PACKAGING CORP OF AMERICA
Form 10-K
February 28, 2019

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

Form 10-K

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d)

OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2018

Commission file number 1-15399

(Exact Name of Registrant as Specified in its Charter)

Delaware (State or Other Jurisdiction of Incorporation or Organization)	36-4277050 (I.R.S. Employer Identification No.)
1 North Field Court, Lake Forest, Illinois (Address of Principal Executive Offices)	60045 (Zip Code)

Registrant's telephone number, including area code: (847) 482-3000

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

Title of Each Class	Name of Each Exchange On Which Registered
Common Stock, $0.01 par value	New York Stock Exchange

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

None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

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

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of “large accelerated filer,” “accelerated filer,” “smaller reporting company,” and “emerging growth company” in Rule 12b-2 of the Exchange Act.

Large accelerated filer	Accelerated filer
Non-accelerated filer	Smaller reporting company
Emerging growth company	

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes No

At June 30, 2018, the last day of the Registrant's most recently completed second fiscal quarter, the aggregate market value of Registrant's common equity held by non-affiliates was approximately $10,429,672,301 based upon the closing sale price as reported on the New York Stock Exchange. This calculation of market value has been made for the purposes of this report only and should not be considered as an admission or conclusion by the Registrant that any person is in fact an affiliate of the Registrant.

On February 22, 2019, there were 94,495,930 shares of Common Stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Specified portions of the Proxy Statement for the Registrant's 2019 Annual Meeting of Stockholders are incorporated by reference to the extent indicated in Part III of this Form 10-K.

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PART I

Item 1. BUSINESS

Packaging Corporation of America ("we," "us," "our," "PCA," or the "Company") is the third largest producer of containerboa products and the third largest producer of uncoated freesheet (UFS) in North America. We operate six containerboard mills, two white paper mills and 95 corrugated products manufacturing plants. We are headquartered in Lake Forest, Illinois and operate primarily in the United States.

We report in three reportable segments: Packaging, Paper and Corporate and Other. For segment financial information see Note 18, Segment Information, of the Notes to Consolidated Financial Statements in "Part II, Item 8, Financial Statements and Supplementary Data" of this Form 10-K.

During the second quarter of 2018, we discontinued the production of uncoated free sheet and coated one-side grades at the Wallula, Washington mill and converted the No. 3 machine to a virgin kraft linerboard machine. Subsequent to the date of conversion in May 2018, operating results for the Wallula mill are primarily included in the Packaging segment. Before such date, operating results were included in the Paper segment.

Production and Shipments

The following table summarizes the Packaging segment's containerboard production and corrugated products shipments and the Paper segment's white paper and market pulp production.

			First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Full Year
Containerboard Production (a)	PCA	2018	953	1,020	1,087	1,021	4,081
(thousand tons)		2017	932	947	996	1,006	3,881
		2016	898	926	950	962	3,736
Corrugated Shipments (BSF)	PCA	2018	14.4	15.1	14.8	14.6	58.9
		2017	13.6	13.9	13.7	14.5	55.7
		2016	12.3	12.7	13.1	13.2	51.3
White Paper (UFS) Production (a)	PCA	2018	279	252	239	247	1,017
(thousand tons)		2017	273	289	278	278	1,118
		2016	283	268	288	288	1,127
Market Pulp Production (b)	PCA	2018	—	—	—	—	—
(thousand tons)		2017	—	—	—	—	—
		2016	16	10	12	7	45

(a) In May 2018, PCA ceased production of uncoated free sheet and coated one-side grades at our Wallula, Washington mill and converted the No. 3 machine to a virgin kraft linerboard machine.

(b) On December 1, 2016, PCA ceased production of softwood market pulp at our Wallula, Washington mill and permanently shut down the No. 1 machine.

Below is a map of our locations:

Packaging

Packaging Products

Our containerboard mills produce linerboard and semi-chemical corrugating medium, which are papers primarily used in the production of corrugated products. Our corrugated products manufacturing plants produce a wide variety of corrugated packaging products, including conventional shipping containers used to protect and transport manufactured goods, multi-color boxes and displays with strong visual appeal that help to merchandise the packaged product in retail locations, and honeycomb protective packaging. In addition, we are a large producer of packaging for meat, fresh fruit and vegetables, processed food, beverages, and other industrial and consumer products.

During the year ended December 31, 2018, our Packaging segment produced 4.1 million tons of containerboard at our mills. Our corrugated products manufacturing plants sold 58.9 billion square feet (BSF) of corrugated products. Our net sales to third parties totaled $5.9 billion in 2018.

Facilities

We currently manufacture containerboard, which includes a variety of performance and specialty grades, at six containerboard mills. Total annual containerboard capacity was approximately 4.4 million tons as of December 31, 2018. We also produce corrugated and protective packaging products at 95 manufacturing locations. The following provides more details of our operations:

Counce. Our Counce, Tennessee mill produces kraft linerboard on two paper machines. The mill can produce basis weights from 26 lb. to 90 lb.

DeRidder. Our DeRidder, Louisiana mill produces kraft linerboard and semi-chemical corrugating medium on two paper machines. The mill can produce linerboard in basis weights of 26 lb. to 69 lb. and medium in basis weights of 23 lb. to 33 lb.

Valdosta. Our Valdosta, Georgia mill produces kraft linerboard on one paper machine. The mill can produce basis weights from 35 lb. to 96 lb.

Tomahawk. Our Tomahawk, Wisconsin mill produces semi-chemical corrugating medium on two paper machines. The mill can produce basis weights from 23 lb. to 47 lb.

Filer City. Our Filer City, Michigan mill produces semi-chemical corrugating medium on three paper machines. The mill can produce basis weights from 20 lb. to 47 lb.

Wallula. Our Wallula, Washington mill produces semi-chemical corrugating medium on its No. 2 machine and kraft linerboard on its No. 3 machine. The mill can produce medium in basis weights from 23 lb. to 33 lb. and linerboard in basis weights from 31 lb. to 52 lb. As described above, the No. 3 machine was converted from white paper to linerboard in May of 2018.

We operate 95 corrugated manufacturing and protective packaging operations, a technical and development center, 10 regional design centers, a rotogravure printing operation, and a complement of packaging supplies and distribution centers. Of the 95 manufacturing facilities, 61 operate as combining operations, commonly called corrugated plants, which manufacture corrugated sheets and finished corrugated packaging products, 33 are sheet plants, which procure combined sheets and manufacture finished corrugated packaging products, and one is a corrugated sheet-only manufacturer.

Corrugated products plants tend to be located in close proximity to customers to minimize freight costs. Each of our plants serve a market radius of approximately 150 miles. Our sheet plants are generally located in close proximity to our larger corrugated plants, which enables us to offer additional services and converting capabilities such as small volume and quick turnaround items.

Major Raw Materials Used

Fiber supply. Fiber is the largest raw material cost to manufacture containerboard. We consume both wood fiber and recycled fiber in our containerboard mills. Our mill system has the capability to shift a portion of its fiber consumption between softwood, hardwood, and recycled sources. All of our mills can utilize virgin wood fiber and all of our mills, other than the Valdosta mill, can utilize some recycled fiber in their containerboard production. Our corrugated manufacturing operations generate recycled fiber as a by-product from the manufacturing process, which is consumed by our mills. In 2018, our usage of recycled fiber, net of internal generation, represents 18% of our containerboard production.

We procure wood fiber through leases of cutting rights, long-term supply agreements, and market purchases and believe we have adequate sources of fiber supply for the foreseeable future.

We participate in the Sustainable Forestry Initiative® (SFI), the Programme for the Endorsement of Forest Certification™ (PEFC), as well as the Forest Stewardship Council® (FSC), and we are certified under their sourcing and chain of custody standards. These standards are aimed at ensuring the long-term health and conservation of forestry resources. We are committed to sourcing wood fiber through environmentally, socially, and economically sustainable practices and promoting resource and conservation stewardship ethics.

Energy supply. Energy at our packaging mills is obtained through self-generated or purchased fuels and electricity. Fuel sources include by-products of the containerboard manufacturing and pulping process (including black liquor and wood waste), natural gas, purchased wood waste, and other purchased fuels. Each of our mills self-generates process steam requirements from by-products (black liquor and wood waste), as well as from the various purchased fuels. The process steam is used throughout the production process and also to generate electricity.

In 2018, our packaging mills consumed about 70 million MMBTU’s of fuel to produce both steam and electricity. Of the 70 million MMBTU’s consumed, about 64% was from mill generated by-products and 36% was from purchased fuels. Of the purchased fuels, 65% was from natural gas, 31% was from purchased wood waste and 4% was from other purchased fuels.

Chemical supply. We consume various chemicals in the production of containerboard, including caustic soda, sulfuric acid, soda ash, and lime. Most of our chemicals are purchased under contracts, which are bid or negotiated periodically.

Sales, Marketing, and Distribution

Our corrugated products are sold through our direct sales and marketing organization, independent brokers, and distribution partners. We have sales representatives and a sales manager at most of our corrugated manufacturing operations and also have corporate account managers who serve customer accounts with a national presence. Additionally, our design centers maintain an on-site dedicated graphics sales force. In addition to direct sales and marketing personnel, we utilize new product development engineers and product graphics and design specialists. These individuals are located at both the corrugated plants and the design centers. General marketing support is located at our corporate headquarters.

Our containerboard sales group is responsible for linerboard and corrugating medium order processing and sales to our corrugated plants, to outside domestic customers, and to export customers. These personnel also coordinate and execute all containerboard trade agreements with other containerboard manufacturers.

Containerboard produced in our mills is shipped by rail or truck. Our corrugated products are delivered by truck due to our large number of customers and their demand for timely service. Our corrugated manufacturing operations typically serve customers within a 150-mile radius. We sometimes use third-party warehouses for short-term storage of corrugated products.

Customers

We sell containerboard and corrugated products to approximately 18,000 customers in over 36,000 locations. About three-quarters of our corrugated products sales are to regional and local accounts, which are broadly diversified across industries and geographic locations. The remaining one-quarter of our customer base consists primarily of national accounts that have multiple locations and are served by a number of PCA plants. No single customer exceeds 10% of segment sales.

The primary end-use markets in the United States for corrugated products are shown below as reported in the 2017 Fibre Box Association annual report:

Food, beverages, and agricultural products	44%
Retail and wholesale trade	22%

Paper and other products	14%
Miscellaneous manufacturing	10%
Chemical, plastic, and rubber products	10%

Competition

As of December 31, 2018, we were the third largest producer of containerboard products in North America, according to industry sources and our own estimates. According to industry sources, corrugated products are produced by about 460 U.S. companies operating approximately 1,200 plants. The primary basis for competition for most of our packaging products includes quality, service, price, product design, and innovation. Most corrugated products are manufactured to the customer's specifications. Corrugated producers generally sell within a 150-mile radius of their plants and compete with other corrugated producers in their local region. Competition in our corrugated products operations tends to be regional, although we also face competition from competitors with significant national account presence.

On a national level, our primary competitors are International Paper Company, WestRock Company, Georgia-Pacific LLC, and Pratt Industries. However, with our strategic focus on regional and local accounts, we also compete with the smaller, independent producers.

Paper

We are the third largest manufacturer of uncoated freesheet in North America, according to industry sources and our own estimates. We manufacture and sell white papers, including both commodity and specialty papers, which may have custom or specialized features such as colors, coatings, high brightness, and recycled content. White papers consist of communication papers, including cut-size office papers and printing and converting papers.

Facilities

We currently have two white paper mills located in the United States. Total annual white paper capacity is 949,000 tons. The following paragraphs describe our white paper mills:

Jackson. Our Jackson, Alabama mill produces both commodity and specialty papers on two paper machines.

International Falls. Our International Falls, Minnesota mill produces both commodity and specialty papers on two paper machines.

Wallula. Our Wallula, Washington mill produced pressure sensitive papers and a variety of white paper grades on its No. 3 machine, prior to its conversion to kraft linerboard during the second quarter of 2018.

Major Raw Materials Used

Fiber supply. Fiber is the largest raw material cost in this segment. We consume wood fiber, recycled fiber, and purchased pulp. Our Jackson mill purchases recycled fiber to produce our line of recycled office papers. We purchase wood fiber through contracts and open-market purchase, and we purchase recycled fiber and pulp from third parties pursuant to contractual agreements.

We participate in the Sustainable Forestry Initiative® (SFI), the Programme for the Endorsement of Forest Certification™ (PEFC), as well as the Forest Stewardship Council®(FSC), and we are certified under their sourcing and chain of custody standards. These standards are aimed at ensuring the long-term health and conservation of forestry resources. We are committed to sourcing wood fiber through environmentally, socially, and economically sustainable practices and promoting resource and conservation stewardship ethics.

Energy supply. We obtain energy through self-generated or purchased fuels and electricity. Fuel sources include by-products of the manufacturing and pulping process (including black liquor and wood waste), natural gas, electricity, and purchased wood waste. Each of the paper mills self-generates process steam requirements from by-products (black liquor and wood waste), as well as from the various purchased fuels. The process steam is used throughout the production process and to generate electricity.

In 2018, our white paper mills consumed about 24 million MMBTU's of fuel to produce both steam and electricity. Of the 24 million MMBTU's consumed, about 62% was from mill generated by-products and 38% was from purchased fuels. Of the purchased fuels, 85% was from natural gas and 15% from purchased wood waste.

Chemical supply. We consume various chemicals in the production of white papers, including starch, precipitated calcium carbonate, caustic soda, and sodium chlorate. Most of our chemicals are purchased under contracts, which are bid or negotiated periodically.

Sales, Marketing, and Distribution

Our white papers are sold primarily through our sales and marketing organization. We ship to customers both directly from our mills and through distribution centers and a network of outside warehouses by rail or truck. This allows us to respond quickly to customer requirements.

Customers

We have over 150 customers in approximately 450 locations. These customers include office products distributors and retailers, paper merchants, and envelope and other converters. We have established long-term relationships with many of our customers. Office Depot, Inc. is our largest customer in the Paper segment. We have an agreement with Office Depot in which we will supply at least 50% of Office Depot's requirements for commodity office papers through December 2019. The agreement will renew automatically through December 2020; however, there are circumstances that could cause the agreement to terminate in 2019. If this were to occur, Office Depot's purchase obligations under the agreement would phase out over two years. In 2018, our sales revenue to Office Depot represented 47% of our Paper segment sales revenue.

Competition

The markets in which our Paper segment competes are large and highly competitive. Commodity grades of white paper are globally traded, with numerous worldwide manufacturers, and as a result, these products compete primarily on the basis of price. All of our paper manufacturing facilities are located in the United States, and although we compete primarily in the domestic market, we do face competition from foreign producers. In 2016, as a result of a case brought by us and other domestic producers before United States international trade authorities, antidumping and countervailing duties at various levels were imposed on producers of uncoated freesheet papers produced in Australia, Brazil, China, Indonesia, and Portugal. These duties remain in effect. Other factors influencing competition from overseas producers include domestic and foreign demand and foreign currency exchange rates.

Our largest competitors include Domtar Corporation, International Paper Company, and Georgia-Pacific LLC. We also face competition from foreign producers. Although price is the primary basis for competition in most of our paper grades, quality and service are also important competitive determinants. Our white papers compete with electronic data transmission, e-readers, electronic document storage alternatives, and paper grades we do not produce. Increasing shifts to these alternatives have had, and are likely to continue to have, an adverse effect on traditional print media and paper usage and lower demand for communication papers.

Corporate and Other

Our Corporate and Other segment includes corporate support staff services and related assets and liabilities. This segment also includes transportation assets, such as rail cars and trucks, which we use to transport some of our products to and from our manufacturing sites, and assets related to a 50% owned variable interest entity, Louisiana Timber Procurement Company, L.L.C. (LTP).

Employees

As of December 31, 2018, we had approximately 15,000 employees, including 4,500 salaried and 10,500 hourly employees. Approximately 63% of our hourly employees worked pursuant to collective bargaining agreements. The majority of our unionized employees are represented by the United Steel Workers (USW), the International Brotherhood of Teamsters (IBT), the International Association of Machinists (IAM), and the Association of Western Pulp and Paper Workers (AWPPW). We are currently in negotiations to renew or extend any union contracts that have recently expired or are expiring in the near future. During 2018, we experienced no work stoppages, and we believe we have satisfactory labor relations with our employees.

Environmental Matters

A discussion of the financial impact of our compliance with environmental laws is presented under the caption “Environmental Matters” in “Part II, Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations” of this Form 10-K.

Executive Officers of the Registrant

Brief statements setting forth the age at February 28, 2019, the principal occupation, employment during the past five years, the year in which such person first became an officer of PCA, and other information concerning each of our executive officers appears below.

Mark W. Kowlzan, 63, Chairman and Chief Executive Officer - Mr. Kowlzan has served as PCA's Chairman since January 2016 and as Chief Executive Officer and a director since July 2010. From 1998 through June 2010, Mr. Kowlzan led the company's containerboard mill system, first as Vice President and General Manager and then as Senior Vice President - Containerboard. From 1996 through 1998, Mr. Kowlzan served in various senior mill-related operating positions with PCA and Tenneco Packaging, including as manager of the Counce linerboard mill. Prior to joining Tenneco Packaging, Mr. Kowlzan spent 15 years at International Paper Company, a global paper and packaging company, where he held a series of operational and managerial positions within its mill organization. Mr. Kowlzan is a member of the board of American Forest and Paper Association.

Thomas A. Hassfurther, 63, Executive Vice President - Corrugated Products - Mr. Hassfurther has served as Executive Vice President - Corrugated Products of PCA since September 2009. From February 2005 to September 2009, Mr. Hassfurther served as Senior Vice President - Sales and Marketing, Corrugated Products. Prior to this he held various senior-level management and sales positions at PCA and Tenneco Packaging. Mr. Hassfurther joined the company in 1977.

Charles J. Carter, 59, Senior Vice President - Containerboard Mill Operations - Mr. Carter has served as Senior Vice President - Containerboard Mill Operations since July 2013. Prior to this, he served as Vice President – Containerboard Mill Operations since January 2011. From March 2010 to January 2011, Mr. Carter served as PCA's Director of Papermaking Technology. Prior to joining PCA in 2010, Mr. Carter spent 28 years with various pulp and paper companies in managerial and technical positions of increasing responsibility, most recently as Vice President and General Manager of the Calhoun, Tennessee mill of Abitibi Bowater from 2007 to 2010 and as manager of SP Newsprint's Dublin, Georgia mill from 1999 to 2007.

Robert P. Mundy, 57, Senior Vice President and Chief Financial Officer - Mr. Mundy has served as PCA's Senior Vice President since July 2015 and Chief Financial Officer since September 2015. He previously served as Senior Vice President and Chief Financial Officer of Verso Corporation, a leading North American supplier of coated papers to catalog and magazine publishers, from 2006 to June 2015. Verso Corporation filed for Chapter 11 bankruptcy in January 2016. Prior to that, he worked at International Paper Company, from 1983 to 2006, where he was Director of Finance of the Coated and Supercalendered Papers division from 2002 to 2006, Director of Finance Projects from 2001 to 2002, Controller of Masonite Corporation from 1999 to 2001, and Controller of the Petroleum and Minerals business from 1996 to 1999. He served in various business positions at International Paper from 1983 to 1996.

Kent A. Pflederer, 48, Senior Vice President, General Counsel and Secretary - Mr. Pflederer has served as Senior Vice President, General Counsel and Corporate Secretary since January 2013 and has led our legal department since June 2007. Prior to joining PCA, Mr. Pflederer served as Senior Counsel, Corporate and Securities, at Hospira, Inc. from 2004 to 2007 and served in the corporate and securities practice at Mayer Brown, LLP from 1996 to 2004.

Thomas W.H. Walton, 59, Senior Vice President - Sales and Marketing, Corrugated Products - Mr. Walton has served as Senior Vice President - Sales and Marketing, Corrugated Products since October 2009. Prior to this, he served as a Vice President and Area General Manager within the Corrugated Products Group since 1998. Mr. Walton joined the company in 1981 and has also held positions in production, sales, and general management.

Available Information

PCA's internet website address is www.packagingcorp.com. Our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports filed or furnished pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 are available free of charge through our website as soon as reasonably practicable after they are electronically filed with, or furnished to, the Securities and Exchange Commission. In addition, our Code of Ethics may be accessed in the Investor Relations section of PCA's website. PCA's website and the information contained or incorporated therein are not intended to be incorporated into this report.

Item 1A. RISK FACTORS

Some of the statements in this report and, in particular, statements found in Management’s Discussion and Analysis of Financial Condition and Results of Operations, that are not historical in nature are forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Forward-looking statements include statements about our expectations regarding our future liquidity, earnings, expenditures, and financial condition. These statements are often identified by the words “will,” “should,” “anticipate,” “believe,” “expect,” “intend,” “estimate,” “hope,” o expressions. These statements reflect management’s current views with respect to future events and are subject to risks and uncertainties. There are important factors that could cause actual results to differ materially from those in forward-looking statements, many of which are beyond our control. These factors, risks and uncertainties include, but are not limited to, the factors described below.

Our actual results, performance, or achievement could differ materially from those expressed in, or implied by, these forward-looking statements, and accordingly, we can give no assurances that any of the events anticipated by the forward-looking statements will transpire or occur, or if any of them do so, what impact they will have on our results of operations or financial condition. In view of these uncertainties, investors are cautioned not to place undue reliance on these forward-looking statements. We expressly disclaim any obligation to publicly revise or otherwise update any forward-looking statements that have been made to reflect the occurrence of events after the date hereof.

In addition to the risks and uncertainties we discuss elsewhere in this Form 10-K (particularly in “Part II, Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations”) or in our other filings with the Securities and Exchange Commission (SEC), the following are important factors that could cause our actual results to differ materially from those we project in any forward-looking statement.

Industry Cyclicality - Changes in the prices of our products could materially affect our financial condition, results of operations, and liquidity. Macroeconomic conditions and fluctuations in industry capacity can create changes in prices, sales volumes, and margins for most of our products, particularly commodity grades of packaging and paper products. Prices for all of our products are driven by many factors, including demand for our products, industry capacity and decisions made by other producers with respect to capacity, and other competitive conditions in our industry. These factors are affected by general global and domestic economic conditions. We have little influence over the timing and extent of price changes of our products, which may be unpredictable and volatile. In addition, our selling prices are influenced by index levels published by trade publications. Changes in how these index levels are determined or maintained may affect our sales prices. If supply exceeds demand, industry operating conditions deteriorate or other factors result in lower prices for our products, our earnings and operating cash flows would be harmed.

