefits" (ASC 715). These models use an attribution approach that generally spreads the financial impact of changes to the plan and actuarial assumptions over the average remaining service lives of the employees in the plan. Changes in liability due to changes in actuarial assumptions such as discount rate, rate of compensation increases and mortality, as well as annual deviations between what was assumed and what was experienced by the plan are treated as actuarial gains or losses. The principle underlying the required attribution approach is that employees render service over their average remaining service lives on a relatively smooth basis and, therefore, the accounting for benefits earned under the pension or non-pension postretirement benefits plans should follow the same relatively smooth pattern. Substantially all domestic defined benefit pension plan participants are no longer accruing benefits; therefore, actuarial gains and losses are amortized based upon the remaining life expectancy of the inactive plan participants. For the years ended December 31, 2018 and 2017, the average remaining life expectancy of the inactive participants in the domestic defined benefit pension plan were 18 and 19 years, respectively.

One of the key assumptions for the net periodic pension calculation is the expected long-term rate of return on plan assets, used to determine the "market-related value of assets." The "market-related value of assets" recognizes differences between the plan's actual return and expected return over a five year period. The required use of an expected long-term rate of return on the market-related value of plan assets may result in recognized pension income that is greater or less than the actual returns of those plan assets in any given year. Over time, however, the expected long-term returns are designed to approximate the actual long-term returns and, therefore, result in a pattern of income and expense recognition that more closely matches the pattern of the services provided by the employees. As differences between actual and expected returns are recognized over five years, they subsequently generate gains and losses that are subject to amortization over the average remaining life expectancy of the inactive plan participants, as described in the preceding paragraph.

We use long-term historical actual return information, the mix of investments that comprise plan assets, and future estimates of long-term investment returns and inflation by reference to external sources to develop the expected long-term rate of return on plan assets as of December 31.

The discount rate assumptions used for pension and non-pension postretirement benefit plan accounting reflect the rates available on high-quality fixed-income debt instruments on December 31 of each year. The rate of compensation increase is based upon our long-term plans for such increases. For retiree medical plan accounting, we review external data and our own historical trends for healthcare costs to determine the healthcare cost trend rates.

For our defined benefit pension and other postretirement benefit plans, we measure service and interest costs by applying the specific spot rates along the yield curve to the plans' estimated cash flows. We believe this approach provides a more precise measurement of service and interest costs by aligning the timing of the plans' liability cash flows to the corresponding spot rates on the yield curve.

Stock-Based Compensation

We measure the cost of employee services received in exchange for an award of equity instruments, such as stock options, performance shares and restricted stock, based on the grant-date fair value of the award. This cost is recognized over the period during which an employee is required to provide service in exchange for the award, the requisite service period (usually the vesting period). An initial measurement is made of the cost of employee services received in exchange for an award of liability instruments based on its current fair value and the value of that award is subsequently remeasured at each reporting date through the settlement date. Changes in fair value of liability awards during the requisite service period are recognized as compensation cost over that period.

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The fair value of each option granted, which typically vests ratably over three years, but not less than one year, was estimated on the date of grant, using the Black-Scholes option-pricing model with the following assumptions:

	2018	2017	2016
Dividend yield	2.43%	2.69%	6.09%
Risk-free interest rate	2.72%	2.06%	1.35%
Expected volatility	32%	34%	32