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.

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

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 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.

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.

(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.

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 activiti