General Economic Conditions - If business, political, and economic conditions change in an adverse manner, our business, results of operations, liquidity, and financial position may be harmed. General global and domestic economic conditions directly affect the levels of demand and production of consumer goods, levels of employment, the availability and cost of credit, and ultimately, the profitability of our business. If economic conditions deteriorate and result in higher unemployment rates, lower disposable income, unfavorable currency exchange rates, lower corporate earnings, lower business investment, and lower consumer spending, we may experience lower demand for our products, which is largely driven by demand for products of our customers which utilize our products. If economic conditions result in higher inflation, we may experience higher production and transportation costs, which we may not be able to recover through higher prices or otherwise. In addition, changes in trade policy, including renegotiating or potentially terminating existing bilateral or multilateral agreements as well as the imposition of tariffs, could impact global markets and demand for our and our customers’ products and the costs associated with certain of our capital investments. Further changes in tax laws or tax rates may have a material impact on our future cash taxes, effective tax rate or deferred tax assets and liabilities. These conditions are beyond our control and may have a material impact on our business, results of operations, liquidity, and financial position.

Competition - The intensity of competition in the industries in which we operate could result in downward pressure on pricing and volume, which could lower earnings and operating cash flows. Our industries are highly competitive, with no single containerboard, corrugated packaging, or white paper producer having a dominant position. Containerboard and commodity white paper products cannot generally be differentiated by producer, which tends to intensify price competition. The corrugated packaging industry is also sensitive to changes in economic conditions, as well as other factors including innovation, design, quality, and service. To the extent that one or more competitors are more successful than we are with respect to any key competitive factor, our business could be adversely affected. Our packaging products also compete, to some extent, with various other packaging materials, including products made of paper, plastics, wood, and various types of metal. If we are unable to successfully compete, we may lose market share or may be required to charge lower sales prices for our products, both of which would reduce our earnings and operating cash flows.

White paper products compete with electronic data transmission and document storage alternatives. Increasing shifts to electronic alternatives have had and will continue to have an adverse effect on usage of these products. As a result of such competition, the industry is experiencing decreasing demand for existing white paper products. As the use of these alternatives grows, demand for paper products is likely to further decline. Declines in demand for our paper products may adversely affect our earnings and operating cash flows.

Some of our competitors are larger than we are and may have greater financial and other resources, greater manufacturing economies of scale, greater energy self-sufficiency, or lower operating costs, compared to our company. We may be unable to compete effectively with these companies particularly during economic downturns. Some of the factors that may adversely affect our ability to compete in the markets in which we participate include the entry of new competitors into the markets we serve, increased competition from overseas producers, our competitors' pricing strategies, changes in customer preferences, and the cost-efficiency of our facilities.

Inflation and Other General Cost Increases - We may not be able to offset higher costs. We are subject to both contractual, inflationary, and other general cost increases, including with regard to our labor costs and purchases of raw materials and transportation services. General economic conditions may result in higher inflation, which may increase our exposure to higher costs. If we are unable to offset these cost increases by price increases, growth, and/or cost reductions in our operations, these inflationary and other general cost increases could have a material adverse effect on our operating cash flows, profitability, and liquidity.

In 2018, our total company costs including cost of sales (COS) and selling, general, and administrative expenses (SG&A) was $5.9 billion, and excluding non-cash costs (depreciation, depletion and amortization, pension and postretirement expense, and share-based compensation expense) was $5.4 billion. A 1% increase in COS and SG&A costs would increase costs by $59 million and cash costs by $54 million.

Cost of Fiber - An increase in the cost of fiber could increase our manufacturing costs and lower our earnings. The market price of wood fiber varies based upon availability, source, and the costs of fuels used in the harvesting and transportation of wood fiber. The cost and availability of wood fiber can also be impacted by weather, general logging conditions, geography, and regulatory activity.

The availability and cost of recycled fiber depends heavily on recycling rates and the domestic and global demand for recycled products. We purchase recycled fiber for use at five of our six containerboard mills and both paper mills. In 2018, we purchased approximately 810,000 tons of recycled fiber, net of the recycled fiber generated by our corrugated box plants. The amount of recycled fiber purchased each year varies based upon production and the prices of both recycled fiber and wood fiber.

Periods of supply and demand imbalance have created significant price volatility. Periods of higher recycled fiber costs and unusual price volatility have occurred in the past, including during 2018 as demand for domestic recycled fiber from Chinese producers declined significantly, and may fluctuate significantly in the future, which could result in higher costs and lower earnings. A $10 per ton price increase in recycled fiber for our containerboard mills, would result in approximately $7 million of additional expense based on 2018 consumption.

Cost of Purchased Fuels and Chemicals - An increase in the cost of purchased fuels and chemicals could lead to higher manufacturing costs, resulting in reduced earnings. We have the ability to use various types of purchased fuels in our manufacturing operations, including natural gas, bark, and other purchased fuels. Fuel prices, in particular prices for oil and natural gas, have fluctuated in the past. New and more stringent environmental regulations may discourage, reduce the availability of, or make more expensive, the use of certain fuels, particularly coal and fossil fuels. In addition, costs for key chemicals used in our manufacturing operations also fluctuate. These fluctuations impact our manufacturing costs and result in earnings volatility. If fuel and chemical prices rise, our production costs and transportation costs will increase and cause higher manufacturing costs and reduced earnings if we are unable to recover such increases through higher prices of our products. A $0.10 per million MMBTU in natural gas prices would result in approximately $3 million of additional expense, based on 2018 usage.

Transportation Costs - Reduced truck and rail availability could lead to higher costs or poorer service, resulting in lower earnings, and harm our ability to distribute our products. We ship our products primarily by truck and rail. We have experienced lower availability of third-party trucking services and service issues, interruptions, and delays in rail services. We have also experienced higher costs for transportation services in general. If these factors persist, we could experience even higher transportation costs in the future and difficulties shipping our products in a timely manner. We may not be able to recover higher transportation costs through higher prices or otherwise, which would result in lower earnings.

Material Disruption of Manufacturing - A material disruption at one of our manufacturing facilities could prevent us from meeting customer demand, reduce our sales, and/or negatively affect our results of operations and financial condition. Our business depends on continuous operation of our facilities, particularly at our mills. Any of our manufacturing facilities, or any of our machines within such facilities, could cease operations unexpectedly for a significant period of time due to a number of events, including:

- Unscheduled maintenance outages.
- Prolonged power failures.

- Equipment or information system breakdowns or failures.
- Explosion of a boiler or other major facilities.
- Disruption in the supply of raw materials, such as wood fiber, energy, or chemicals.
- A spill or release of pollutants or hazardous substances.
- Closure or curtailment related to environmental concerns.
- Labor difficulties.
- Disruptions in the transportation infrastructure, including roads, bridges, railroad tracks, and tunnels.
- Fires, floods, earthquakes, hurricanes, or other catastrophic events.
- Terrorism or threats of terrorism.
- Other operational problems.

These events could harm our ability to produce our products and serve our customers and may lead to higher costs and reduced earnings.

Environmental Matters - PCA may incur significant environmental liabilities with respect to both past and future operations. We are subject to, and must comply with, a variety of federal, state and local environmental laws, particularly those relating to air and water quality, waste disposal and the cleanup of contaminated soil and groundwater. Failure to comply with these regulations could result in fines, which may be significant, or other adverse regulatory action. Because environmental regulations are constantly evolving, we have incurred, and will continue to incur, costs to maintain compliance with those laws. See Item 7. “Management’s Discussion and Analysis of Financial Condition and Results of Operations - Environmental Matters” for estimates of expenditures we expect to make for environmental compliance in the next few years. New and more stringent environmental regulations may be adopted and may require us to incur additional operating expenses and/or significant additional capital expenditures to modify or replace certain of our boilers and other equipment. In addition, environmental regulations may increase the cost of our raw materials and purchased energy. Although we have established reserves to provide for known environmental liabilities, these reserves may change over time due to the enactment of new environmental laws or regulations or changes in existing laws or regulations, which might require additional significant environmental expenditures.

Mergers and Acquisitions - Our acquired businesses may underperform relative to our expectations, and we may not be able to successfully integrate these businesses into our own. We have completed several mergers and acquisitions and investments in recent years. Our success will depend in part on our ability to successfully integrate, and receive the intended benefits from, these acquisitions. There may be difficulties, costs and delays involved in the integration of these businesses into ours. Integration requires modification of operational and financial systems and may result in significant additional expenses. If the acquired businesses underperform relative to our expectations, or if we fail to successfully integrate these businesses, our business, financial condition and results of operations may be materially and adversely affected.

Customer Concentration - We rely on certain large customers. Our packaging and paper segments each have large customers, the loss of which could adversely affect the segment’s sales and profitability. In particular, because our businesses operate in highly competitive industry segments, we regularly bid for new business or for renewal of existing business. The loss of business from our larger customers, or the renewal of business on less favorable terms, may adversely impact our financial results.

We have a supply agreement with Office Depot, our largest customer in the Paper segment. The agreement requires Office Depot to buy, and us to supply, at least 50% of Office Depot's requirements for commodity office papers through December 2019.

In 2018, sales to Office Depot represented 47% of our Paper segment sales and 7% of our consolidated sales. If these sales are reduced, including if we are unable to renew the agreement at committed volumes, we would need to find new customers. We may not be able to fully replace any lost sales, and any new sales may be at lower prices or higher costs. Any significant deterioration in the financial condition of Office Depot affecting its ability to pay or any other change that makes Office Depot less willing to purchase our products will harm our business and results of operations.

Labor Relations- If we experience strikes or other work stoppages, our business will be harmed. Our workforce is highly unionized and operates under various collective bargaining agreements. We must negotiate to renew or extend any union contracts that have recently expired or are expiring in the near future. While we believe that we have satisfactory labor relations, we may not be able to successfully negotiate new agreements without work stoppages or labor difficulties in the future or renegotiate them on favorable terms. If we are unable to successfully renegotiate the terms of any of these agreements, or if we experience any extended interruption of operations at any of our facilities as a result of strikes or other work stoppages, our business, results of operations and financial condition may be harmed.

Reliance on Personnel - We may fail to attract and retain qualified personnel, including key management personnel. Our ability to operate and grow our business depends on our ability to attract and retain employees with the skills necessary to operate and maintain our facilities, produce our products and serve our customers. The increasing demand for qualified personnel may make it more difficult for us to attract and retain qualified employees. Changing demographics and labor work force trends may make it difficult for us to replace retiring employees at our manufacturing and other facilities. If we fail to attract and retain qualified personnel, or if we experience labor shortages, we may experience higher costs and other difficulties, and our business may be adversely impacted.

In addition, we rely on key executive and management personnel to manage our business efficiently and effectively. As our business has grown in size and geographic scope, we have relied on these individuals to manage increasingly complex operations. The loss of any of our key personnel could adversely affect our business.

Cyber Security - Risks related to security breaches of company, customer, employee, and vendor information, as well as the technology that manages our operations and other business processes, could adversely affect our business. We rely on various information technology systems to capture, process, store, and report data and interact with customers, vendors, and employees. Despite careful security and controls design, implementation, updating, and internal and independent third-party assessments, our information technology systems, and those of our third party providers, could become subject to cyber attacks or security breaches. Network, system, and data breaches could result in misappropriation of sensitive data or operational disruptions including interruption to systems availability and denial of access to and misuse of applications required by our customers to conduct business with us. Misuse of internal applications; theft of intellectual property, trade secrets, or other corporate assets; and inappropriate disclosure of confidential information could stem from such incidents. Delayed sales, slowed production, or other issues resulting from these disruptions could result in lost sales, business delays, and negative publicity and could have a material adverse effect on our operations, financial condition, or operating cash flows.

Debt obligations - Our debt service obligations may reduce our operating flexibility. At December 31, 2018, we had $2.5 billion of debt outstanding and a $326.9 million undrawn revolving credit facility, after deducting letters of credit. All debt is comprised of fixed-rate senior notes. We and our subsidiaries are not restricted from incurring, and may incur, additional indebtedness in the future.

Our current borrowings, plus any future borrowings, may affect our ability to operate our business, including, without limitation:

- Result in significant cash requirements to make interest and maturity payments on our outstanding indebtedness;
- Increase our vulnerability to adverse changes in our business or industry conditions;

- Increase our vulnerability to increases in interest rates;
- Limit our ability to obtain additional financing for working capital, capital expenditures, general corporate, and other purposes;
- Limit our flexibility in planning for, or reacting to, changes in our business and our industry; and
- Limit our flexibility to make acquisitions.

Further, if we cannot service our indebtedness, we may have to take actions to secure additional cash by selling assets, seeking additional equity or reducing investments, which may not be achievable on acceptable terms or at all.

Pension Plans – Our pension plans may require additional funding. We record a liability associated with our pensions equal to the excess of the benefit obligations over the fair value of the assets funding the plans. The actual required amounts and timing of future cash contributions will be sensitive to changes in the applicable discount rates and returns on plan assets, and could also be impacted by future changes in the laws and regulations applicable to plan funding. Fluctuations in the market performance of our plan assets will affect our pension plan costs in future periods. Changes in assumptions regarding expected long-term rate of return on plan assets, our discount rate, expected compensation levels, or mortality will also increase or decrease pension costs.

Market Price of our Common Stock - The market price of our common stock may be volatile, which could cause the value of the stock to decline. Securities markets worldwide periodically experience significant price declines and volume fluctuations due to macroeconomic factors and other factors beyond our control. This market volatility, as well as general economic, market, or political conditions, could reduce the market price of our common stock with little regard to our operating performance. In addition, our operating results could be below the expectations of public market analysts and investors, and in response, the market price of our common stock could decrease significantly.

Item 1B. UNRESOLVED STAFF COMMENTS

None.

Item 2. PROPERTIES

We own and lease properties in our business. Primarily all of our leases are noncancelable and are accounted for as operating leases. These leases are not subject to early termination except for standard nonperformance clauses.

Information concerning capacity and utilization of our principal operating facilities, the segments that use those facilities, and a map of geographical locations is presented in “Part I, Item 1. Business” of this Form 10-K. We assess the condition and capacity of our manufacturing, distribution, and other facilities needed to meet our operating requirements. Our properties have been generally well maintained and are in good operating condition. In general, our facilities have sufficient capacity and are adequate for our production and distribution requirements.

We currently own buildings and land for six containerboard mills and two white paper mills. Additionally, we have 95 corrugated manufacturing operations, of which the buildings and land for 51 are owned, including 43 combining operations, or corrugated plants, one corrugated sheet-only manufacturer, and seven sheet plants. We lease the buildings for 18 corrugated plants and 26 sheet plants. We own warehouses and miscellaneous other properties, including sales offices and woodlands management offices. We lease space for regional design centers and numerous other distribution centers, warehouses, and facilities. The equipment in these leased facilities is, in virtually all cases, owned by us, except for forklifts and other rolling stock, which are generally leased.

We lease the cutting rights to approximately 75,000 acres of timberland located near our Valdosta mill (68,000 acres) and our Counce mill (7,000 acres). On average, these cutting rights agreements have terms with approximately 13 years remaining. Additionally, we lease approximately 3,000 acres of land for a fiber farm, located near our Wallula mill, where we plant, grow, and harvest fiber.

Our corporate headquarters is located in Lake Forest, Illinois. The headquarter facility is owned, and we lease additional neighboring office space through the next three years with provisions for two additional five year lease extensions.

Item 3. LEGAL PROCEEDINGS

Information concerning legal proceedings can be found in Note 19, Commitments, Guarantees, Indemnifications, and Legal Proceedings, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K.

Item 4. MINE SAFETY DISCLOSURE

Not applicable.

PART II

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

Market Information

PCA’s common stock is listed on the New York Stock Exchange (NYSE) under the symbol “PKG”.

Stockholders

On February 22, 2019, there were 78 holders of record of our common stock.

Purchases of Equity Securities

Stock Repurchase Program

On February 25, 2016, PCA announced that its Board of Directors authorized the repurchase of $200.0 million of the Company's outstanding common stock. At the time of the announcement, there was no remaining authority under previously announced programs. Repurchases may be made from time to time in open market or privately negotiated transactions in accordance with applicable securities regulations. The timing and amount of repurchases will be determined by the Company in its discretion based on factors such as PCA’s stock price and market and business conditions.

The Company did not repurchase any shares of its common stock under this authority during the years ended December 31, 2018 and 2017. In 2016, we paid $100.3 million to repurchase 1,987,187 shares of common stock, which fully depleted the $93.3 million of repurchase authority under previous authorizations by our board of directors. As of December 31, 2018, we are authorized to repurchase $193.0 million of the Company’s common stock.

Pursuant to its equity incentive plan, the Company withholds shares from vesting employee equity awards to cover employee tax liabilities. Total shares withheld in 2018 were 69,255 to cover $7.9 million in employee tax liabilities. Total shares withheld in 2017 were 97,946 to cover $10.8 million of employee tax liabilities. Total shares withheld in 2016 were 172,438 for $11.2 million. Shares withheld are included in the number of shares repurchased in the table below.

The following table presents information related to our repurchases of common stock made under repurchase plans authorized by PCA's Board of Directors, and shares withheld to cover taxes on vesting of equity awards, during the three months ended December 31, 2018:

Issuer Purchases of Equity Securities				
Period	Total	Average	Total	Approximate
	Number		Number of	
		Price		Dollar Value
	of Shares	Paid	Shares	
			Purchased	of Shares
		Per Share		That

	Purchased (a)		as Part of Publicly Announced Plans or Programs	May Yet Be Purchased Under the Plans or Programs (in millions)
October 1-31, 2018	—	$ —	—	$ 193.0
November 1-30, 2018	186	88.05	—	193.0
December 1-31, 2018	449	83.46	—	193.0
Total	635	(a) $ 84.80	—	$ 193.0

(a) 635 shares were withheld from employees to cover income and payroll taxes on equity awards that vested during the period.

Performance Graph

The graph below compares PCA’s cumulative 5-year total shareholder return on common stock with the cumulative total returns of the S&P 500 index; the S&P Midcap 400 index; a New Peer Group that includes three publicly-traded companies, which are International Paper Company, WestRock Company, and Domtar Corporation; and an Old Peer Group that includes two publicly-traded companies, which are International Paper Company and KapStone Paper and Packaging Corporation. Peer group members WestRock Company and Domtar Corporation were added to the New Peer Group because they are primarily domestic integrated packaging and paper companies who, similar to PCA, produce and sell corrugated and paper products, respectively. In addition, these two companies are included in the competitive group for executive compensation purposes in PCA’s Proxy Statement. Old Peer Group member KapStone Paper and Packaging Corporation was acquired by New Peer Group member WestRock Company in 2018. The graph tracks the performance of a $100 investment (including the reinvestment of all dividends) in our common stock, in each index, and in each peer group's common stock from December 31, 2013, through December 31, 2018. The stock price performance included in this graph is not necessarily indicative of future stock price performance.

	Cumulative Total Return					
	December 31,					
	2013	2014	2015	2016	2017	2018
Packaging Corporation of America	$100.00	$126.09	$105.18	$146.29	$212.84	$151.41
S&P 500	100.00	113.69	115.26	129.05	157.22	150.33
S&P Midcap 400	100.00	109.77	107.38	129.65	150.71	134.01
2017 Peer Group	100.00	114.15	83.10	122.09	138.07	99.79
2018 Peer Group	100.00	111.00	83.42	113.97	136.22	93.20

The information in the graph and table above is not deemed “filed” with the Securities and Exchange Commission and is not to be incorporated by reference in any of PCA’s filings under the Securities Act of 1933 or the Securities Exchange Act of 1934, whether made before or after the date of this Annual Report on Form 10-K, except to the extent that PCA specifically incorporates such information by reference.

Item 6. SELECTED FINANCIAL DATA

The following table sets forth selected historical financial data of PCA (dollars and shares in millions, except per share data). The information contained in the table should be read in conjunction with the disclosures in “Part II, Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations” and “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K.

	Year Ended December 31,				
	2018	2017	2016	2015	2014
Statement of Income Data (a):					
Net Sales	$7,014.6	$6,444.9	$5,779.0	$5,741.7	$5,852.6
Net Income	738.0	668.6	449.6	436.8	392.6
Net income per common share:					
— basic	7.82	7.09	4.76	4.47	3.99
— diluted	7.80	7.07	4.75	4.47	3.99
Weighted average common shares outstanding:					
— basic	93.7	93.5	93.5	96.6	97.0
— diluted	93.9	93.7	93.7	96.7	97.1
Cash dividends declared per common share	3.00	2.52	2.36	2.20	1.60
Balance Sheet Data (a):					
Total assets	$6,569.7	$6,197.5	$5,777.0	$5,272.3	$5,258.7
Total debt obligations	2,502.7	2,650.7	2,667.4	2,319.7	2,365.2
Stockholders' equity	2,672.4	2,182.6	1,759.8	1,633.3	1,521.4

(a) Effective January 1, 2016, the Company adopted Accounting Standards Update (ASU) 2015-03 (Topic 835): Simplifying the Presentation of Debt Issuance Costs. We applied this guidance retrospectively, as required, and reclassified the debt issuance costs from “Other long-term assets” to “Long-term debt” on our Consolidated Balance Sheet to conform with current period presentation. Total assets for all periods presented have been updated to reflect this adoption.

Effective December 31, 2015, the Company adopted Accounting Standards Update 2015-17, Balance Sheet Classification of Deferred Taxes. The guidance eliminates the requirement to classify deferred taxes between current and noncurrent and requires that all deferred tax assets and liabilities, along with any related valuation allowance, be classified as noncurrent on the balance sheet. Our total assets for all periods presented have been updated to reflect this adoption.

Effective January 1, 2014, the Company changed its method of accounting for inventories from lower of cost, as determined by the LIFO method, or market, to lower of cost, as determined by the average cost method, or market. The Company applied the change retrospectively to all prior periods presented herein in accordance with US generally accepted accounting principles (GAAP) relating to accounting changes.

Net income and net income per common share are impacted by a lower U.S. corporate federal statutory income tax rate of 21% in 2018 and 35% in in all prior years presented in this table. In addition, both 2018 and 2017 include a tax benefit of $2.0 million and $122.1 million, respectively, related to the enactment in December 2017 of the Tax Cuts and Jobs Act (H.R.1). See Note 7, Income Taxes, for more information.

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

The following discussion and analysis of historical results of operations and financial condition should be read in conjunction with the audited financial statements and the notes thereto which appear elsewhere in this Form 10-K. This discussion includes forward-looking statements regarding our expectations with respect to our future performance, liquidity, and capital resources. Such statements, along with any other non-historical statements in the discussion, are forward-looking. See our discussion regarding forward-looking statements included under “Part I, Item 1A. Risk Factors” of this Form 10-K.

Overview

PCA is the third largest producer of containerboard products and the third largest producer of uncoated freesheet paper in North America. We operate six containerboard mills, two paper mills, and 95 corrugated products manufacturing plants. Our containerboard mills produce linerboard and corrugating medium, which are papers primarily used in the production of corrugated products. Our corrugated products manufacturing plants produce a wide variety of corrugated packaging products, including conventional shipping containers used to protect and transport manufactured goods, multi-color boxes and displays with strong visual appeal that help to merchandise the packaged product in retail locations, and honeycomb protective packaging. In addition, we are a large producer of packaging for meat, fresh fruit and vegetables, processed food, beverages, and other industrial and consumer products. We also manufacture and sell white papers, including both commodity and specialty papers, which may have custom or specialized features such as colors, coatings, high brightness, and recycled content. We are headquartered in Lake Forest, Illinois and operate primarily in the United States.

Executive Summary

Net sales were $7.01 billion for the year ended December 31, 2018 and $6.44 billion in 2017. We reported $738 million of net income, or $7.80 per diluted share, in 2018, compared to $669 million, or $7.07 per diluted share, in 2017. Net income included $22 million of expense for special items in 2018, compared to $100 million of income for special items in 2017, including $122 million of estimated income tax benefit related to the enactment in December 2017 of the Tax Cut and Jobs Act (H.R.1). Special items in both periods are described later in this section. Excluding special items, we recorded $760 million of net income, or $8.03 per diluted share, in 2018, compared to $569 million, or $6.02 per diluted share, in 2017. The increase was driven primarily by higher prices and mix and volumes in our Packaging segment, higher prices and mix in our Paper segment, lower taxes, and lower wood and recycled fiber costs, partially offset by lower volumes in our Paper segment, higher operating and converting costs, higher freight and logistic expenses, and higher annual outage expense, and other costs. For additional detail on special items included in reported GAAP results and other non-GAAP measures, see “Item 7. Reconciliations of Non-GAAP Financial Measures to Reported Amounts.”

Packaging segment income from operations was $1,045 million in 2018, compared to $950 million in 2017. Packaging segment EBITDA excluding special items was $1,401 million in 2018, compared to $1,264 million in 2017. The increase was driven primarily by higher containerboard and corrugated products prices and mix and sales and production volumes driven by strong demand, and lower recycled fiber costs; partially offset by higher operating and converting costs; higher freight and logistic expense; and higher annual outage expense.

Paper segment income from operations was $98 million in 2018, compared to $54 million in 2017. Paper segment EBITDA excluding special items was $165 million in 2018, compared to $145 million in 2017. The increase was due primarily to higher paper prices and mix, lower operating costs, and lower annual outage expense, partially offset by higher freight and logistic expense and higher fiber costs.

During the second quarter of 2018, the Company discontinued production of uncoated freesheet and coated one-side grades at its Wallula, Washington mill and converted the No. 3 paper machine to a 400,000 ton-per-year virgin kraft linerboard machine. The Company incurred charges in the Packaging and Paper segments relating to these activities during 2017 and 2018 as described below under "Special Items and Earnings per Diluted Share, Excluding Special Items."

In October 2017, the Company acquired substantially all of the assets of Sacramento Container Corporation, and 100% of the membership interests of Northern Sheets, LLC and Central California Sheets, LLC (collectively the "Sacramento Container acquisition") for $274 million with cash on hand. The acquired companies operate two full-line corrugated product operations and sheet feeders in McClellan, California and Kingsburg, California. The operating results of the companies acquired in the Sacramento Container acquisition are included in our results and reported in the Packaging segment from and after October 2017. These operations have been substantially integrated into our business and have helped drive growth in our corrugated products volumes during 2018.

Special Items and Earnings per Diluted Share, Excluding Special Items

Earnings per diluted share, excluding special items, in 2018 and 2017 were as follows:

	Year Ended December 31,	
	2018	2017
Earnings per diluted share	$7.80	$7.07
Special items:		
Wallula mill restructuring (a)	0.24	0.21
Facilities closure and other costs (b)	0.01	(0.04)
Tax reform (c)	(0.02)	(1.29)
Internal legal entity consolidation (d)	—	0.04
DeRidder mill incident (e)	—	0.03
Acquisition and integration related costs (f)	—	0.01
Deferred debt issuance costs (g)	—	0.01
Expiration of timberland repurchase option (h)	—	(0.01)
Hexacomb working capital adjustment (i)	—	(0.01)
Total special items (income) expense	0.23	(1.05)
Earnings per diluted share, excluding special items	$8.03	$6.02

(a) For 2018 and 2017, includes $30.0 million and $33.4 million, respectively, of charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine.

(b) For 2018, includes $1.8 million of charges consisting of closure costs related to corrugated products facilities and a corporate administration facility. For 2017, includes $5.8 million of income primarily related to the sale of land corresponding to the closure of a corrugated products facility, partially offset by closure costs related to corrugated products facilities, a paper administration facility, a corporate administration facility, and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities.

(c) For 2018 and 2017, includes $2.0 million and $122.1 million, respectively, of income tax benefit for the re-measurement of our net deferred tax liability for the reduction in the U.S. corporate federal statutory income tax rate related to our 2017 measurement period adjustments in accordance with SEC Staff Accounting Bulletin No. 118 (SAB 118), Income Tax Accounting Implications of the Tax Cuts and Jobs Act.

(d) Includes $3.3 million of tax expense for the change in value of deferred taxes as a result of an internal legal entity consolidation that will simplify future operating activities.

(e) Includes $5.0 million of costs for the property damage and business interruption insurance deductible corresponding to the February 2017 explosion at our DeRidder, Louisiana mill.

(f) Includes $1.7 million of charges for acquisition and integration costs related to recent acquisitions.

(g) Includes $1.8 million of expense related to the write-off of deferred debt issuance costs in connection with the December 2017 debt refinancing.

(h) Includes a $2.0 million gain related to the expiration of a repurchase option corresponding to timberland previously sold.

(i) Includes $2.3 million of income related to a working capital adjustment from the April 2015 sale of our Hexacomb corrugated manufacturing operations in Europe and Mexico.

Management excludes special items, as it believes these items are not necessarily reflective of the ongoing results of operations of our business. We present these measures because they provide a means to evaluate the performance of our segments and our company on an ongoing basis using the same measures that are used by our management, because these measures assist in providing a meaningful comparison between periods presented and because these measures are frequently used by investors and other interested parties in the evaluation of companies and the performance of their segments. A reconciliation of diluted EPS to diluted EPS excluding special items is included above and the reconciliations of other non-GAAP measures used in this Management's Discussion and Analysis of Financial Condition and Results of Operations, to the most comparable measure reported in accordance with GAAP, are included later in Item 7 under “Reconciliations of Non-GAAP Financial Measures to Reported Amounts.” Any analysis of non-GAAP financial measures should be done in conjunction with results presented in accordance with GAAP. The non-GAAP measures are not intended to be substitutes for GAAP financial measures and should not be used as such.

Industry and Business Conditions

Trade publications reported North American industry-wide corrugated products total shipments increased 1.7% during 2018, compared to 2017. Reported industry containerboard production increased 1.7% compared to 2017, and reported industry containerboard inventories at the end of 2018 were approximately 2.7 million tons, up 11.7% compared to 2017. Reported containerboard export shipments were flat compared to 2017. In March 2018, trade publications reported a $50 price per ton increase on linerboard and corrugating medium. In January 2019, trade publications reported a $10 price per ton decrease on corrugating medium.

The market for communication papers competes heavily with electronic data transmission and document storage alternatives. Increasing shifts to these alternatives have reduced usage of traditional print media and communication papers. Trade publications reported North American uncoated freesheet paper shipments were down 4.0% in 2018, compared to 2017. Average prices reported by a trade publication for cut size office papers increased $83 per ton, or 8.7%, in 2018, compared to 2017.

Outlook

Looking ahead to the first quarter of 2019, we expect continued strong demand in our Packaging segment for both containerboard volume and corrugated products volume, and we expect strong market conditions in our Paper segment to continue. We anticipate higher labor and benefits costs with annual wage increases and other timing-related expenses. Although we expect costs for freight and recycled fiber to be fairly flat, we do anticipate some inflation with most of our chemical and repair and materials costs, while seasonally colder weather will increase energy usage and wood costs. We also expect our tax rate to be slightly higher. Finally, the recent decrease in the published price for domestic medium will have a minimal effect on earnings. Considering these items, we expect first quarter 2019 earnings, excluding special items, to be lower than fourth quarter 2018. We do not expect special items to be significant during the first quarter of 2019.

Results of Operations

Year Ended December 31, 2018, Compared with Year Ended December 31, 2017

The historical results of operations of PCA for the years ended December 31, 2018 and 2017 are set forth below (dollars in millions):

	Year Ended December 31,		
	2018	2017 (c)	Change
Packaging	$5,938.5	$5,312.3	$626.2
Paper	1,002.0	1,051.8	(49.8)
Corporate and other and eliminations	74.1	80.8	(6.7)
Net sales	$7,014.6	$6,444.9	$569.7
Packaging	$1,045.4	$950.3	$95.1
Paper	97.7	54.0	43.7
Corporate and other	(75.4)	(71.8)	(3.6)
Income from operations	1,067.7	932.5	135.2
Interest expense, net and other	(97.2)	(103.9)	6.7
Income before taxes	970.5	828.6	141.9

Income tax expense (a)	(232.5)	(160.0)	(72.5)
Net income	$738.0	$668.6	$69.4
Net income excluding special items (b)	$760.4	$569.1	$191.3
EBITDA (b)	$1,478.6	$1,323.9	$154.7
EBITDA excluding special items (b)	$1,497.2	$1,343.4	$153.8

(a) The U.S. corporate federal statutory income tax rate in 2018 was 21% and in 2017 was 35%. Income tax expense for 2018 and 2017 included a tax benefit of $2.0 million and $122.1 million, respectively, related to the enactment in December 2017 of the Tax Cuts and Jobs Act (H.R.1). See Note 7, Income Taxes, for more information.

(b) See “Reconciliations of Non-GAAP Financial Measures to Reported Amounts” included in this Item 7 for a reconciliation of non-GAAP measures to the most comparable GAAP measure.

(c) Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost and applied this standard retrospectively to the prior period reflected herein. See Note 2, Summary of Significant Accounting Policies and Note 18, Segment Information, for more information.

Net Sales

Net sales increased $570 million, or 8.8%, to $7,015 million in 2018, compared to $6,445 million in 2017.

Packaging. Net sales increased $626 million, or 11.8%, to $5,939 million, compared to $5,312 million in 2017, due to increased containerboard and corrugated products volume ($367 million) and higher domestic and export containerboard and corrugated products prices and mix ($259 million). In 2018, our domestic containerboard prices increased 6.3% and export prices increased 16.3% compared to 2017. Containerboard outside shipments increased 10.7%, and total corrugated products shipments were up 5.2% per day and 5.6% in total, compared to 2017. Prices reported by trade publications increased $50 per ton on linerboard and corrugating medium in March of 2018.

Paper. Net sales decreased $50 million, or 4.7%, to $1,002 million, compared to $1,052 million in 2017. The decrease was due to lower volume ($93 million), primarily as a result of discontinuing the production and sale of the products on the No. 3 machine at the Wallula mill in connection with its conversion to linerboard production, partially offset by higher prices and mix ($43 million).

Gross Profit

Gross profit increased $175 million in 2018, compared to 2017. The increase was driven primarily by higher containerboard and corrugated products prices and mix and sales and production volumes, higher paper prices and mix, and lower wood and recycled fiber costs, partially offset by lower volumes in our Paper segment and higher operating and converting costs. In 2018, gross profit included special items of $15 million related to the conversion of the No. 3 machine at the Wallula mill, compared to $11 million related to the conversion of the No. 3 machine at the Wallula mill and acquisition-related costs in 2017.

Selling, General, and Administrative Expenses

Selling, general, and administrative expenses (SG&A) increased $17 million in 2018, compared to 2017. The increase in 2018 was primarily due to higher employee salaries and fringes ($18 million), the Sacramento Container acquisition ($8 million), outside professional services ($6 million) and other administrative expenses individually insignificant ($10 million). These increases were partially offset by certain expenses that were previously recorded in SG&A for 2017 which are now recorded in cost of sales for 2018 ($25 million). Effective January 1, 2018, the Company adopted ASU 2014-09 (Topic 606): Revenue from Contracts with Customers using the modified retrospective method. The new standard provides additional clarity concerning contract fulfillment costs, which resulted in certain costs being classified as cost of sales rather than SG&A for 2018.

Other (Expense) Income, Net

Other (expense) income, net for the years ended December 31, 2018 and 2017 are set forth below (dollars in millions):

	Year Ended December 31,	
	2018	2017
Asset disposals and write-offs	$(17.3)	$(10.5)
Wallula mill restructuring	(14.9)	(23.1)

Facilities closure and other costs	(1.6)	5.9
Insurance deductible for property damage	(0.5)	—
Acquisition and integration related costs	(0.2)	(0.8)
DeRidder mill incident	—	9.7
Hexacomb working capital adjustment	—	2.3
Expiration of timberland repurchase option	—	2.0
Other	(6.7)	(3.9)
Total	$(41.2)	$(18.4)

We discuss these items in more detail in Note 6, Other (Expense) Income, Net of the Condensed Notes to the Consolidated Financial Statements in “Part II, Item 8. Financial Statements” of this Form 10-K.

Income from Operations

Income from operations increased $135 million, or 14.5%, for the year ended December 31, 2018, compared to 2017. Income from operations in 2018 included $32 million of expense for special items compared to $30 million in 2017. Special items in 2018 consist of $30 million of charges related to the conversion of the Wallula No. 3 paper machine and $2 million related to facilities closures and other costs. 2017 special items included $33 million of charges related to the conversion of the Wallula No. 3 paper machine, $5 million for the property damage and business interruption insurance deductible related to the DeRidder mill incident, $2 million for integration-related costs, and $11 million in net gains related to facility closures and land sales, an adjustment to Hexacomb working capital, and the expiration of a repurchase option to timberland previously sold.

Packaging. Segment income from operations increased $95 million to $1,045 million, compared to $950 million in 2017. The increase in 2018 related primarily to higher containerboard and corrugated products prices and mix ($237 million), higher containerboard and corrugated products sales and production volumes ($141 million), and lower wood and recycled fiber costs ($25 million), partially offset by higher operating and converting costs ($177 million), higher annual outage expense ($36 million), higher freight expense ($26 million), higher depreciation expense ($24 million), Wallula No. 3 paper machine conversion-related costs ($5 million), and other expenses primarily related to the disposition of fixed assets ($8 million) and a 2017 insurance recovery related to the DeRidder incident ($13 million). Special items in 2018 included expense of $12 million of charges related to the conversion of the Wallula No. 3 paper machine and $2 million related to facilities closures and other costs. Special items in 2017 included expense of $5 million for property damage and business interruption insurance deductible related to the DeRidder mill incident, $2 million in integration-related costs, and $11 million in net gains related to facility closures, land sales, an adjustment to Hexacomb working capital and the expiration of a repurchase option corresponding to timberland previously sold.

Paper. Segment income from operations increased $44 million to $98 million, compared to $54 million in 2017. The increase primarily related to higher paper prices and mix ($43 million), lower operating costs ($19 million), lower annual outage expense ($19 million), and lower depreciation expense ($6 million), partially offset by lower sales and production volumes ($35 million), higher freight expense ($12 million), and higher wood and recycled fiber costs ($12 million). Special items during 2018 included expense of $18 million compared to $33 million in 2017 related to the conversion of the Wallula No. 3 paper machine to kraft linerboard.

Interest Expense, Net and Other, and Income Taxes

Interest expense, net and other, during 2018 decreased $7 million compared to 2017. The decrease is primarily related to our repayment of the 6.50% Senior Notes in March 2018 and our term loans in December 2017, partially offset by interest expense on the new notes related to the December 2017 refinancing.

During 2018, income tax expense increased $73 million compared to 2017, primarily due to the 2017 income tax benefit of $122.1 million recorded for the re-measurement of our net deferred tax liability to the lower federal income tax rate as a result of H.R. 1 (P.L. 115-97), originally known as the “Tax Cuts and Jobs Act”, which the President signed into law on December 22, 2017. For additional information regarding the 2017 impact of the Tax Act, see Note 7, Income Taxes, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K. Excluding the tax reform related income tax benefits of $2.0 million in 2018 and $122.1 million in 2017, the 2018 income tax expense would have decreased $48 million compared to 2017, primarily as a result of the reduction in the U.S. corporate federal statutory income tax rate. The effective tax rate for 2018 and 2017 was 24.0% and 19.3%, respectively. Excluding the tax reform related income tax benefits of $2.0 million in 2018 and $122.1 million in 2017, the effective tax rate for 2018 and 2017 would have been 24.2% and 34.1%, respectively.

Year Ended December 31, 2017, Compared with Year Ended December 31, 2016

	Year Ended December 31, 2017 (c)	 2016 (c)	 Change
Packaging	$5,312.3	$4,584.8	$727.5
Paper	1,051.8	1,093.9	(42.1)
Corporate and other and eliminations	80.8	100.3	(19.5)
Net sales	$6,444.9	$5,779.0	$665.9
Packaging	$950.3	$718.5	$231.8
Paper	54.0	131.7	(77.7)
Corporate and other	(71.8)	(66.9)	(4.9)
Income from operations	932.5	783.3	149.2
Interest expense, net and other	(103.9)	(94.8)	(9.1)
Income before taxes	828.6	688.5	140.1
Income tax expense (a)	(160.0)	(238.9)	78.9
Net income	$668.6	$449.6	$219.0
Net income excluding special items (b)	$569.1	$462.0	$107.1
EBITDA (b)	$1,323.9	$1,141.3	$182.6
EBITDA excluding special items (b)	$1,343.4	$1,157.5	$185.9

(a) Income tax expense in 2017 included a tax benefit of $122.1 million related to the enactment in December 2017 of the Tax Cuts and Jobs Act (H.R.1). See Note 7, Income Taxes, for more information.
(b) See "Reconciliations of Non-GAAP Financial Measures to Reported Amounts" included in this Item 7 for a reconciliation of non-GAAP measures to the most comparable GAAP measure.
(c) Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost and applied this standard retrospectively to the prior periods reflected herein. See Note 2, Summary of Significant Accounting Policies and Note 18, Segment Information, for more information.

Net Sales

Net sales increased $666 million, or 11.5%, to $6,445 million in 2017, compared to $5,779 million in 2016.

Packaging. Net sales increased $728 million, or 15.9%, to $5,312 million, compared to $4,585 million in 2016, due to increased containerboard and corrugated products volume ($428 million) and higher domestic and export containerboard and corrugated products prices and mix ($299 million). In 2017, our domestic containerboard prices increased 11.1% and export prices increased 17.2% compared to 2016. Containerboard outside shipments increased 7.9%, and total corrugated products shipments were up 8.6%, compared to 2016. Prices reported by trade publications increased $50 per ton on linerboard in April; corrugating medium increased $50, $20, and $10 per ton in April, July, and August respectively.

Paper. Net sales decreased $42 million, or 3.8%, to $1,052 million, compared to $1,094 million in 2016. The decrease was due to lower pulp volume ($47 million) as a result of the December 2016 shutdown of our market pulp operations at our Wallula mill, and unfavorable changes in prices and mix ($7 million), partially offset by higher white paper volume ($12 million).

Gross Profit

Gross profit increased $195 million in 2017, compared to 2016. The increase was driven primarily by higher containerboard and corrugated products prices and mix and sales and production volumes, partially offset by lower Paper segment prices and mix and sales and production volumes, and higher input and operating costs. In 2017, gross profit included special items of $10 million related to the conversion of the No. 3 machine at the Wallula mill and $1 million of acquisition-related costs, compared to $5 million in 2016 for facility closure and acquisition-related costs.

Selling, General, and Administrative Expenses

Selling, general, and administrative expenses increased $51 million in 2017, compared to 2016. The increase in 2017 was due primarily to higher administrative costs corresponding to the acquisitions of TimBar and Columbus Container in the second half of 2016 and Sacramento Container in the fourth quarter of 2017.

Other (Expense) Income, Net

Other (expense) income, net for the years ended December 31, 2017 and 2016 are set forth below (dollars in millions):

	Year Ended December 31,	
	2017	2016
Wallula mill restructuring	$(23.1)	$—
Asset disposals and write-offs	(10.5)	(11.9)
Acquisition and integration related costs	(0.8)	(3.3)
Expiration of timberland repurchase option	2.0	—
Hexacomb working capital adjustment	2.3	—
Facilities closure and other costs	5.9	(10.3)
DeRidder mill incident	9.7	—
Ceased production of market pulp at Wallula	—	(0.6)
Other	(3.9)	1.8
Total	$(18.4)	$(24.3)

We discuss these items in more detail in Note 6, Other (Expense) Income, Net of the Condensed Notes to the Consolidated Financial Statements in “Part II, Item 8. Financial Statements” of this Form 10-K.

Income from Operations

Income from operations increased $149 million, or 19.0%, for the year ended December 31, 2017, compared to 2016. 2017 income from operations included $30 million of expense for special items compared to $19 million of expense in 2016. Special items in 2017 consist of $33 million of charges related to the conversion of the Wallula No. 3 paper machine, $5 million for the property damage and business interruption insurance deductible related to the DeRidder mill incident, $2 million for integration-related costs, and $11 million in net gains related to facility closures and land sales, an adjustment to Hexacomb working capital, and the expiration of a repurchase option corresponding to timberland previously sold. 2016 special items included $11 million of facility closure costs related to corrugated manufacturing facilities and a paper distribution center, $4 million of TimBar and Columbus Container acquisition-related costs, $3 million related to shutdown of market pulp operations at our Wallula mill, and $1 million related to our withdrawal from a multiemployer pension plan for one of our corrugated products facilities.

Packaging. Segment income from operations increased $232 million to $950 million, compared to $718 million in 2016. The increase in 2017 related primarily to higher containerboard and corrugated products prices and mix ($223 million), and higher containerboard and corrugated products sales and production volumes ($81 million), partially offset by higher costs for input costs ($49 million), labor and fringes ($21 million), freight ($13 million), converting and other costs ($8 million), and higher depreciation expense ($12 million). Special items in 2017 included expense of $5 million for property damage and business interruption insurance deductible related to the DeRidder mill incident,

$2 million in integration-related costs, and $11 million in net gains related to facility closures and land sales, an adjustment to Hexacomb working capital, and the expiration of a repurchase option corresponding to timberland previously sold. Special items in 2016 included $9 million of facility closure costs, $4 million of TimBar and Columbus Container acquisition-related costs, and $1 million related to our withdrawal from a multiemployer pension plan for one of our corrugated products facilities.

Paper. Segment income from operations decreased $78 million to $54 million, compared to $132 million in 2016. The decrease primarily related to lower sales and production volumes ($17 million), lower paper prices and mix ($8 million), and higher costs for energy ($12 million) and annual outage expenses ($10 million). Special items during 2017 included expense of $33 million related to the conversion of the Wallula No. 3 machine to kraft linerboard, compared to $4 million related to the shutdown of market pulp operations at our Wallula mill and facilities closures in 2016.

Interest Expense, Net and Other, and Income Taxes

Interest expense, net and other, during 2017 increased $9 million compared to 2016. The increase in interest expense was primarily due to interest on term loan borrowings for the TimBar acquisition made in August 2016, higher interest rates on variable rate debt due to higher LIBOR in 2017 compared to 2016, and interest on the new notes related to the December 2017 refinancing.

During 2017, income tax expense decreased $79 million compared to 2016 primarily due to a $122.1 million tax benefit as a result of H.R. 1 (P.L. 115-97), originally known as the "Tax Cuts and Jobs Act" (the "Tax Act"), which the President signed into law on December 22, 2017. The effective tax rate for 2017 and 2016 was 19.3% and 34.7%, respectively. For additional information regarding the impact of the Tax Act, see Note 7, Income Taxes, in "Part II, Item 8. Financial Statements and Supplementary Data" of this Form 10-K.

Liquidity and Capital Resources

Sources and Uses of Cash

Our primary sources of liquidity are net cash provided by operating activities and available borrowing capacity under our revolving credit facility. We ended the year with $362 million of cash and $327 million of unused borrowing capacity under the revolving credit facility, net of letters of credit. Currently, our primary uses of cash are for operations, capital expenditures, acquisitions, debt service, common stock dividends, and repurchases of common stock. We believe that net cash generated from operating activities, cash on hand, available borrowings under our revolving credit facility and available capital through access to capital markets will be adequate to meet our liquidity and capital requirements, including payments of any declared common stock dividends, for the foreseeable future. As our debt or credit facilities become due, we will need to repay, extend or replace such facilities. Our ability to do so will be subject to future economic conditions and financial, business, and other factors, many of which are beyond our control.

Below is a summary table of our cash flows, followed by a discussion of our sources and uses of cash through operating activities, investing activities, and financing activities (dollars in millions):

	Year Ended December 31,		
	2018	2017	2016
Net cash provided by (used for):			
Operating activities	$1,180.1	$856.1	$806.9
Investing activities	(608.2)	(609.1)	(769.6)
Financing activities	(427.3)	(269.4)	17.8
Net increase (decrease) in cash and cash equivalents	$144.6	$(22.4)	$55.1

Operating Activities

Our operating cash flow is primarily driven by our earnings and changes in operating assets and liabilities, such as accounts receivable, inventories, accounts payable and other accrued liabilities, as well as other factors described below. Cash requirements for operating activities are subject to PCA's operating needs and the timing of collection of receivables and payments of payables and expenses.

2018

During 2018, net cash provided by operating activities was $1,180 million, compared to $856 million for 2017, an increase of $324 million. Cash from operations excluding changes in cash used for operating assets and liabilities increased $231 million. The increase was primarily due to higher income from operations in 2018 as discussed above and lower qualified pension plan contributions of $20 million made in 2018 compared to the same period in 2017. Cash increased by $93 million due to changes in operating assets and liabilities. The increase was primarily due to the following: (a) a reduction in taxes paid in 2018 as a result of the lower U.S. corporate federal statutory income tax rate of 21% and the utilization in 2018 of a federal overpayment from 2017 as a result of Federal Tax Reform, (b) lower accounts receivables levels in 2018 compared to 2017 due to fewer shipping days in December 2018 compared to December 2017, as well as timing of collections, and (c) the receipt of the DeRidder insurance proceeds in the first quarter of 2018. These changes were partially offset by lower accounts payable levels in 2018 compared to 2017 primarily related to timing of payments.

2017

During 2017, net cash provided by operating activities was $856 million, compared to $807 million for 2016, an increase of $49 million. Cash from operations excluding changes in cash used for operating assets and liabilities increased $200 million. The increase was primarily due to higher income from operations in 2017 as discussed above. Cash decreased by $151 million due to changes in operating assets and liabilities. The decrease was primarily due to higher accounts receivable levels in 2017 compared to 2016 because of increased sales and timing of collections; and a higher federal and state income tax receivable in 2017 compared to 2016 primarily due to an overpayment of required taxes made in 2017 prior to the enactment of tax reform. These changes were partially offset by an increase in accounts payable levels in 2017 compared to 2016 primarily related to timing of payments.

Investing Activities

2018

We used $608 million for investing activities in 2018, compared to $609 million in 2017. In 2018, we spent $552 million for internal capital investments, compared to $343 million in 2017. During 2018, we spent $56 million for acquisitions (Englander dZignPak), compared to $274 million for acquisitions in 2017 (Sacramento Container).

The details of capital expenditures for property and equipment, excluding acquisitions, by segment for the years ended December 31, 2018, 2017, and 2016, are included in the table below (dollars in millions).

	Year Ended December 31,		
	2018	2017	2016
Packaging	$504.0	$305.1	$239.9
Paper	12.6	22.6	31.6
Corporate and Other	34.8	15.3	2.8
	$551.4	$343.0	$274.3

We expect capital investments in 2019 to be between $390 million and $410 million. These expenditures could increase or decrease as a result of a number of factors, including our financial results, strategic opportunities, future economic conditions, and our regulatory compliance requirements. We currently estimate capital expenditures to comply with environmental regulations will be about $10 million in 2019. Our estimated environmental expenditures could vary significantly depending upon the enactment of new environmental laws and regulations. For additional information, see “Environmental Matters” in this Management's Discussion and Analysis of Financial Condition and Results of Operations.

At December 31, 2018, the Company had commitments for capital expenditures of $113 million. The Company believes that cash-on-hand combined with cash flow from operations will be sufficient to fund these commitments.

2017

We used $609 million for investing activities in 2017, compared to $770 million in 2016. In 2017, we spent $343 million for internal capital investments, compared to $274 million in 2016. During 2017, we spent $274 million for acquisitions (Sacramento Container), compared to $485 million for acquisitions in 2016 (TimBar and Columbus

Container).

Financing Activities

2018

In 2018, net cash used for financing activities was $427 million, compared to $269 million of cash used for financing activities in 2017, an increase of $158 million. The increase primarily relates to higher debt repayments and dividends in 2018. In March 2018, we repaid from cash $150 million of our maturing 6.5% senior notes. We paid $268 million of dividends in 2018 compared to $238 million in 2017.

2017

In 2017, net cash used for financing activities was $269 million, compared to $18 million of cash provided by financing activities in 2016, a change of $287 million. In 2017, we paid down approximately $14 million of debt, including scheduled principal payments on our term loan borrowings and the refinancing of those borrowings as described below. In 2016, we increased our debt, as we borrowed $385 million to finance the TimBar acquisition. In addition, in 2016, we repurchased $100 million of shares, with no such repurchase activity in 2017. We paid $238 million of dividends in 2017 compared to $216 million in 2016.

To reduce exposure to variable interest rates, in December 2017, we issued a total of $1 billion in three-year and ten-year notes with fixed interest rates of 2.45% and 3.40%, respectively, and used the proceeds to fully pay down our five-year and seven-year term loans.

For more information about our debt, treasury lock derivative instruments, and commitments, see Note 10, Debt, Note 14, Derivative Instruments and Hedging Activities, and Note 19, Commitments, Guarantees, Indemnifications, and Legal Proceedings, respectively, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K.

Commitments

Contractual Obligations

The table below sets forth our enforceable and legally binding obligations as of December 31, 2018 for the categories described below. Some of the amounts included in the table are based on management's estimates and assumptions about these obligations, including their duration, the possibility of renewal, anticipated actions by third parties, and other factors. Because these estimates and assumptions are necessarily subjective, our actual payments may vary from those reflected in the table. Purchase orders made in the ordinary course of business are excluded from the table below. Any amounts for which we are liable under purchase orders are reflected on the Consolidated Balance Sheets as accounts payable and accrued liabilities (dollars in millions):

	Payments Due by Period				
		Less Than 1 Year	1-3 Years	3-5 Years	More Than 5 Years
	Total	2019	2020-2021	2022-2023	2024 & After
2.45% Senior Notes, due December 2020	$500.0	$—	$ 500.0	$ —	$—
3.90% Senior Notes, due June 2022	400.0	—	—	400.0	—
4.50% Senior Notes, due November 2023	700.0	—	—	700.0	—
3.65% Senior Notes, due September 2024	400.0	—	—	—	400.0
3.40% Senior Notes, due December 2027	500.0	—	—	—	500.0
Total short-term and long-term debt (a)	2,500.0	—	500.0	1,100.0	900.0
Interest on long-term debt (b)	477.2	90.9	169.7	134.0	82.6
Capital lease obligations, including interest	25.9	2.7	5.4	5.4	12.4
Operating leases (c)	270.3	70.1	106.1	47.7	46.4
Capital commitments	112.8	112.8	—	—	—
Purchase commitments:					
Raw materials (d)	335.1	48.6	87.3	85.1	114.1
Energy related (e)	35.7	26.7	4.5	1.1	3.4
Other liabilities reflected on our Consolidated Balance Sheet (f):					

Compensation and benefits (g)	359.9	50.9	111.8	126.9	70.3
Other (h)	71.1	13.2	7.1	2.7	48.1
	$4,188.0	$415.9	$ 991.9	$ 1,502.9	$1,277.3

(a) The table assumes our long-term debt is held to maturity and includes the current portion of long-term debt. See Note 10, Debt, of the Notes to Consolidated Financial Statements in "Part II, Item 8. Financial Statements and Supplementary Data" of this Form 10-K. Amounts reported are gross amounts and do not include unamortized debt discounts of $3.7 million at December 31, 2018.

(b) Amounts represent estimated future interest payments as of December 31, 2018, assuming our long-term debt is held to maturity. All interest rates are fixed.

(c) We enter into operating leases in the normal course of business. We lease some of our operating facilities, as well as other property and equipment, under operating leases. Some lease agreements provide us with the option to renew the lease or purchase the leased property. Our operating lease obligations would change if we exercised these renewal options and/or if we entered into additional operating lease agreements.

(d) Included among our raw materials purchase obligations are contracts to purchase approximately $321.0 million of wood fiber. Purchase prices under most of these agreements are set quarterly, semiannually, or annually based on regional market prices, and the estimate is based on contract terms or first quarter 2019 pricing. Except for deposits required pursuant to wood supply contracts, these obligations are not recorded in our consolidated financial statements until contract payment terms take effect. Our log, fiber, and wood chip obligations are subject to change based on, among other things, the effect of governmental laws and regulations, disruptions to our manufacturing operations, and log and fiber availability.

(e) We enter into utility contracts for the purchase of electricity and natural gas. We also purchase these services under utility tariffs. The contractual and tariff arrangements include multiple-year commitments and minimum annual purchase requirements. Our payment obligations were based upon prices in effect on December 31, 2018, or contract language, if available.

(f) Long-term deferred income taxes of $285.2 million and unrecognized tax benefits of $5.2 million, including interest and penalties, are excluded from this table, because the timing of their future cash outflows are uncertain.

(g) Amounts primarily consist of pension and postretirement obligations. We have minimum qualified pension contributions of approximately $15.8 million in 2019. See Note 11, Employee Benefit Plans and Other Postretirement Benefits, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K, for additional information.

(h) Amounts primarily consist of workers compensation, environmental, and asset retirement obligations.

Off-Balance-Sheet Arrangements

The Company does not have any off-balance sheet arrangements as of December 31, 2018.

Inflation and Other General Cost Increases

We are subject to both contractual, inflation, and other general cost increases. If we are unable to offset these cost increases by price increases, growth, and/or cost reductions in our operations, these inflation and other general cost increases could have a material adverse effect on our operating cash flows, profitability, and liquidity.

In 2018, our total company costs including cost of sales (COS) and selling, general, and administrative expenses (SG&A) was $5.9 billion, and excluding non-cash costs (depreciation, pension and postretirement expense, and share-based compensation expense) was $5.4 billion. A 1% increase in COS and SG&A costs would increase costs by $59 million and cash costs by $54 million.

Certain items of product input costs have historically been subject to more cost volatility including fiber, purchased energy, and chemicals.

Energy

In 2018, our mills, including both packaging and paper mills, consumed about 95 million MMBTU’s of fuel, including internally generated and externally purchased, to produce both steam and electricity. The following table for 2018 provides the total MMBTU's purchased externally by fuel type each quarter and the average cost per MMBTU by fuel type for the year. Our mills represent about 90% of our total purchased fuel costs. The cost per MMBTU includes the cost of the fuel plus our transportation and delivery costs.

	2018 Fuel Purchased (millions of MMBTU's)					2018 Avg.
	First	Second	Third	Fourth	Full	Cost /
Fuel Type	Quarter	Quarter	Quarter	Quarter	Year	MMBTU

Natural gas	6.97	5.83	5.47	6.23	24.50	$ 3.48
Purchased bark	2.53	2.20	2.17	2.37	9.27	2.42
Other purchased fuels	0.31	0.23	0.23	0.33	1.10	4.11
Total mills	9.81	8.26	7.87	8.93	34.87	$ 3.22

In addition, the mills purchased 22.41 million CkWh (hundred kilowatt-hours) of electricity in 2018. The purchases by quarter and the average cost per CkWh were as follows:

	2018 Purchased Electricity (millions of CkWh)					2018 Avg.
	First	Second	Third	Fourth	Full	Cost /
	Quarter	Quarter	Quarter	Quarter	Year	CkWh
Purchased electricity	5.38	5.66	6.04	5.33	22.41	$ 5.57

Environmental Matters

Environmental compliance requirements are a significant factor affecting our business. We employ processes in the manufacture of containerboard, paper, and pulp, which result in various discharges, emissions and waste disposal. These processes are subject to numerous federal, state, local and foreign environmental laws and regulations. We operate and expect to continue to operate, under environmental permits and similar authorizations from various governmental authorities that regulate such discharges, emissions, and waste disposal. The most significant of these laws affecting the Company are:

- Resource Conservation and Recovery Act (RCRA);
- Clean Water Act (CWA);
- Clean Air Act (CAA);
- The Emergency Planning and Community Right-to-Know-Act (EPCRA);
- Toxic Substance Control Act (TSCA); and
- Safe Drinking Water Act (SDWA).

We believe that we are currently in material compliance with these and all applicable environmental rules and regulations. Because environmental regulations are constantly evolving, the Company has incurred, and will continue to incur, costs to maintain compliance with these and other environmental laws. The Company works diligently to anticipate and budget for the impact of applicable environmental regulations, and does not currently expect that future environmental compliance obligations will materially affect its business or financial condition. For the years ended December 31, 2018, 2017, and 2016, we spent $40 million, $39 million, and $44 million, respectively, to comply with the requirements of these and other environmental laws. Additionally, we had $7 million of environmental capital expenditures in 2018, $9 million in 2017, and $8 million in 2016.

In January 2013, the U.S. Environmental Protection Agency (the “EPA”) established a three-year deadline for compliance with the Boiler MACT regulations, establishing air emissions standards and certain other requirements for industrial boilers. PCA's compliance actions involved modifying or replacing certain boilers, and all PCA mills are in full compliance with Boiler MACT requirements. On July 29, 2016, the U.S. Court of Appeals for the District of Columbia Circuit issued a ruling on the consolidated cases challenging Boiler MACT. The court vacated key portions of the rule, including emission limits for certain subcategories of solid fuel boilers, and remanded issues to the EPA for further rulemaking. At this time, we cannot predict with certainty how the recent decision will impact our existing Boiler MACT compliance efforts or whether we will incur additional costs to comply with any revised standards.

As is the case with any industrial operation, PCA has, in the past, incurred costs associated with the remediation of soil or groundwater contamination, as required by the federal Comprehensive Environmental Response, Compensation and Liability Act, commonly known as the federal “Superfund” law, and analogous state laws. Cleanup requirements arise with respect to properties the Company currently owns or operates, former facilities and off-site facilities where the Company has disposed of hazardous substances. As part of the sale to PCA of the containerboard and corrugated products business of Pactiv Corporation in April 1999, Pactiv agreed to retain all liability for all former facilities and all sites associated with pre-closing off-site waste disposal. Pactiv also retained environmentally impaired real property in Filer City, Michigan unrelated to current mill operations. In addition, OfficeMax (now an indirect, wholly owned subsidiary of Office Depot) retains responsibility for certain environmental liabilities related to some of the businesses, facilities, and assets we acquired from Boise. Generally, this responsibility relates to hazardous substance releases and other environmental incidents that arose before 2004. Some of these liabilities could be significant; however, Office Depot may not have sufficient funds to satisfy its indemnification obligations, and in some cases, we may not be entitled to such indemnification.

Because liability for remediation costs under environmental laws is strict, meaning that liability is imposed without fault, joint and several, meaning that liability is imposed on each party without regard to contribution, and retroactive, PCA could receive notifications of cleanup liability in the future and this liability could be material. From 2006 through 2018, there were no significant environmental remediation costs at PCA's mills and corrugated plants. As of December 31, 2018, we maintained an environmental reserve of $27.3 million relating to on-site landfills and surface impoundments as well as ongoing and anticipated remedial projects. The Company believes that it is not reasonably possible that future environmental expenses above the $27.3 million accrued at December 31, 2018, will have a material impact on its financial condition, results of operations, and cash flows.

While legislation regarding the regulation of greenhouse gas emissions has been proposed at the federal level, it is uncertain whether such legislation will be passed and, if so, what the breadth and scope of such legislation will be. The result of the regulation of greenhouse gas emissions could be an increase in our future environmental compliance costs, through caps, taxes or additional capital expenditures to modify facilities, which may be material. However, climate change legislation and the resulting future energy policy could also provide us with opportunities if the use of renewable energy is encouraged. We currently self-generate a significant portion of our power requirements at our mills using bark, black liquor and biomass as fuel, which are derived from renewable resources. While we believe we are well-positioned to take advantage of any renewable energy incentives, it is uncertain what the ultimate costs and opportunities of any climate change legislation will be and how our business and industry will be affected.

Critical Accounting Policies and Estimates

Management’s discussion and analysis of financial condition and results of operations are based upon the Company’s consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States of America. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosures of contingent assets and liabilities. On an ongoing basis, PCA evaluates its estimates, including those related to business combinations, goodwill and intangible assets, pensions and other postretirement benefits, environmental liabilities, income taxes, and long-lived asset impairment, among others. PCA bases its estimates on historical experience and on various other assumptions that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

Critical accounting estimates are those that are most important to the portrayal of our financial condition and results. These estimates require management's most difficult, subjective, or complex judgments. We review the development, selection, and disclosure of our critical accounting estimates with the Audit Committee of our board of directors. The Company believes that of its significant accounting policies, the following involve a higher degree of judgment and/or complexity:

Pensions

The Company accounts for defined benefit pension plans in accordance with Accounting Standards Codification (ASC) 715, Compensation - Retirement Benefits. The calculation of pension expense and pension liabilities requires decisions about a number of key assumptions that can significantly affect expense and liability amounts, including discount rates, expected return on plan assets, expected rate of compensation increases, longevity and service lives of participants, expected contributions, and other factors. The pension assumptions used to measure pension expense and liabilities are discussed in Note 11, Employee Benefit Plans and Other Postretirement Benefits.

We recognize the funded status of our pension plans on our Consolidated Balance Sheet and recognize the actuarial and experience gains and losses and the prior service costs and credits as a component of “Accumulated Other Comprehensive Loss” in our Consolidated Statement of Changes in Stockholders' Equity. Actual results that differ from assumptions are accumulated and amortized over future periods and, therefore, generally affect recognized expense in future periods. At December 31, 2018, we had approximately $127.9 million of actuarial losses and prior service costs, net of tax, recorded in “Accumulated other comprehensive loss” on our Consolidated Balance Sheet. Accumulated losses in excess of 10% of the greater of the projected benefit obligation or the market-related value of assets will be recognized on a straight-line basis over the average remaining service period of active employees in PCA plans (which is between seven and ten years) and over the average remaining lifetime of inactive participants of Boise plans (which is between 24 and 27 years), to the extent that losses are not offset by gains in subsequent years. While we believe that the assumptions used to measure our pension obligations are reasonable, differences in actual experience or changes in assumptions may materially affect our pension obligations and future expense.

We believe that the accounting estimate related to pensions is a critical accounting estimate because it is highly susceptible to change from period to period. As discussed above, the future effects of pension plans on our financial position and results of operations will depend on economic conditions, employee demographics, mortality rates, retirement rates, investment performance, and funding decisions, among other factors. The following table presents selected assumptions used and expected to be used in the measurement of pension expense in the following periods (dollars in millions):

	Year Ending December 31,	Year Ended December 31	
	2019	2018	2017
Pension expense	$ 32.8	$27.1	$24.8
Assumptions			
Discount rate	4.31 %	3.66%	4.24%
Expected rate of return on plan assets	6.06 %	6.06%	6.55%

A change of 0.25% in either direction to the discount rate or the expected rate of return on plan assets would have had the following effect on 2018 and 2019 pension expense (dollars in millions):

		Increase (Decrease) in Pension Expense(a)	
	Base Expense	0.25% Increase	0.25% Decrease
2018			
Discount rate	$ 27.1	$ (2.2)	$ 2.6
Expected rate of return on plan assets	27.1	(2.3)	2.3
2019			
Discount rate	$ 32.8	$ (2.3)	$ 2.5
Expected rate of return on plan assets	32.8	(2.2)	2.2

(a) The sensitivities shown above are specific to 2018 and 2019. The sensitivities may not be additive, so the impact of changing multiple factors simultaneously cannot be calculated by combining the individual sensitivities shown.

For more information related to our pension benefit plans, see Note 11, Employee Benefit Plans and Other Postretirement Benefits, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K.

Goodwill Impairment

Goodwill represents the excess of the cost of an acquired business over the fair value of the identifiable tangible and intangible assets acquired and liabilities assumed in a business combination. At December 31, 2018, we had $917.3 million of goodwill, of which, during 2018, we recorded $28.6 million in connection with the acquisition of Englander. At December 31, 2018, we had $862.1 million and $55.2 million of goodwill recorded in our Packaging and Paper segments, respectively.

We maintain two reporting units for purposes of our goodwill impairment testing, Packaging and Paper, which are the same as our operating segments discussed in Note 18, Segment Information, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K. We test goodwill for impairment annually in the fourth quarter or sooner if events or changes in circumstances indicate that the carrying value of the asset may exceed fair value.

Under ASU 2017-04 (Topic 350), Intangibles - Goodwill and Other – Simplifying the Test for Goodwill Impairment, companies are no longer required to determine the fair value of individual assets and liabilities of a reporting unit to measure goodwill impairment, thus eliminating Step Two of the analysis that was required under the prior guidance. Under ASU 2017-04, goodwill impairment testing is performed by comparing the fair value of the reporting unit with its carrying amount and recognizing an impairment charge for the amount by which the carrying amount exceeds the reporting unit’s fair value. The Company adopted this ASU prospectively beginning with its annual goodwill impairment test in the fourth quarter of 2017.

The update to the standard does not eliminate the optional qualitative assessment of goodwill impairment that is often used to determine if the quantitative assessment is necessary. The qualitative assessment requires the evaluation of certain events and circumstances such as macroeconomic conditions, industry and market considerations, cost factors and overall financial performance, as well as company and reporting unit specific items. If, after assessing these qualitative factors, the Company determines that it is more likely than not that the carrying value of the reporting unit is less than its fair value, then no further testing is required. Otherwise, the Company would perform a quantitative analysis.

The quantitative analysis requires companies to compare the fair value of the reporting units to which goodwill was assigned to their respective carrying values. In calculating fair value, we use the income approach as our primary indicator of fair value. Under the income approach, we calculate the fair value of a reporting unit based on the present value of estimated future cash flows. These estimates are based on a number of factors including industry experience, business expectations and the economic environment. If the fair value exceeds the carrying value, no further work is required and no impairment loss is recognized. If the carrying value exceeds the fair value, the goodwill of the reporting unit is potentially impaired, and the carrying value of goodwill is then reduced to the implied value, or to zero if the fair value of the assets exceeds the fair value of the reporting unit, through an impairment charge.

During the annual goodwill impairment test performed in the fourth quarter of 2018, we assessed qualitative factors to determine whether it was more likely than not that the fair value of each reporting unit was less than its carrying value. Based on the results of the qualitative impairment test, we determined that it was more likely than not that the carrying value was less than the fair value of the Packaging and Paper reporting units.

If management's estimates of future operating results materially change or if there are changes to other assumptions, the estimated fair value of our goodwill could change significantly. Such change could result in impairment charges in future periods, which could have a significant noncash impact on our operating results and financial condition. We cannot predict the occurrence of future events that might adversely affect the reported value of our goodwill. As additional information becomes known, we may change our estimates.

Long-Lived Asset Impairment

An impairment of a long-lived asset exists when the carrying value of an asset is not recoverable through future undiscounted cash flows from operations and when the carrying value of the asset exceeds its fair value. Long-lived asset impairment is a critical accounting estimate, as it is susceptible to change from period to period.

We review the carrying value of long-lived assets, including intangible assets, for impairment when events or changes in circumstances indicate that the carrying amount of assets may not be recoverable. For purposes of testing for impairment, we group our long-lived assets at the lowest level for which identifiable cash flows are largely independent of the cash flows from other assets and liabilities. Our asset groupings vary based on the related business in which the long-lived asset is employed and the interrelationship between those long-lived assets in producing net cash flows. Asset groupings could change in the future if changes in the operations of the business or business environment affect the way particular long-lived assets are employed or the interrelationships between assets. To estimate whether the carrying value of an asset or asset group is impaired, we estimate the undiscounted cash flows that could be generated under a range of possible outcomes. To measure future cash flows, we are required to make assumptions about future production volumes, future product pricing, and future expenses to be incurred. In addition, estimates of future cash flows may change based on the availability of fiber, environmental requirements, capital spending, and other strategic management decisions. We estimate the fair value of an asset or asset group based on quoted market prices for similar assets and liabilities or inputs that are observable either directly (Level 1 measurement) or indirectly (the amount for which the asset(s) could be bought or sold in a current transaction with a third party) when available (Level 2 measurement). When quoted market prices are not available, we use a discounted cash flow model to estimate fair value (Level 3 measurement).

We periodically assess the estimated useful lives of our assets. Changes in circumstances, such as changes to our operational or capital strategy, changes in regulation, or technological advances, may result in the actual useful lives differing from our estimates. Revisions to the estimated useful lives of assets requires judgment and constitutes a change in accounting estimate, which is accounted for prospectively by adjusting or accelerating depreciation and amortization rates. In 2018 and 2017, we recognized incremental depreciation expense of $14.5 million and $10.5 million, respectively, primarily related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine. Additionally, in conjunction with the conversion of the No. 3 paper machine, we recognized an impairment loss of $3.1 million and $13.5 million associated with the fiber farm asset group during 2018 and 2017, respectively.

New and Recently Adopted Accounting Standards

For a listing of our new and recently adopted accounting standards, see Note 2, Summary of Significant Accounting Policies, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K.

Reconciliations of Non-GAAP Financial Measures to Reported Amounts

Net income excluding special items, EBITDA, and EBITDA excluding special items are non-GAAP financial measures. Management excludes special items, as it believes that these items are not necessarily reflective of the ongoing operations of our business. These measures are presented because they provide a means to evaluate the performance of our segments and our Company on an ongoing basis using the same measures that are used by our management, because these measures assist in providing a meaningful comparison between periods and because these measures are frequently used by investors and other interested parties in the evaluation of companies and the performance of their segments. Any analysis of non-GAAP financial measures should be done in conjunction with results presented in accordance with GAAP. The non-GAAP measures are not intended to be substitutes for GAAP financial measures and should not be used as such. Reconciliations of the non-GAAP measures to the most comparable measure reported in accordance with GAAP for the years ended December 31, 2018, 2017, and 2016, follow (dollars in millions):

	Year Ended December 31,					
	2018			2017		
	Income before Taxes	Income Taxes	Net Income	Income before Taxes	Income Taxes	Net Income
As reported in accordance with GAAP	$970.5	$(232.5)	$738.0	$828.6	$(160.0)	$668.6
Special items:						
Wallula mill restructuring (a)	30.0	(7.5)	22.5	33.4	(13.1)	20.3
Facilities closure and other costs (b)	1.8	(0.5)	1.3	(5.8)	2.3	(3.5)
Insurance deductible for property damage (c)	0.5	(0.1)	0.4	—	—	—
Acquisition and integration related costs (d)	0.2	—	0.2	1.7	(0.7)	1.0
Tax reform (e)	—	(2.0)	(2.0)	—	(122.1)	(122.1)
DeRidder mill incident (f)	—	—	—	5.0	(2.0)	3.0
Deferred debt issuance costs (g)	—	—	—	1.8	(0.7)	1.1
Hexacomb working capital adjustment (h)	—	—	—	(2.3)	0.9	(1.4)
Expiration of timberland repurchase option (i)	—	—	—	(2.0)	0.8	(1.2)
Internal legal entity consolidation (j)	—	—	—	—	3.3	3.3
Total special items	32.5	(10.1)	22.4	31.8	(131.3)	(99.5)
Excluding special items	$1,003.0	$(242.6)	$760.4	$860.4	$(291.3)	$569.1

	Year Ended December 31,		
	2016		
	Income before Taxes	Income Taxes	Net Income
As reported in accordance with GAAP	$688.5	$(238.9)	$449.6

Special items:			
Facilities closure and other costs (b)	11.9	(4.2)	7.7
Acquisition and integration related costs (d)	4.5	(1.6)	2.9
Ceased production of market pulp at Wallula (k)	2.7	(0.9)	1.8
Total special items	19.1	(6.7)	12.4
Excluding special items	$707.6	$(245.6)	$462.0

(a) Includes charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine.

(b) For 2018, includes charges consisting of closure costs related to corrugated products facilities and a corporate administration facility. For 2017, includes income primarily related to the sale of land corresponding to the closure of a corrugated products facility, partially offset by closure costs related to corrugated products facilities, a paper administration facility, a corporate administration facility, and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities. For 2016, includes closure costs related to corrugated product facilities and a paper products facility, and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities.

(c) Includes costs for the property damage insurance deductible for a weather-related incident at one of the corrugated products facilities.

(d) Includes charges for acquisition and integration costs related to recent acquisitions.

(e) For 2018 and 2017, includes $2.0 million and $122.1 million, respectively, of income tax benefit for the re-measurement of our net deferred tax liability for the reduction in the U.S. corporate federal statutory income tax rate related to our 2017 measurement period adjustments in accordance with SEC Staff Accounting Bulletin No. 118 (SAB 118), Income Tax Accounting Implications of the Tax Cuts and Jobs Act.

(f) Includes costs for the property damage and business interruption insurance deductible corresponding to the February 2017 explosion at our DeRidder, Louisiana mill.

(g) Includes expense related to the write-off of deferred debt issuance costs in connection with the December 2017 debt refinancing.

(h) Includes income related to a working capital adjustment from the April 2015 sale of our Hexacomb corrugated manufacturing operations in Europe and Mexico.

(i) Includes a gain related to the expiration of a repurchase option corresponding to timberland previously sold.

(j) Includes tax expense for the change in value of deferred taxes as a result of an internal legal entity consolidation that will simplify future operating activities.

(k) Includes costs related to ceased production of softwood market pulp operations at our Wallula, Washington mill and the permanent shutdown of the No. 1 machine.

The following table reconciles net income (loss) to EBITDA and EBITDA excluding special items for the periods indicated (dollars in millions):

	Year Ended December 31,				
	2018	2017		2016	
Net income	$738.0	$668.6		$449.6	
Interest expense, net and other	97.2	103.9	(a)	94.8	(a)
Provision for income taxes (b)	232.5	160.0		238.9	
Depreciation, amortization, and depletion	410.9	391.4		358.0	
EBITDA	$1,478.6	$1,323.9	(a)	$1,141.3	(a)
Special items:					
Acquisition and integration related costs	$0.2	$1.7		$4.5	
Facilities closure and other costs	1.6	(6.0	)	11.1	
Wallula mill restructuring	16.3	23.1		—	
Insurance deductible for property damage	0.5	—		—	
DeRidder mill incident	—	5.0		—	
Hexacomb working capital adjustment	—	(2.3	)	—	
Expiration of timberland repurchase option	—	(2.0	)	—	
Ceased production of market pulp at Wallula	—	—		0.6	
EBITDA excluding special items	$1,497.2	$1,343.4	(a)	$1,157.5	(a)

(a) Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost and applied this standard retrospectively to the prior periods reflected herein. See Note 2, Summary of Significant Accounting Policies and Note 18, Segment

Information, for more information.

(b) The U.S. corporate federal statutory income tax rate in 2018 was 21% and 35% in all prior years presented in the table. Income tax expense for 2018 and 2017 included a tax benefit of $2.0 million and $122.1 million, respectively, related to the enactment in December 2017 of the Tax Cuts and Jobs Act (H.R.1). See Note 7, Income Taxes, for more information.

The following table reconciles segment income (loss) to EBITDA and EBITDA excluding special items (dollars in millions):

	Year Ended December 31,		
	2018	2017 (a)	2016 (a)
Packaging			
Segment income	$1,045.4	$950.3	$718.5
Depreciation, amortization, and depletion	342.0	317.5	293.3
EBITDA	1,387.4	1,267.8	1,011.8
Facilities closure and other costs	1.6	(7.2)	10.2
Acquisition and integration related costs	0.2	1.7	4.2
Wallula mill restructuring	11.3	—	—
Insurance deductible for property damage	0.5	—	—
DeRidder mill incident	—	5.0	—
Expiration of timberland repurchase option	—	(2.0)	—
Hexacomb working capital adjustment	—	(1.6)	—
EBITDA excluding special items	$1,401.0	$1,263.7	$1,026.2
Paper			
Segment income	$97.7	$54.0	$131.7
Depreciation, amortization, and depletion	62.0	67.6	59.6
EBITDA	159.7	121.6	191.3
Wallula mill restructuring	5.0	23.1	—
Facilities closure and other costs	—	0.4	0.9
Ceased production of market pulp at Wallula	—	—	0.6
EBITDA excluding special items	$164.7	$145.1	$192.8
Corporate and Other			
Segment loss	$(75.4)	$(71.8)	$(66.9)
Depreciation, amortization, and depletion	6.9	6.3	5.1
EBITDA	(68.5)	(65.5)	(61.8)
Facilities closure and other costs	—	0.8	—
Hexacomb working capital adjustment	—	(0.7)	—
Acquisition and integration related costs	—	—	0.3
EBITDA excluding special items	$(68.5)	$(65.4)	$(61.5)
EBITDA	$1,478.6	$1,323.9	$1,141.3
EBITDA excluding special items	$1,497.2	$1,343.4	$1,157.5

(a) Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost and applied this standard retrospectively to the prior periods reflected herein. See Note 2, Summary of Significant Accounting Policies and Note 18, Segment Information, for more information.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

PCA is exposed to the impact of interest rate changes and changes in the market value of its financial instruments. PCA periodically enters into derivatives in order to minimize these risks, but not for trading purposes. We were not party to any derivative-based arrangements at December 31, 2018. For a discussion of derivatives and hedging activities, see Note 14, Derivative Instruments and Hedging Activities, of the Notes to Consolidated Financial Statements in “Part II, Item 8. Financial Statements and Supplementary Data” of this Form 10-K.

At December 31, 2018, the interest rates on 100% of PCA’s outstanding debt are fixed.

Item 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and Board of Directors

Packaging Corporation of America:

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

We have audited the accompanying consolidated balance sheets of Packaging Corporation of America and subsidiaries (the Company) as of December 31, 2018 and 2017, the related consolidated statements of income and comprehensive income, changes in stockholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and the related notes (collectively, the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2018, in conformity with U.S. generally accepted accounting principles. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018 based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control Over Financial Reporting

A company’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company’s internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company’s assets that could have a material effect on the financial statements.

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

/s/ KPMG LLP

We have served as the Company's auditor since 2014.

Chicago, Illinois
February 28, 2019

Packaging Corporation of America

Consolidated Statements of Income and Comprehensive Income

(dollars in millions, except per-share data)

	Year Ended December 31,		
	2018	2017	2016
Statements of Income			
Net sales	$7,014.6	$6,444.9	$5,779.0
Cost of sales	(5,369.3)	(4,974.1)	(4,502.9)
Gross profit	1,645.3	1,470.8	1,276.1
Selling and administrative expenses	(536.4)	(519.9)	(468.5)
Other expense, net	(41.2)	(18.4)	(24.3)
Income from operations	1,067.7	932.5	783.3
Interest expense, net and other	(97.2)	(103.9)	(94.8)
Income before taxes	970.5	828.6	688.5
(Provision) benefit for income taxes	(232.5)	(160.0)	(238.9)
Net income	$738.0	$668.6	$449.6
Net income per common share:			
Basic	$7.82	$7.09	$4.76
Diluted	$7.80	$7.07	$4.75
Dividends declared per common share	$3.00	$2.52	$2.36
Statements of Comprehensive Income:			
Net income	$738.0	$668.6	$449.6
Other comprehensive income (loss), net of tax:			
Foreign currency translation adjustment	$(0.1)	$(0.2)	$—
Reclassification adjustments to cash flow hedges included in net income, net of tax of $1.3 million, $2.2 million, and $2.2 million for 2018, 2017, and 2016, respectively	4.0	3.5	3.5
Amortization of pension and postretirement plans actuarial loss and prior service cost, net of tax of $4.0 million, $4.9 million, and $4.2 million for 2018, 2017, and 2016, respectively	11.8	8.2	6.7
Changes in unfunded employee benefit obligations, net of tax of ($0.8) million, $18.0 million, and $15.7 million for 2018, 2017, and 2016, respectively	2.4	(28.8)	(24.9)
Other comprehensive income (loss)	18.1	(17.3)	(14.7)
Comprehensive income	$756.1	$651.3	$434.9

See notes to consolidated financial statements.

Packaging Corporation of America

Consolidated Balance Sheets

(dollars and shares in millions, except per-share data)

	December 31,	
	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	$361.5	$216.9
Accounts receivable, net of allowance for doubtful accounts and customer deductions of $13.6 million and $12.6 million as of December 31, 2018 and 2017, respectively	901.9	830.7
Inventories	795.6	762.5
Prepaid expenses and other current assets	39.4	35.5
Federal and state income taxes receivable	16.7	69.5
Total current assets	2,115.1	1,915.1
Property, plant and equipment, net	3,108.6	2,924.9
Goodwill	917.3	883.2
Other intangible assets, net	378.2	410.0
Other long-term assets	50.5	64.3
Total assets	$6,569.7	$6,197.5
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Current maturities of long-term debt	$—	$150.0
Capital lease obligations	1.4	1.3
Accounts payable	382.2	402.9
Dividends payable	76.1	60.5
Accrued liabilities	222.4	203.2
Accrued interest	11.5	14.8
Total current liabilities	693.6	832.7
Long-term liabilities:		
Long-term debt	2,483.7	2,480.4
Capital lease obligations	17.6	19.0
Deferred income taxes	285.2	239.5
Compensation and benefits	357.5	372.5
Other long-term liabilities	59.7	70.8
Total long-term liabilities	3,203.7	3,182.2
Commitments and contingent liabilities		
Stockholders' equity:		
Common stock, par value $0.01 per share, 300.0 million shares authorized, 94.5 million and 94.3 million shares issued as of December 31, 2018 and 2017,	0.9	0.9

respectively		
Additional paid in capital	494.5	471.2
Retained earnings	2,315.8	1,867.4
Accumulated other comprehensive loss	(138.8)	(156.9)
Total stockholders' equity	2,672.4	2,182.6
Total liabilities and stockholders' equity	$6,569.7	$6,197.5

See notes to consolidated financial statements.

Packaging Corporation of America

Consolidated Statements of Cash Flows

(dollars in millions)

	Year Ended December 31,		
	2018	2017	2016
Cash Flows from Operating Activities:			
Net income	$738.0	$668.6	$449.6
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation, depletion, and amortization of intangibles	410.9	391.4	358.0
Amortization of deferred financing costs	8.6	10.0	7.8
Share-based compensation expense	23.5	20.6	19.7
Deferred income tax (benefit) provision	38.7	(84.5)	(4.0)
Net loss on impairment of assets	3.1	13.5	—
Pension and post-retirement benefits expense, net of contributions	3.1	(20.4)	(30.5)
Other, net	7.1	3.0	1.4
Changes in operating assets and liabilities, net of acquisitions:			
Increase in assets —			
Accounts receivable	(56.1)	(115.1)	(3.6)
Inventories	(35.6)	(21.0)	(25.7)
Prepaid expenses and other current assets	(2.1)	(5.2)	—
(Decrease) increase in liabilities —			
Accounts payable	(17.6)	41.0	16.6
Accrued liabilities	5.5	8.4	(3.2)
Federal and state income tax payable / receivable	53.0	(54.2)	20.8
Net cash provided by operating activities	1,180.1	856.1	806.9
Cash Flows from Investing Activities:			
Additions to property, plant, and equipment	(551.4)	(343.0)	(274.3)
Acquisitions of businesses, net of cash acquired	(56.3)	(273.8)	(485.4)
Additions to other long term assets	(4.5)	(7.8)	(10.4)
Proceeds from asset disposals	1.5	16.6	0.5
Other, net	2.5	(1.1)	—
Net cash used for investing activities	(608.2)	(609.1)	(769.6)
Cash Flows from Financing Activities:			
Proceeds from issuance of debt	—	997.8	385.0
Repayments of debt and capital lease obligations	(151.3)	(1,011.9)	(37.5)
Financing costs paid	—	(6.8)	(2.0)
Common stock dividends paid	(268.1)	(237.6)	(216.1)
Repurchases of common stock	—	—	(100.3)
Shares withheld to cover employee restricted stock taxes	(7.9)	(10.8)	(11.2)
Other, net	—	(0.1)	(0.1)
Net cash (used for) provided by financing activities	(427.3)	(269.4)	17.8
Net increase (decrease) in cash and cash equivalents	144.6	(22.4)	55.1

Cash and cash equivalents, beginning of year	216.9	239.3	184.2
Cash and cash equivalents, end of year	$361.5	$216.9	$239.3

See notes to consolidated financial statements.

Packaging Corporation of America

Consolidated Statements of Changes in Stockholders' Equity

(dollars in millions and shares in thousands)

					Accumulated	
			Additional		Other	Total
	Common Stock		Paid in	Retained	Comprehensive	Stockholders'
	Shares	Amount	Capital	Earnings	Loss	Equity
Balance at January 1, 2016	96,129	$ 1.0	$ 439.9	$1,317.3	$ (124.9)	$ 1,633.3
Common stock repurchases and retirements	(1,987)	(0.1)	(13.1)	(87.1)	—	(100.3)
Common stock withheld and retired to cover taxes on vested stock awards	(172)	—	(1.1)	(10.1)	—	(11.2)
Common stock dividends declared	—	—	—	(222.6)	—	(222.6)
Restricted stock/performance unit grants and cancellations	243	—	5.7	—	—	5.7
Share-based compensation expense	—	—	19.7	—	—	19.7
Other	—	—	0.3	—	—	0.3
Comprehensive income	—	—	—	449.6	(14.7)	434.9
Balance at December 31, 2016	94,213	$ 0.9	$ 451.4	$1,447.1	$ (139.6)	$ 1,759.8
Common stock withheld and retired to cover taxes on vested stock awards	(98)	—	(0.7)	(10.1)	—	(10.8)
Common stock dividends declared	—	—	—	(238.2)	—	(238.2)
Share-based compensation expense	235	—	20.6	—	—	20.6
Other	—	—	(0.1)	—	—	(0.1)
Comprehensive income	—	—	—	668.6	(17.3)	651.3
Balance at December 31, 2017	94,350	$ 0.9	$ 471.2	$1,867.4	$ (156.9)	$ 2,182.6
Common stock withheld and retired to cover taxes on vested stock awards	(69)	—	(0.5)	(7.4)	—	(7.9)
Common stock dividends declared		—	—	(284.0)	—	(284.0)
Share-based compensation expense	216	—	23.5	—	—	23.5
Adoption of ASC 606	—	—	—	1.6	—	1.6
Other	—	—	0.3	0.2	—	0.5
Comprehensive income	—	—	—	738.0	18.1	756.1
Balance at December 31, 2018	94,497	$ 0.9	$ 494.5	$2,315.8	$ (138.8)	$ 2,672.4

See notes to consolidated financial statements.

Notes to Consolidated Financial Statements

1. Nature of Operations and Basis of Presentation

Packaging Corporation of America ("we," "us," "our," "PCA," or the "Company") was incorporated on January 25, 1999. In April 1999, PCA acquired the containerboard and corrugated packaging products business of Pactiv Corporation (Pactiv), formerly known as Tenneco Packaging, Inc., a wholly owned subsidiary of Tenneco Inc. We are a large, diverse manufacturer of both packaging and paper products. We are headquartered in Lake Forest, Illinois and we operate primarily in the United States. We have approximately 15,000 employees.

We report our business in three reportable segments: Packaging, Paper, and Corporate and Other. Our Packaging segment produces a wide variety of containerboard and corrugated packaging products. The Paper segment primarily manufactures and sells a range of communication-based papers. During the second quarter of 2018, the Company discontinued the production of uncoated free sheet and coated one-side grades at the Wallula, Washington mill and converted the No. 3 machine to a virgin kraft linerboard machine. Subsequent to the date of the conversion in May 2018, operating results for the Wallula mill are primarily included in the Packaging segment. Corporate and other includes support staff services and related assets and liabilities, transportation assets, and activity related to other ancillary support operations. For more information about our segments, see Note 18, Segment Information.

In these consolidated financial statements, certain amounts in prior periods' consolidated financial statements have been reclassified to conform with the current period presentation.

The consolidated financial statements include the accounts of PCA and its majority-owned subsidiaries after elimination of intercompany balances and transactions.

2. Summary of Significant Accounting Policies

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions about future events. These estimates and the underlying assumptions affect the amounts of assets and liabilities reported, disclosures about contingent assets and liabilities, and reported amounts of revenues and expenses. These estimates and assumptions are based on management's best estimates and judgment. Management evaluates its estimates and assumptions on an ongoing basis using historical experience and other factors, including the current economic environment. We adjust such estimates and assumptions when facts and circumstances dictate. As future events and their effects cannot be determined with precision, actual results could differ significantly from these estimates. Changes in these estimates will be reflected in the consolidated financial statements in future periods.

Revenue Recognition

We recognize revenue when control of the promised goods or services is transferred to customers in an amount that reflects the consideration expected to be received in exchange for those goods or services. The timing of revenue recognition for most goods and services occurs when performance obligations under the terms of a contract with the customer are satisfied. This occurs with the transfer of control of our products at a specific point in time. For most packaging and paper products, revenue is recognized when the product is shipped from the mill or from our manufacturing facility to our customer. Shipping and handling fees billed to a customer are recorded on a gross basis in "Net sales", with the corresponding shipping and handling costs included in "Cost of sales" in the concurrent period as the revenue is recorded. We present taxes collected from customers and remitted to governmental authorities on a net basis in our Consolidated Statements of Income. In January 2018, the Company adopted ASU 2014-09 (Topic 606): Revenue from Contracts with Customers. See Note 3, Revenue, for more information.

Planned Major Maintenance Costs

The Company accounts for its planned major maintenance activities in accordance with ASC 360, Property, Plant, and Equipment, using the deferral method. All maintenance costs incurred during the year are expensed in the year in which the maintenance activity occurs.

Share-Based Compensation

We recognize compensation expense for awards granted under the PCA long-term equity incentive plans based on the fair value on the grant date. We recognize the cost of the equity awards expected to vest over the period the awards vest. See Note 13, Share-Based Compensation, for more information.

Research and Development

Research and development costs are expensed as incurred. The amount charged to expense was $14.4 million, $12.8 million, and $13.3 million for the years ended December 31, 2018, 2017, and 2016, respectively.

Cash and Cash Equivalents

Cash and cash equivalents include all cash balances and highly liquid investments with a stated maturity of three months or less. Cash equivalents are stated at cost, which approximates market. Cash and cash equivalents totaled $361.5 million and $216.9 million at December 31, 2018 and 2017, respectively, which included cash equivalents of $311.1 million and $160.2 million, respectively. At December 31, 2018 and 2017, we had $2.3 million and $1.8 million, respectively, of cash at our operations outside the United States.

Trade Accounts Receivable, Allowance for Doubtful Accounts, and Customer Deductions

Trade accounts receivable are stated at the amount we expect to collect. The collectability of our accounts receivable is based upon a combination of factors. In circumstances where a specific customer is unable to meet its financial obligations to PCA (e.g., bankruptcy filings, substantial downgrading of credit sources), a specific reserve for bad debts is recorded against amounts due to the Company to reduce the net recorded receivable to the amount the Company reasonably believes will be collected. For all other customers, reserves for bad debts are recognized based on historical collection experience. If collection experience deteriorates (i.e., higher than expected defaults or an unexpected material adverse change in a major customer's ability to meet its financial obligations to the Company), the estimate of the recoverability of amounts due could be reduced by a material amount. We periodically review our allowance for doubtful accounts and adjustments to the valuation allowance are recorded as income or expense. Trade accounts receivable balances that remain outstanding after we have used reasonable collection efforts are written off through a charge to the valuation allowance and a credit to accounts receivable. At December 31, 2018 and 2017, the allowance for doubtful accounts was $4.6 million and $4.2 million, respectively.

The customer deductions reserve represents the estimated amount required for customer returns, allowances, and earned discounts. Based on the Company's experience, customer returns, allowances, and earned discounts have averaged approximately 1% of gross selling price. Accordingly, PCA reserves 1% of its open customer accounts receivable balance for these items. The reserves for customer deductions of $9.0 million and $8.4 million at December 31, 2018 and 2017, respectively, are also included as a reduction of the accounts receivable balance.

Derivative Instruments and Hedging Activities

The Company records its derivatives, if any, in accordance with ASC 815, Derivatives and Hedging. The guidance requires the Company to recognize derivative instruments as either assets or liabilities on the balance sheet at fair value. The accounting for changes in the fair value of a derivative depends on the intended use and designation of the derivative instrument. For a derivative designated as a fair value hedge, the gain or loss on the derivative is recognized in earnings in the period of change at fair value together with the offsetting gain or loss on the hedged item. For a derivative instrument designated as a cash flow hedge, the effective portion of the derivative's gain or loss is initially reported as a component of accumulated other comprehensive income (loss) (AOCI) and is subsequently recognized in earnings when the hedged exposure affects earnings. The ineffective portion of the gain or loss is recognized in earnings. We were not party to any derivative-based arrangements at December 31, 2018 and 2017.

Fair Value Measurements

PCA measures the fair value of its financial instruments in accordance with ASC 820, Fair Value Measurements and Disclosures. The guidance defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. It is determined based on assumptions that market participants would use in pricing an asset or liability. As a basis for considering such assumptions, ASC 820 establishes the following hierarchy that prioritizes the inputs to valuation methodologies used to measure fair value:

Level 1 — Valuations based on quoted prices for identical assets and liabilities in active markets.

Level 2 — Valuations based on observable inputs other than quoted prices included in Level 1, such as quoted prices for similar assets and liabilities in active markets, quoted prices for identical or similar assets and liabilities in markets that are not active, or other inputs that are observable or can be corroborated by observable market data.

Level 3 — Valuations based on unobservable inputs in which there is little or no market data, which require the reporting entity to develop its own assumptions.

Assets that are measured at fair value using the net asset value (NAV) per share as a practical expedient are not categorized within the fair value hierarchy.

Financial instruments measured at fair value on a recurring basis include the fair value of our pension and postretirement benefit assets and liabilities. See Note 11, Employee Benefit Plans and Other Postretirement Benefits, for more information. Other assets and liabilities measured and recognized at fair value on a nonrecurring basis include assets acquired and liabilities assumed in acquisitions and our asset retirement obligations. Given the nature of these assets and liabilities, evaluating their fair value from the perspective of a market participant is inherently complex. Assumptions and estimates about future values can be affected by a variety of internal and external factors. Changes in these factors may require us to revise our estimates and could require us to retroactively adjust provisional amounts that we recorded for the fair values of assets acquired and liabilities assumed in connection with business combinations. These adjustments could have a material effect on our financial condition and results of operations. See Note 4, Acquisitions, and Note 12, Asset Retirement Obligations, for more information.

Inventory Valuation

We value our raw materials, work in process, and finished goods inventories using lower of cost, as determined by the average cost method, or market. Supplies and materials are valued at the first-in, first-out (FIFO) or average cost methods.

The components of inventories were as follows (dollars in millions):

	December 31,	
	2018	2017
Raw materials	$307.8	$279.8
Work in process	13.9	12.6
Finished goods	199.0	217.0
Supplies and materials	274.9	253.1
Inventories	$795.6	$762.5

Property, Plant, and Equipment

Property, plant, and equipment are recorded at cost. Cost includes expenditures for major improvements and replacements and the amount of interest cost associated with significant capital additions. Repairs and maintenance costs are expensed as incurred. When property and equipment are retired, sold, or otherwise disposed of, the asset's carrying amount and related accumulated depreciation are removed from the accounts and any gain or loss is included in “Net income” in our Consolidated Statements of Income.

Property, plant, and equipment consisted of the following (dollars in millions):

	December 31,	
	2018	2017
Land and land improvements	$161.9	$156.0
Buildings	795.5	729.8
Machinery and equipment	5,481.6	5,162.5
Construction in progress	176.7	194.5
Other	75.4	68.4
Property, plant and equipment, at cost	6,691.1	6,311.2
Less accumulated depreciation	(3,582.5)	(3,386.3)
Property, plant and equipment, net	$3,108.6	$2,924.9

The amount of interest capitalized from construction in progress was $4.5 million, $2.5 million, and $2.5 million for the years ended December 31, 2018, 2017, and 2016, respectively.

Depreciation is computed on the straight-line basis over the estimated useful lives of the related assets. Assets under capital leases are depreciated on the straight-line method over the term of the lease or the useful life, if shorter. The following lives are used for the various categories of assets:

Buildings and land improvements	5 to 40 years
Machinery and equipment	3 to 25 years
Trucks and automobiles	3 to 10 years
Furniture and fixtures	3 to 20 years
Computers and hardware	3 to 10 years
Leasehold improvements	Period of the lease or useful life, if shorter

The amount of depreciation expense was $361.7 million, $347.8 million, and $324.1 million for the years ended December 31, 2018, 2017, and 2016, respectively. In 2018 and 2017, we recognized incremental depreciation expense of $14.5 million and $10.5 million, respectively, primarily related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine. During the year ended December 31, 2016, we recognized $2.9 million of incremental depreciation expense primarily related to facilities closure costs and the Wallula, Washington mill restructuring due to the discontinuation of market pulp production.

Pursuant to the terms of an industrial revenue bond, title to certain property, plant, and equipment was transferred to a municipal development authority in 2009 in order to receive a property tax abatement. The title of these assets will revert back to PCA upon retirement or cancellation of the bond. The assets are included in the consolidated balance sheets under the caption “Property, plant, and equipment, net” as all risks and rewards remain with the Company.

Leases

We assess lease classification as either capital or operating at lease inception or upon modification. We lease some of our locations, as well as other property and equipment, under operating leases. For purposes of determining straight-line rent expense, the lease term is calculated from the date of possession of the facility, including any periods of free rent and any renewal option periods that are reasonably assured of being exercised. In February 2016, the FASB issued ASU 2016-02 (Topic 842): Leases, which amends a number of aspects of lease accounting. The guidance of ASU 2016-02 is effective for the Company beginning in January 2019.

Long-Lived Asset Impairment

Long-lived assets other than goodwill and other intangibles are reviewed for impairment in accordance with provisions of ASC 360, Property, Plant and Equipment. In the event that facts and circumstances indicate that the carrying amount of any long-lived assets may be impaired, an evaluation of recoverability is performed. If an evaluation is required, the estimated future undiscounted cash flows associated with the asset (or group of assets) is compared to the assets (or group of assets) carrying amount to determine if a write-down to fair value is required.

Goodwill and Intangible Assets

The Company has capitalized certain intangible assets, primarily goodwill, customer relationships, and trademarks and trade names, based on their estimated fair value at the date of acquisition. Amortization is provided for customer relationships on a straight-line basis over periods ranging from ten to 40 years, and trademarks and trade names over periods ranging from five to 20 years.

Goodwill, which amounted to $917.3 million and $883.2 million for the years ended December 31, 2018 and 2017, respectively, is not amortized but is subject to an annual impairment test in accordance with ASC 350, Intangibles – Goodwill and Other. We test goodwill for impairment annually in the fourth quarter or sooner if events or changes in circumstances indicate that the carrying value of the asset may exceed fair value. Additionally, we evaluate the remaining useful lives of our finite-lived purchased intangible assets to determine whether any adjustments to the useful lives are necessary. The Company concluded that none of the goodwill or intangible assets were impaired in the 2018, 2017, and 2016 annual impairment tests. See Note 8, Goodwill and Intangible Assets, for additional information.

Pension and Postretirement Benefits

Several estimates and assumptions are required to record pension costs and liabilities, including discount rate, return on assets, and longevity and service lives of employees. We review and update these assumptions annually unless a plan curtailment or other event occurs, requiring that we update the estimates on an interim basis. While we believe the assumptions used to measure our pension and postretirement benefit obligations are reasonable, differences in actual experience or changes in assumptions may materially affect our pension and postretirement benefit obligations and future expense. See Note 11, Employee Benefit Plans and Other Postretirement Benefits, for additional information.

For postretirement health care plan accounting, the Company reviews external data and its own historical trends for health care costs to determine the health care cost trend rate assumption.

In January 2018, the Company adopted ASU 2017-07, Compensation – Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost, which requires the presentation of non-service cost components of net periodic benefits expense to be shown separately outside the subtotal of operating income in the Consolidated Statements of Income and Comprehensive Income.

Environmental Matters

Environmental expenditures that extend the life of the related property or mitigate or prevent future environmental contamination are capitalized. Liabilities are recorded for environmental contingencies when such costs are probable and reasonably estimable. These liabilities are adjusted as further information develops or circumstances change. Environmental expenditures related to existing conditions resulting from past or current operations from which no current or future benefit is discernible are expensed as incurred.

Asset Retirement Obligations

The Company accounts for its retirement obligations related predominantly to landfill closure, wastewater treatment pond dredging, closed-site monitoring costs, and certain leasehold improvements under ASC 410, Asset Retirement and Environmental Obligations, which requires recognition of legal obligations associated with the retirement of long-lived assets whether these assets are owned or leased. These legal obligations are recognized at fair value at the time that the obligations are incurred. When we record the liability, we capitalize the cost by increasing the carrying amount of the related long-lived asset, which is amortized to expense over the useful life of the asset. See Note 12, Asset Retirement Obligations, for additional information.

Deferred Debt Issuance Costs

PCA has capitalized certain costs related to obtaining its financing. These costs are amortized to interest expense using the effective interest rate method over the terms of the related financing, which range from three to ten years. At December 31, 2018 and 2017 deferred debt issuance costs were $12.6 million and $15.3 million, respectively, and were recorded in “Long-Term Debt” on our Consolidated Balance Sheets.

Cutting Rights and Fiber Farms

We lease the cutting rights to approximately 75,000 acres of timberland, and we lease 3,000 acres of land where we operate fiber farms as a source of future fiber supply. For our cutting rights and fiber farms, we capitalize the annual lease payments and reforestation costs associated with these leases. Costs are recorded as depletion when the timber or fiber is harvested and used in operations or sold to customers. Capitalized long-term lease costs for our cutting rights and fiber farms, primarily recorded in “Other long-term assets” on our Consolidated Balance Sheets, were $22.4 million and $31.5 million as of December 31, 2018 and 2017, respectively. The amount of depletion expense was $7.6 million, $5.2 million, and $4.7 million for the years ended December 31, 2018, 2017, and 2016, respectively. Additionally, in conjunction with the conversion of the No. 3 machine at the Wallula mill to kraft linerboard, management performed a recoverability test on associated fiber farms in 2018 and 2017 and deemed the asset group to not be fully recoverable. As a result of the recoverability calculation on the fiber farm asset group, the Company recorded an impairment loss of $3.1 million and $13.5 million during 2018 and 2017, respectively.

Deferred Software Costs

PCA capitalizes costs related to the purchase and development of software, which is used in its business operations. The costs attributable to these software systems are amortized over their estimated useful lives based on various factors such as the effects of obsolescence, technology, and other economic factors. Net capitalized software costs recorded in “Other long-term assets” on our Consolidated Balance Sheets were $1.6 million and $3.3 million for the years ended December 31, 2018 and 2017, respectively. Software amortization expense was $2.1 million, $2.3 million, and $2.5 million for the years ended December 31, 2018, 2017, and 2016, respectively.

Income Taxes

PCA utilizes the liability method of accounting for income taxes whereby it recognizes deferred tax assets and liabilities for the future tax consequences of temporary differences between the tax basis of assets and liabilities and their reported amounts in the financial statements. Deferred tax assets will be reduced by a valuation allowance if, based upon management’s estimates, it is more likely than not that a portion of the deferred tax assets will not be realized in a future period. The estimates utilized in the recognition of deferred tax assets are subject to revision in future periods based on new facts or circumstances. PCA’s practice is to recognize interest and penalties related to unrecognized tax benefits in income tax expense.

Trade Agreements

PCA regularly trades containerboard with other manufacturers primarily to reduce shipping costs. These agreements are entered into with other producers on an annual basis, pursuant to which both parties agree to ship an identical number of tons of containerboard to each other within the agreement period. These agreements lower transportation costs by allowing each party’s containerboard mills to ship containerboard to the other party’s closer corrugated products plant. PCA tracks each shipment to ensure that the other party’s shipments to PCA match PCA’s shipments to the other party during the agreement period. Such transfers are possible because containerboard is a commodity product with no distinguishing product characteristics. These transactions are accounted for at carrying value, and revenue is not recorded as the transactions do not represent the culmination of an earnings process. The transactions are recorded into inventory accounts, and no sale or income is recorded until such inventory is converted to a finished product and sold to an end-use customer.

Business Combinations

The Company accounts for acquisitions under ASC 805, Business Combinations, which requires separate recognition of assets acquired and liabilities assumed from goodwill, at the acquisition date fair values. Goodwill as of the acquisition date is measured as the excess of consideration transferred over the net of the acquisition date fair values of the assets acquired and liabilities assumed. During the measurement period, which may be up to one year from the acquisition date, the Company records adjustments to the assets acquired and liabilities assumed with the corresponding offset to goodwill. Upon the conclusion of the measurement period or final determination of the values of assets acquired or liabilities assumed, whichever comes first, any subsequent adjustments are recorded to the consolidated financial statements. In January 2018, the Company adopted ASU 2017-01, Clarifying the Definition of a Business, which adds guidance to assist entities with evaluating whether transfers of assets and activities should be accounted for as acquisitions of assets or businesses.

Recently Adopted Accounting Standards

Effective January 1, 2018, the Company adopted Accounting Standards Update (“ASU”) 2014-09 (Topic 606): Revenue from Contracts with Customers. This ASU supersedes the revenue recognition requirements in Topic 605 Revenue

Recognition (Topic 605) and requires entities to recognize revenue when control of the promised goods or services is transferred to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. The ASU requires additional disclosure about the nature, amount, timing, and uncertainty of revenue and cash flows arising from customer contracts, including significant judgments and estimates, and changes in those estimates. The Company adopted the standard utilizing the modified retrospective method, in which case the cumulative effect was recognized at the date of initial application on January 1, 2018. The adoption of the standard did not have a material effect on the Company's financial position or results of operations; however, the following adjustment and reclassification of certain costs were made in 2018:

a. The Company ships a portion of its products to customers under consignment agreements. These products do not have an alternative use, and, under the new standard, revenue associated with these products is required to be recognized earlier than under prior revenue recognition standards. Utilizing the modified retrospective method, the cumulative impact of adopting the new standard resulted in an increase of approximately $1.6 million, net of tax, to opening retained earnings as of January 1, 2018.

b. The new revenue standard also provides additional clarity concerning contract fulfillment costs, which resulted in certain costs being classified as cost of sales rather than selling, general and administrative expenses beginning January 1, 2018. For the year ended December 31, 2018, this amount totaled $28.2 million.

See Note 3, Revenue, for more information.

Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost. The guidance in this update requires that an employer disaggregate the service cost component from the other components of net benefit cost. Non-service cost components of net periodic benefit cost are required to be presented in the income statement separately from the service cost component and outside the subtotal of operating income. The update also allows only the service cost component to be eligible for capitalization for internally developed capital projects. The amendments in this update are applied retrospectively for the income statement presentations and prospectively for the capitalization of service costs.

The adoption of this ASU retrospectively resulted in a $1.3 million and $3.0 million reclassification between cost of sales and selling, general and administrative expenses (both components of income from operations) and interest expense, net and other (a component outside of income from operations) for the years ended December 31, 2017 and 2016, respectively.

Effective January 1, 2018, the Company adopted ASU 2017-09, Compensation - Stock Compensation (Topic 718): Scope of Modification Accounting, which clarifies what changes to the terms or conditions of a share-based payment award require an entity to apply modification accounting in Topic 718. This ASU will be applied prospectively when changes to the terms or conditions of a share-based payment award occur.

Effective January 1, 2018, the Company adopted ASU 2017-01 (Topic 805): Clarifying the Definition of a Business, which amends the guidance in ASC 805, Business Combinations. The ASU changes the definition of a business to assist entities with evaluating when a set of transferred assets and activities is a business. Under the new guidance, an entity first determines whether substantially all of the fair value of the gross assets acquired is concentrated in a single identifiable asset or a group of similar identifiable assets. If this threshold is met, the set is not a business. If it is not met, the entity then evaluates whether the set meets the requirements that a business include, at a minimum, an input and a substantive process that together significantly contribute to the ability to create outputs. The ASU defines an output as “the result of inputs and processes applied to those inputs that provide goods or services to customers, investment income (such as dividends or interest), or other revenues.” The ASU will be applied prospectively to any transactions subsequent to adoption.

Effective January 1, 2018, the Company adopted ASU 2016-15 (Topic 230), Statement of Cash Flows: Classification of Certain Cash Receipts and Cash Payments. This ASU adds or clarifies guidance on the classification of certain cash receipts and payments in the statement of cash flows. The adoption of this guidance did not have a material impact on the Company's financial condition, results of operations, or cash flows.

New Accounting Standards Not Yet Adopted

In February 2016, the Financial Accounting Standards Board (“FASB”) issued ASU 2016-02 (Topic 842): Leases, which requires lessees to recognize a right-of-use (“ROU”) asset and a lease liability on the balance sheet for all leases, with the exception of short-term leases, and expands disclosures about leasing arrangements for both lessees and lessors, among other items. The new standard is effective for the Company beginning January 1, 2019. In July 2018, the FASB issued ASU No. 2018-11, which provides a modified retrospective transition method where an entity can elect to apply the transition provisions at the adoption date and recognize a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption. Under this method, comparative prior period financial information is not restated.

Effective January 1, 2019, the Company will adopt the new lease accounting standard using the modified retrospective transition method at the adoption date with prior periods not restated. In addition, we will elect the package of practical expedients permitted under the transition guidance within the new standard, which permits us to not reassess our prior conclusions about lease identification, lease classification and initial direct costs. We will also elect the practical expedient related to land easements, allowing us to carry forward our current accounting treatment for existing agreements on land easements, which are not accounted for as leases. We will elect the short-term lease recognition exemption, which permits us to exclude short-term leases (i.e. leases with terms of 12 months or less) from the recognition requirements of this standard.

In preparing for the transition of the new standard, we identified and assessed appropriate changes to our business processes, systems and controls to support the new leasing accounting requirements and disclosures under the new standard. We expect that adoption of this standard will result in recognition of lease liabilities of approximately $220 million to $240 million as of January

1, 2019, with corresponding ROU assets of the same amount based on the present value of the remaining minimum rental payments for existing operating leases. We do not expect to make any cumulative-effect adjustment to retained earnings as a result of the adoption of this standard. We do not believe that adoption of this ASU will have a material impact on our consolidated net earnings, liquidity, or debt covenants under our current debt agreements.

In February 2018, the FASB issued ASU 2018-02 (Topic 220): Income Statement – Reporting Comprehensive Income – Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income, which allows for optional reclassification from accumulated other comprehensive income to retained earnings for the stranded tax effects resulting from the enactment of H.R.1 (P.L. 115-97), originally known as the "Tax Cuts and Jobs Act," in December 2017. An entity that elects to reclassify these amounts must reclassify stranded tax effects related to the change in federal tax rate for all items accounted for in other comprehensive income (e.g., pension and postretirement benefits and cash flow hedges). Entities may also elect to reclassify other stranded tax effects that relate to the Act but do not directly relate to the change in the federal tax rate (e.g., state taxes). Upon adoption of ASU 2018-02, entities are required to disclose their policy for releasing the income tax effects from accumulated other comprehensive income. ASU 2018-02 is effective for annual periods beginning after December 15, 2018, and interim periods within those fiscal years. Early adoption is permitted. The Company is currently finalizing its evaluation of this guidance but does not expect this ASU to have a material impact on the Company's financial position, results of operations, or cash flow.

In August 2018, the FASB issued ASU 2018-14, Compensation – Retirement Benefits – Defined Benefit Plans – General (Subtopic 715-20): Disclosure Framework – Changes to the Disclosure Requirements for Defined Benefit Plans. ASU 2018-14 removes certain disclosures that are not considered cost beneficial, clarifies certain required disclosures and adds additional disclosures. The ASU is effective for annual periods beginning after December 31, 2020, with early adoption permitted. The amendments in ASU 2018-14 would need to be applied on a retrospective basis. The Company is currently evaluating the impact this guidance will have on its related disclosures.

In August 2018, the FASB issued ASU 2018-13, Fair Value Measurement (Topic 820): Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement. ASU 2018-13 removes or modifies certain disclosure requirements and adds additional requirements to improve the usefulness of the fair value measurement disclosure for financial statement users. The ASU is effective for annual and interim periods beginning after December 15, 2019, with early adoption permitted. Certain amendments of ASU 2018-13 are required to be applied prospectively for the first interim period of the initial year of adoption. All other amendments need to be applied retrospectively. The Company is currently evaluating the impact of the new guidance.

There were no other accounting standards recently issued that had or are expected to have a material impact on our financial position or results of operations.

3. Revenue

Revenue Recognition

Revenue is recognized when control of the promised goods or services is transferred to customers in an amount that reflects the consideration expected to be received in exchange for those goods or services. Sales, value added, and other taxes collected concurrently with revenue-producing activities are excluded from revenue.

The following table presents our revenues disaggregated by product line (dollars in millions):

	Year Ended December 31,		
	2018	2017 (a)	2016 (a)
Packaging	$5,938.5	$5,312.3	$4,584.8
Paper	1,002.0	1,051.8	1,093.9
Corporate and Other	74.1	80.8	100.3
Total revenue	$7,014.6	$6,444.9	$5,779.0

(a) Prior periods have not been adjusted under the modified retrospective method for Topic 606.

Packaging Revenue

Our containerboard mills produce linerboard and semi-chemical corrugating medium which are papers primarily used in the production of corrugated products. The majority of our containerboard production is used internally by our corrugated products manufacturing facilities. The remaining containerboard is sold to outside domestic and export customers. Our corrugated products manufacturing plants produce a wide variety of corrugated packaging products and retail merchandise displays. We sell corrugated products to national, regional and local accounts, which are broadly diversified across industries and geographic locations.

The Company recognizes revenue for its packaging products when performance obligations under the terms of a contract with a customer are satisfied. This occurs with the transfer of control of our products at a specific point in time. Based on our express terms and conditions of the sale of products to our customers, as well as terms included in contractual arrangements with our customers, we do not have an enforceable right of payment that includes a reasonable profit throughout the duration of the contract for products that do not have an alternative use. Revenue is recognized when the product is shipped from the mill or from our manufacturing facility to our customer. Certain customers may receive volume-based incentives, which are accounted for as variable consideration. We estimate these amounts based on the expected amount to be provided to customers and reduce revenue recognized.

Certain customers receive a portion of their packaging products as consigned inventory with billing triggered once the customer uses or consumes the designated product. Prior to invoicing, these amounts are handled as unbilled receivables. Total unbilled receivables, which are immaterial in amount, are included in the accounts receivable financial statement caption.

Paper Revenue

We manufacture and sell a range of communication-based papers. Communication papers consist of cut-size office papers, and printing and converting papers. Pressure sensitive papers, including release liners, are used for specialty applications such as consumer and commercial product labels. Production of pressure sensitive papers was discontinued during the second quarter of 2018 as a result of the No. 3 paper machine conversion at the Wallula, Washington mill to virgin kraft linerboard machine.

The Company recognizes revenue for its paper products when performance obligations under the terms of a contract with a customer are satisfied. This occurs with the transfer of control of our products at a specific point in time. Revenue is recognized when the product is shipped from the mill or from our manufacturing facility or distribution center to our customer. Certain customers may receive volume-based incentives, which are accounted for as variable consideration. We estimate these amounts based on the expected amount to be provided to customers and reduce revenue recognized.

Corporate and Other Revenue

Revenue in this segment primarily relates to Louisiana Timber Procurement Company, L.L.C. (LTP), a variable-interest entity that is 50% owned by PCA and 50% owned by Boise Cascade Company (Boise Cascade). PCA is the primary beneficiary of LTP and has the power to direct the activities that most significantly affect the economic performance of LTP. Therefore, we consolidate 100% of LTP in our financial statements. See Note 17, Transactions With Related Parties, for more information related to LTP.

The Company recognizes revenue within this segment when performance obligations under the terms of a contract with a customer are satisfied. This occurs with the transfer of control of our products at a specific point in time.

Practical Expedients and Exemption

Shipping and handling fees billed to a customer are recorded on a gross basis in "Net sales" with the corresponding shipping and handling costs included in "Cost of sales" in the concurrent period as the revenue is recorded. We expense sales commissions when incurred because the amortization period is one year or less. Sales commissions are recorded in "Selling, general, and administrative expenses".

We do not disclose the value of unsatisfied performance obligations for contracts with an original expected duration of one year or less.

4. Acquisitions

Englander Acquisition

On October 9, 2018, PCA acquired the assets of Englander dZignPak ("Englander"), a corrugated products manufacturer, for $56.3 million. The assets include two sheet plants located in Waco, Texas and Carrollton, Texas. Sales and total assets of the acquired company are not material to our overall sales and total assets. Operating results of the acquired assets subsequent to October 9, 2018 are included in our Packaging segment's 2018 operating results. We have estimated the allocation of the purchase price to the assets acquired and liabilities assumed based on estimates of the fair value at the date of acquisition, of which $28.6 million was allocated to goodwill (which is deductible for tax purposes) and $14.1 million to intangible assets (to be amortized over a weighted average life of approximately 9.7 years), primarily customer relationships, in the Packaging segment. The purchase price allocation continues to be preliminary, as estimates and assumptions are subject to change as more information becomes available.

Sacramento Container Acquisition

In October 2017, PCA acquired substantially all of the assets of Sacramento Container Corporation, and 100% of the membership interests of Northern Sheets, LLC and Central California Sheets, LLC (collectively referred to as "Sacramento Container") for a purchase price of $274 million, including working capital adjustments. Funding for the acquisition came from available cash on hand. Assets acquired include full-line corrugated products and sheet feeder operations in both McClellan, California and Kingsburg, California. Sacramento Container provides packaging solutions to customers serving portions of California's strong agricultural market. Sacramento Container's financial results are included in the Packaging segment from the date of acquisition.

The Company accounted for the Sacramento Container acquisition using the acquisition method of accounting in accordance with ASC 805, Business Combinations. The total purchase price has been allocated to tangible and intangible assets acquired and liabilities assumed based on respective fair values, as follows (dollars in millions):

	12/31/17 Allocation	Adjustments	Revised Allocation
Goodwill	$ 151.1	$ 5.5	$ 156.6
Other intangible assets	72.6	(5.5)	67.1
Property, plant and equipment	26.7	—	26.7
Other net assets	23.4	—	23.4
Net assets acquired	$ 273.8	$ —	$ 273.8

During the second quarter ended June 30, 2018, we made a $5.5 million net adjustment based on the final valuation of the intangible assets. We recorded the adjustment as a decrease to other intangible assets with an offset to goodwill.

Goodwill is calculated as the excess of the purchase price over the fair value of the net assets acquired. Among the factors that contributed to the recognition of goodwill were Sacramento Container's commitment to continuous improvement and regional synergies, as well as the expected increases in PCA's containerboard integration levels. Goodwill is deductible for tax purposes.

Other intangible assets, primarily customer relationships, were assigned an estimated weighted average useful life of 9.6 years.

Property, plant and equipment were assigned estimated useful lives ranging from one to 13 years.

5. Earnings Per Share

The following table sets forth the computation of basic and diluted income per common share for the periods presented (dollars and shares in millions, except per share data).

	Year Ended December 31,		
	2018	2017	2016
Numerator:			
Net income	$738.0	$668.6	$449.6
Less: distributed and undistributed earnings allocated to participating securities	(5.7)	(5.6)	(4.4)
Net income attributable to common stockholders	$732.3	$663.0	$445.2
Denominator:			
Weighted average common shares outstanding	93.7	93.5	93.5
Effect of dilutive securities	0.2	0.2	0.2
Diluted common shares outstanding	93.9	93.7	93.7
Basic income per common share	$7.82	$7.09	$4.76
Diluted income per common share	$7.80	$7.07	$4.75

6. Other (Expense) Income, Net

The components of other (expense) income, net, were as follows (dollars in millions):

	Year Ended December 31,		
	2018	2017	2016
Asset disposals and write-offs	$(17.3)	$(10.5)	$(11.9)
Wallula mill restructuring (a)	(14.9)	(23.1)	—
Facilities closure and other costs (b)	(1.6)	5.9	(10.3)
Insurance deductible for property damage (c)	(0.5)	—	—
Acquisition and integration related costs (d)	(0.2)	(0.8)	(3.3)
DeRidder mill incident (e)	—	9.7	—
Hexacomb working capital adjustment (f)	—	2.3	—
Expiration of timberland repurchase option (g)	—	2.0	—
Ceased production of market pulp at Wallula (h)	—	—	(0.6)
Other	(6.7)	(3.9)	1.8
Total	$(41.2)	$(18.4)	$(24.3)

(a) Includes charges related to the discontinuation of production of uncoated free sheet and coated one-side grades at the Wallula, Washington mill in the second quarter of 2018 and the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine.

(b) For 2018, includes charges consisting of closure costs related to corrugated products facilities. For 2017, includes income primarily related to the sale of land corresponding to the closure of a corrugated products facility, partially offset by closure costs related to corrugated products facilities, a paper administration facility, a corporate administration facility, and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities. For 2016, includes expenses related to the closure of corrugated products facilities and a paper administration facility and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities.

(c) Includes charges for the property damage insurance deductible for a weather-related incident at one of our corrugated products facilities.

(d) Includes charges for acquisition and integration costs related to recent acquisitions.

(e) Includes the property damage and business interruption insurance recoveries and corresponding costs related to the February 2017 explosion at our DeRidder, Louisiana mill.

(f) Includes income related to a working capital adjustment from the April 2015 sale of our Hexacomb corrugated manufacturing operations in Europe and Mexico.

(g) Includes a gain related to the expiration of a repurchase option corresponding to timberland previously sold.

(h) Includes costs related to ceased softwood market pulp operations at our Wallula, Washington mill and the permanent shutdown of the No. 1 machine.

7. Income Taxes

On December 22, 2017, the President signed into law H.R.1 (P.L. 115-97), originally known as the "Tax Cuts and Jobs Act" (the "Tax Act"). The Tax Act significantly revised the U.S. tax code by, among other items, reducing the federal corporate tax rate from 35% to 21%, providing for the full expensing of certain depreciable property, eliminating the corporate alternative minimum tax, limiting the deductibility of interest expense, further limiting the deductibility of certain executive compensation, limiting the use of net operating loss carryforwards created in tax years beginning after December 31, 2017, and implementing a territorial tax system imposing a deemed repatriation transition tax ("Transition Tax") on earnings of foreign subsidiaries.

Generally accepted accounting principles require companies to record the impact of the Tax Act in their financial statements for the period during which the Tax Act becomes law, even if provisions of the Tax Act become effective at a future date. The SEC staff issued Staff Accounting Bulletin No. 118 (SAB 118), Income Tax Accounting Implications of the Tax Cuts and Jobs Act, which provided guidance on accounting for the effects and included a measurement period that ends when a company has obtained, prepared and analyzed the information necessary to finalize its accounting of the Tax Act which cannot extend beyond one year. In accordance with SAB 118, a company must reflect the income tax effects of those aspects of the Tax Act for which the accounting under ASC 740, Income Taxes, is complete. To the extent that a company's accounting for certain income tax effects of the Tax Act is incomplete, but it is able to determine a reasonable estimate, it must record a provisional estimate in the financial statements. If a company cannot determine a provisional estimate to be included in the financial statements, it should continue to apply ASC 740 on the basis of the provisions of the tax laws that were in effect immediately before the enactment of the Tax Act.

In accordance with SAB 118, the Company recorded a final adjustment for the income tax effects of the Tax Act in the fourth quarter of 2018 totaling a net tax benefit of $2.0 million, primarily related to the re-measurement of our U.S. deferred tax assets and liabilities to the lower enacted corporate tax rate as a result of the release of additional regulatory guidance and the completion and filing of the 2017 federal and state income tax returns during calendar year 2018. The Company recorded provisional estimates of the income tax effects of the Tax Act in the fourth quarter of 2017 totaling a net tax benefit of $122.1 million, primarily related to the re-measurement of our U.S. deferred tax assets and liabilities to the lower enacted corporate tax rate for $128.0 million offset by a reduction in the domestic manufacturers deduction for $5.1 million, the Transition Tax and other current year tax reform impacts of $0.8 million.

The following is an analysis of the components of the consolidated income tax provision (dollars in millions):

	Year Ended December 31,		
	2018	2017	2016
Current income tax provision (benefit) -			
U.S. federal	$150.7	$209.3	$213.6
State and local	42.9	34.9	29.1
Foreign	0.2	0.3	0.2
Total current provision for taxes	193.8	244.5	242.9
Deferred -			
U.S. federal	34.7	(90.2)	(1.2)
State and local	4.0	5.7	(3.0)
Foreign	—	—	0.2
Total deferred provision (benefit) for taxes	38.7	(84.5)	(4.0)

Total provision for taxes	$232.5	$160.0	$238.9

The effective tax rate varies from the U.S. federal statutory tax rate principally due to the following (dollars in millions):

	2018	2017	2016
Provision computed at U.S. federal statutory rate (a)	$203.8	$290.0	$241.0
Federal tax reform	(2.0)	(127.2)	—
State and local taxes, net of federal benefit	36.9	24.0	19.8
Domestic manufacturers deduction (b)	—	(21.1)	(21.1)
Other	(6.2)	(5.7)	(0.8)
Total	$232.5	$160.0	$238.9

(a) U.S. federal statutory rate of 21% in 2018 and 35% in 2017 and 2016.

(b) The domestic manufacturers deduction was eliminated after 2017 as a result of the Tax Cuts and Jobs Act.

The following details the scheduled expiration dates of our tax effected net operating loss (NOL) and other tax carryforwards at December 31, 2018 (dollars in millions):

	2019 Through 2028	2029 Through 2038	Indefinite	Total
U.S. federal NOLs	$ 28.6	$ 3.8	$ —	$32.4
State taxing jurisdiction NOLs	1.8	0.2	—	2.0
U.S. federal tax credit carryforwards	—	0.1	—	0.1
U.S. federal and non-U.S. capital loss carryforwards	3.1	—	0.1	3.2
Total	$ 33.5	$ 4.1	$ 0.1	$37.7

Deferred income taxes reflect the net tax effects of temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and the amounts for income tax purposes. Deferred income tax assets and liabilities at December 31 are summarized as follows (dollars in millions):

	December 31,	
	2018	2017
Deferred tax assets:		
Accrued liabilities	$17.1	$13.7
Employee benefits and compensation	37.7	21.1
Inventories	12.6	15.4
Net operating loss carryforwards	34.4	38.1
Restricted stock and performance units	10.2	9.0
Pension and postretirement benefits	87.4	90.6
Derivatives	4.7	6.1

Capital loss and general business credit carryforwards	3.3	3.2
Gross deferred tax assets	207.4	197.2
Valuation allowance (c)	(3.1)	(3.1)
Net deferred tax assets	$204.3	$194.1
Deferred tax liabilities:		
Property, plant and equipment	$(422.3)	$(368.6)
Goodwill and intangible assets	(67.2)	(65.0)
Total deferred tax liabilities	$(489.5)	$(433.6)
Net deferred tax liabilities (d)	$(285.2)	$(239.5)

(c) Deferred tax assets are reduced by a valuation allowance when it is more likely than not that some portion of the deferred tax assets will not be realized. Both the 2018 and 2017 valuation allowance relates to capital losses. We do not expect to generate capital gains before the capital losses expire. If or when recognized, the tax benefits relating to the reversal of any or all of the valuation allowance would be recognized as a benefit to income tax expense.

(d) As of December 31, 2018, we did not recognize U.S. deferred income taxes on our cumulative total of undistributed foreign earnings for our foreign subsidiaries. We indefinitely reinvest our earnings in operations outside the United States. It is not practicable to determine the amount of unrecognized deferred tax liability on these undistributed earnings because the actual tax liability, if any, is dependent on circumstances existing when the repatriation occurs.

Cash payments for federal, state, and foreign income taxes were $140.8 million, $298.7 million, and $222.1 million for the years ended December 31, 2018, 2017, and 2016, respectively.

The following table summarizes the changes related to PCA's gross unrecognized tax benefits excluding interest and penalties (dollars in millions):

	2018	2017	2016
Balance as of January 1	$(4.8)	$(5.2)	$(5.8)
Increases related to prior years' tax positions	(0.1)	—	—
Increases related to current year tax positions	(0.3)	(0.4)	(0.5)
Decreases related to prior years' tax positions	—	—	0.1
Settlements with taxing authorities	—	—	0.3
Expiration of the statute of limitations	0.6	0.8	0.7
Balance at December 31	$(4.6)	$(4.8)	$(5.2)

At December 31, 2018, PCA had recorded a $4.6 million gross reserve for unrecognized tax benefits, excluding interest and penalties. Of the total, $4.0 million (net of the federal benefit for state taxes) would impact the effective tax rate if recognized.

PCA recognizes interest accrued related to unrecognized tax benefits and penalties as income tax expense. For both years ended December 31, 2018 and 2017, we had $1.1 million of interest and penalties recorded for unrecognized tax benefits. During the next 12 months, it is possible that PCA's unrecognized tax benefits related to state apportionment issues could decrease by approximately $3.1 million due to settlements with state taxing authorities.

PCA is subject to taxation in the United States, various state and local, and foreign jurisdictions. A federal examination of the 2013 tax year was concluded in November 2016. The tax years 2015 - 2018 remain open to federal examination. The tax years 2014 - 2018 remain open to state examinations. Some foreign tax jurisdictions are open to examination for the 2009 tax year forward. Through the Boise acquisition, PCA recorded net operating losses and credit carryforwards from 2008 through 2011 and 2013 that are subject to examinations and adjustments for at least three years following the year in which utilized.

8. Goodwill and Intangible Assets

Goodwill

Goodwill represents the excess of the cost of an acquired business over the fair value of the identifiable tangible and intangible assets acquired and liabilities assumed in a business combination. At December 31, 2018 and 2017, we had $862.1 million and $828.0 million, respectively, of goodwill recorded in our Packaging segment and $55.2 million for both years in our Paper segment on our Consolidated Balance Sheets.

Changes in the carrying amount of our goodwill were as follows (dollars in millions):

	Total

	Packaging	Paper	Goodwill
Balance at January 1, 2017	$ 682.7	$55.2	$ 737.9
Acquisitions (a)(b)	145.3	—	145.3
Balance at December 31, 2017	$ 828.0	$55.2	$ 883.2
Acquisitions (c)(d)	34.1	—	34.1
Balance at December 31, 2018	$ 862.1	$55.2	$ 917.3

(a) In connection with the October 2017 acquisition of Sacramento Container, the Company recorded $151.1 million of goodwill in the Packaging segment.

(b) During 2017, the Company recorded opening balance sheet adjustments related to the TimBar and Columbus Container acquisitions resulting in a decrease to goodwill of $5.8 million.

(c) During 2018, the Company recorded a $5.5 million adjustment to increase the goodwill balance for the Company's October 2017 acquisition of Sacramento Container.

(d) In connection with the October 2018 acquisition of Englander, the Company recorded $28.6 million of goodwill in the Packaging segment.

See Note 4, Acquisitions, for more information.

Intangible Assets

Intangible assets are comprised of customer relationships and trademarks and trade names.

The weighted average useful life, gross carrying amount, and accumulated amortization of our intangible assets were as follows (dollars in millions):

	As of December 31, 2018			As of December 31, 2017		
	Weighted Average Remaining Useful Life (in Years)	Gross Carrying Amount	Accumulated Amortization	Weighted Average Remaining Useful Life (in Years)	Gross Carrying Amount	Accumulated Amortization
Customer relationships (e)	10.9	$ 504.6	$ 144.5	11.8	$ 497.8	$ 109.8
Trademarks and trade names (e)	10.1	34.8	18.3	9.8	32.9	13.2
Other (e)	3.0	4.4	2.7	3.6	4.3	2.0
Total intangible assets (excluding goodwill)	10.8	$ 543.7	$ 165.5	11.7	$ 535.0	$ 125.0

(e) In connection with the October 2018 acquisition of Englander, the Company recorded intangible assets of $13.2 million for customer relationships, $0.8 million for trade names, and $0.1 million for other intangibles. In October 2017, the Company acquired Sacramento Container and recorded intangible assets of $61.9 million for customer relationships, $5.1 million for trade names, and $0.1 million for other intangibles.

Amortization expense was $40.5 million, $35.7 million, and $26.6 million for the years ended December 31, 2018, 2017, and 2016, respectively. Estimated amortization expense of intangible assets over the next five years is expected to approximate $38.8 million (2019), $38.8 million (2020), $38.0 million (2021), $35.5 million (2022), and $34.5 million (2023).

Impairment Testing

We test goodwill for impairment annually in the fourth quarter or sooner if events or changes in circumstances indicate that the carrying value of the asset may exceed fair value. Additionally, when we experience changes to our business or operating environment, we evaluate the remaining useful lives and recoverability of our finite-lived purchased intangible assets to determine whether any adjustments to the useful lives or impairment are necessary. We completed our test in the fourth quarter and there was no indication of goodwill or intangible asset impairment.

9. Accrued Liabilities

The components of accrued liabilities were as follows (dollars in millions):

December 31,

	2018	2017
Compensation and benefits	$136.7	$127.5
Medical insurance and workers' compensation	27.5	23.9
Customer volume discounts and rebates	25.2	23.4
Franchise, property, sales and use taxes	13.4	16.0
Environmental liabilities and asset retirement obligations	5.0	4.0
Severance, retention, and relocation	2.2	3.1
Other	12.4	5.3
Total	$222.4	$203.2

10. Debt

At December 31, 2018 and 2017, our long-term debt and interest rates on that debt were as follows (dollars in millions):

	December 31, 2018		December 31, 2017	
	Amount	Interest Rate	Amount	Interest rate
Revolving Credit Facility, due August 2021	$—	— %	$—	— %
6.50% Senior Notes due March 2018	—	— %	150.0	6.50 %
2.45% Senior Notes, net of discount of $0.4 million and $0.5 million as of December 31, 2018 and 2017, respectively, due December 2020	499.6	2.45 %	499.5	2.45 %
3.90% Senior Notes, net of discounts of $0.1 million and $0.2 million as of December 31, 2018 and 2017, respectively, due June 2022	399.9	3.90 %	399.8	3.90 %
4.50% Senior Notes, net of discount of $1.0 million a $1.2 million as of December 31, 2018 and 2017, respectively, due November 2023	699.0	4.50 %	698.8	4.50 %
3.65% Senior Notes, net of discount of $0.7 million and $0.8 million as of December 31, 2018 and 2017, respectively, due September 2024	399.3	3.65 %	399.2	3.65 %
3.40% Senior Notes, net of discount of $1.5 million and $1.6 million as of December 31, 2018 and 2017, respectively, due December 2027	498.5	3.40 %	498.4	3.40 %
Total	2,496.3	3.64 %	2,645.7	3.80 %
Less current portion	—	— %	150.0	6.50 %
Less unamortized debt issuance costs	12.6		15.3	
Total long-term debt	$2,483.7	3.64 %	$2,480.4	3.64 %

On December 13, 2017, the Company issued $500.0 million of 2.45% senior notes due 2020 and $500.0 million of 3.40% senior notes due 2027, through a registered public offering. The net proceeds of $997.8 million were used to repay in full all amounts outstanding under our Seven-Year term loan due October 2020 of $625.6 million and our Five-Year term loan due August 2021 of $350.4 million. Any remaining net proceeds were used to pay $6.8 million of debt issuance costs and for general corporate purposes. The debt issuance costs will be amortized to interest expense using the effective interest method over the terms of the notes.

As of December 31, 2018, the details of our borrowings were as follows:

- Senior Unsecured Credit Agreement. On October 18, 2013, we entered into a $1.65 billion senior unsecured credit facility. Loans bear interest at LIBOR plus a margin that is determined based upon our credit ratings. On August 29, 2016, we amended and restated our five-year credit agreement dated October 18, 2013 to include a new term loan facility (that was subsequently repaid in full in 2017) to finance an acquisition and to extend the maturity of the revolving credit facility to 2021. We have repaid all amounts borrowed, and the current facility now only includes a $350.0 million unsecured revolving credit facility with variable interest (LIBOR plus a margin) due August 2021. During 2018, we did not borrow under the Revolving Credit Facility. At December 31, 2018, we had $23.1 million of outstanding letters of credit that were considered outstanding on the revolving credit facility, resulting in $326.9 million of unused borrowing capacity. The outstanding letters of credit were primarily for workers compensation. We are required to pay commitment fees on the unused portions of the credit facility.
- 3.90% Senior Notes. On June 26, 2012, we issued $400.0 million of 3.90% senior notes due June 15, 2022, through a registered public offering.
- 4.50% Senior Notes. On October 22, 2013, we issued $700.0 million of 4.50% senior notes due November 1, 2023, through a registered public offering.
- 3.65% Senior Notes. On September 5, 2014, we issued $400.0 million of 3.65% senior notes due September 15, 2024, through a registered public offering.
- 2.45% Senior Notes. On December 13, 2017, we issued $500.0 million of 2.45% senior notes due December 15, 2020, through a registered public offering.

- 3.40% Senior Notes. On December 13, 2017, we issued $500.0 million of 3.40% senior notes due December 15, 2027, through a registered public offering.

The instruments governing our indebtedness contain financial and other covenants that limit the ability of PCA and its subsidiaries to enter into sale and leaseback transactions, incur liens, incur indebtedness at the subsidiary level, enter into certain transactions with affiliates, merge or consolidate with any other person or sell or otherwise dispose of all or substantially all of our assets. Our credit facility also requires us to comply with certain financial covenants, including maintaining a minimum interest coverage ratio and a maximum leverage ratio. A failure to comply with these restrictions could lead to an event of default, which could result in an acceleration of any outstanding indebtedness and/or prohibit us from drawing on the revolving credit facility. Such an acceleration may also constitute an event of default under the senior notes indenture. At December 31, 2018, we were in compliance with these covenants.

At December 31, 2018, we have $2,496.3 million of fixed-rate senior notes outstanding. At December 31, 2018, the fair value of our fixed-rate debt was estimated to be $2,468.8 million. The difference between the book value and fair value is due to the difference between the period-end market interest rate and the stated rate of our fixed-rate debt. We estimated the fair value of our fixed-rate debt using quoted market prices (Level 2 inputs), discussed further in Note 2, Summary of Significant Accounting Policies.

Repayments, Interest, and Other

In 2018, we used cash on hand to repay debt outstanding of $150.0 million under the 6.50% Senior Notes due March 15, 2018 at maturity.

In 2017, we used the net proceeds from our 2.45% and 3.40% senior note offerings and other cash on hand to repay approximately $1.0 billion of borrowings outstanding under our term loans.

In 2016, we used cash on hand to make principal payments of $36.3 million under our term loans.

As of December 31, 2018, annual principal maturities for debt, excluding unamortized debt discount, are: none for 2019; $500.0 million for 2020; none for 2021; $400.0 million for 2022; and $1.6 billion for 2023 and thereafter.

Interest payments paid in connection with the Company’s debt obligations for the years ended December 31, 2018, 2017, and 2016, were $97.0 million, $96.3 million, and $88.3 million, respectively.

Included in interest expense, net, are amortization of financing costs and amortization of treasury lock settlements. Amortization of treasury lock settlements was a $5.3 million net loss in 2018 and a $5.7 million net loss in both 2017 and 2016. Amortization of financing costs in 2018, 2017, and 2016 was $2.7 million, $4.0 million (including a $1.8 million write-off of deferred debt issuance costs related to the December 2017 debt refinancing), and $1.8 million, respectively.

11. Employee Benefit Plans and Other Postretirement Benefits

PCA has defined pension benefit plans for both salaried and hourly employees. The plans covering salaried employees are closed to new entrants with only certain current active participants still accruing benefits. The plans covering certain hourly employees are closed to new participants. We also have a Supplemental Executive Retirement Plan (SERP) and other nonqualified defined benefit pension plans that provide unfunded supplemental retirement benefits to certain of our executives and former executives. The SERP provides for incremental pension benefits in excess of those offered in our principal pension plans.

Other Postretirement Benefits

PCA provides postretirement medical benefits for certain retired salaried employees and postretirement medical and life insurance benefits for certain hourly employees. The plan covering salaried employees is closed to new participants.

Obligations and Funded Status of Defined Benefit Pension and Other Postretirement Benefits Plans

The funded status of PCA's plans change from year to year based on the plan asset investment return, contributions, benefit payments, the discount rate used to measure the liability, and expected participant longevity. The following table, which includes only company-sponsored defined benefit and other postretirement benefit plans, reconciles the beginning and ending balances of the projected benefit obligation and the fair value of plan assets. We recognize the unfunded status of these plans on the Consolidated Balance Sheets, and we recognize changes in funded status in the year changes occur through the Consolidated Statements of Comprehensive Income (dollars in millions):

	Pension Plans Year Ended December 31		Postretirement Plans Year Ended December 31	
	2018	2017	2018	2017
Change in Benefit Obligation				
Benefit obligation at beginning of period	$1,300.2	$1,158.4	$16.5	$19.5
Service cost	25.0	23.7	0.3	0.3
Interest cost	42.4	41.6	0.5	0.6
Plan amendments	3.0	17.3	(0.4)	(0.5)
Actuarial (gain) loss (a)	(121.1)	99.3	(1.2)	(2.2)
Participant contributions	—	—	1.1	1.3
Benefits paid	(44.6)	(40.1)	(2.2)	(2.5)
Benefit obligation at plan year end	$1,204.9	$1,300.2	$14.6	$16.5
Accumulated benefit obligation portion of above	$1,163.3	$1,237.7		
Change in Fair Value of Plan Assets				
Plan assets at fair value at beginning of period	$954.8	$830.4	$—	$—
Actual return on plan assets	(59.9)	121.0	—	—
Company contributions	22.9	43.5	1.1	1.2
Participant contributions	—	—	1.1	1.3
Benefits paid	(44.6)	(40.1)	(2.2)	(2.5)
Fair value of plan assets at plan year end	$873.2	$954.8	$—	$—
Underfunded status	$(331.7)	$(345.4)	$(14.6)	$(16.5)
Amounts Recognized on Consolidated Balance Sheets				
Current liabilities	(1.4)	(1.4)	(0.8)	(1.0)
Noncurrent liabilities	(330.3)	(344.0)	(13.8)	(15.5)
Accrued obligation recognized at December 31	$(331.7)	$(345.4)	$(14.6)	$(16.5)
Amounts Recognized in Accumulated Other Comprehensive Loss (Income) (Pre-Tax)				
Prior service cost (credit)	$28.7	$32.7	$(5.4)	$(5.3)
Actuarial loss (gain)	194.6	208.5	(5.0)	(4.0)
Total	$223.3	$241.2	$(10.4)	$(9.3)

(a) The actuarial gain in 2018 was due primarily to an increase in the weighted average discount rate used to estimate pension benefit obligations. The actuarial loss in 2017 was due primarily to a decrease in the weighted average discount rate used to estimate our pension benefit obligations.

Components of Net Periodic Benefit Cost and Other Comprehensive (Income) Loss

The components of net periodic benefit cost and other comprehensive (income) loss (pretax) were as follows (dollars in millions):

	Pension Plans Year Ended December 31,			Postretirement Plans Year Ended December 31,		
	2018	2017	2016	2018	2017	2016
Service cost	$25.0	$23.7	$24.5	$0.3	$0.3	$0.5
Interest cost	42.4	41.6	40.9	0.5	0.6	0.6
Expected return on plan assets	(56.7)	(53.9)	(49.5)	—	—	—
Net amortization of unrecognized amounts						
Prior service cost (credit)	6.9	5.8	5.7	(0.3)	(0.2)	(0.1)
Actuarial loss (gain)	9.4	7.6	5.8	(0.2)	(0.1)	(0.4)
Net periodic benefit cost	$27.0	$24.8	$27.4	$0.3	$0.6	$0.6
Changes in plan assets and benefit obligations recognized in other comprehensive (income) loss						
Actuarial net loss (gain)	$(4.6)	$32.2	$40.4	$(1.2)	$(2.2)	$3.6
Prior service cost (credit)	3.0	17.4	1.8	(0.3)	(0.6)	(5.3)
Amortization of prior service cost (credit)	(6.9)	(5.8)	(5.7)	0.3	0.2	0.1
Amortization of actuarial loss (gain)	(9.4)	(7.6)	(5.8)	0.2	0.1	0.4
Total recognized in other comprehensive loss (income) (b)	$(17.9)	$36.2	$30.7	$(1.0)	$(2.5)	$(1.2)
Total recognized in net periodic benefit cost and other comprehensive loss (income) (pre-tax)	$9.2	$61.0	$58.1	$(0.7)	$(1.9)	$(0.6)

(b) Accumulated losses in excess of 10% of the greater of the projected benefit obligation or the market-related value of assets will be recognized on a straight-line basis over the average remaining service period of active employees in PCA plans (which is between seven and ten years) and over the average remaining lifetime of inactive participants of Boise plans (which is between 24 and 27 years), to the extent that losses are not offset by gains in subsequent years. The estimated net loss and prior service cost that will be amortized from "Accumulated other comprehensive loss" into net periodic benefit in 2019 is $12.7 million.

The accumulated benefit obligations for the plans with obligations in excess of plan assets is $1.1 billion.

Assumptions

The following table presents the assumptions used in the measurement of our benefits obligations:

	Pension Plans			Postretirement Plans		
	December 31,			December 31,		
	2018	2017	2016	2018	2017	2016
Weighted-Average Assumptions Used to Determine Benefit Obligations at December 31						
Discount rate	4.31%	3.66%	4.24%	4.21%	3.55%	3.91%
Rate of compensation increase	4.00%	4.00%	4.00%	N/A	N/A	N/A
Weighted-Average Assumptions Used to Determine Net Periodic Benefit Cost for the Years Ended December 31						
Discount rate	3.66%	4.24%	4.49%	3.57%	3.92%	4.17%
Expected return on plan assets	6.06%	6.55%	6.57%	N/A	N/A	N/A
Rate of compensation increase	4.00%	4.00%	4.00%	N/A	N/A	N/A

Discount Rate Assumption. The discount rate reflects the current rate at which the pension obligations could be settled on the measurement date: December 31. The discount rate assumption used to calculate the present value of pension and postretirement benefit obligations reflects the rates available on high-quality, fixed-income debt instruments at December 31. In all periods, the bonds included in the models reflect anticipated investments that would be made to match the expected monthly benefit payments over time. The plans' projected cash flows were duration-matched to these models to develop an appropriate discount rate.

Beginning in 2016, we refined the method used to determine the service and interest cost components of our net periodic benefit cost. Previously, the cost was determined using a single weighted-average discount rate derived from the yield curve. Under the refined method, known as the spot rate approach, we use individual spot rates along the yield curve that correspond with the timing of each benefit payment. We believe this change provides a more precise measurement of service and interest costs by improving the correlation between projected cash outflows and corresponding spot rates on the yield curve.

Asset Return Assumption. The expected return on plan assets reflects the expected long-term rates of return for the categories of investments currently held in the plans as well as anticipated returns for additional contributions made in the future. The expected long-term rate of return is adjusted when there are fundamental changes in expected returns on the plan investments. The weighted-average expected return on plan assets we will use in our calculation of 2019 net periodic pension benefit cost is 6.06%.

Rate of Compensation Increase. The rate of compensation increase is determined by PCA based upon annual reviews. The compensation increase assumption is not applicable for all plans as many of our pension plans are frozen and not accruing benefits.

Health Care Cost Trend Rate Assumptions. PCA assumed health care cost trend rates for its postretirement benefits plans were as follows:

	2018	2017	2016
Health care cost trend rate assumed for next year	7.24%	7.57%	7.35%
Rate to which the cost trend rate is assumed to decline (the ultimate trend rate)	4.44%	4.44%	4.50%
Year that the rate reaches the ultimate trend rate	2028	2027	2025

Postretirement Health Care Plan Assumptions. For postretirement health care plan accounting, PCA reviews external data and its own historical trends for health care costs to determine the health care cost trend rate assumption.

A one-percentage point change in assumed health care cost trend rates would have the following effects on the 2018 postretirement benefit obligation and the 2017 net postretirement benefit cost (dollars in millions):

	1-Percentage Point Increase	1-Percentage Point Decrease
Effect on postretirement benefit obligation	$ 0.7	$ (0.6)
Effect on net postretirement benefit cost	0.1	(0.1)

Investment Policies and Strategies

PCA has retained the services of professional advisors to oversee pension investments and provide recommendations regarding investment strategy. PCA's overall strategy and related apportionments between equity and debt securities may change from time to time based on market conditions, external economic factors, and the funded status of the plans. The general investment objective for all of our plan assets is to optimize growth of the pension plan trust assets, while minimizing the risk of significant losses to enable the plans to satisfy their benefit payment obligations over time. The objectives take into account the long-term nature of the benefit obligations, the liquidity needs of the plans, and the expected risk/return trade-offs of the asset classes in which the plans may choose to invest. Assets of our pension plans were invested in the following classes of securities at December 31, 2018 and 2017:

	Percentage of Fair Value at December 31,	
	2018	2017
Fixed income securities	53 %	21 %
International equity securities	27 %	6 %
Domestic equity securities	18 %	9 %
Other	2 %	64 %

At December 31, 2017, the Company was in the process of consolidating the Boise pension plan assets with the PCA pension plans under one trustee. Due to this timing, 100% of the Boise pension plan assets were classified as Other (Cash) on December 31, 2017. Upon completion of the transfer on January 5, 2018, the pension plan assets were invested in the following classes of securities:

	Percentage of Fair Value at January 5, 2018
Fixed income securities	52 %
International equity securities	28 %
Domestic equity securities	20 %

At December 31, 2018, the targeted investment allocations differed between the acquired Boise plans and PCA's historical plans based on funded status. At December 31, 2018, PCA's historical plans, which comprised $384.3 million of the total fair value of plan assets, targeted 50% invested in equities, 49% invested in fixed income securities, and 1% in other, whereas the Boise plans, which comprised $488.9 million of the total fair value of plan assets, targeted 54% invested in fixed income securities, 44% invested in equities, and 2% in other. Our retirement committee reviews the investment allocations for reasonableness at a minimum, semi-annually.

Investment securities, in general, are exposed to various risks, such as interest rate, credit, and overall market volatility risk, all of which are subject to change. Due to the level of risk associated with some investment securities, it is reasonably possible that changes in the values of investment securities will occur in the near term, and such changes could materially affect the reported amounts.

Fair Value Measurements of Plan Assets

The following tables set forth, by level within the fair value hierarchy, discussed in Note 2, Summary of Significant Accounting Policies, the pension plan assets, by major asset category, at fair value at December 31, 2018 and 2017 (dollars in millions):

	Fair Value Measurements at December 31, 2018				
Asset Category	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	Net Asset Value (NAV) (a)	Total
Cash and short-term investments	$0.4	$ 11.6	$ —	$ —	$12.0
Common/collective trust funds:					
Domestic equities	—	154.5	—	—	154.5
International equities	136.9	17.8	—	84.1	238.8
Corporate and government bonds:					
Government bonds	155.0	9.4	—	—	164.4
Corporate bonds	—	64.4	—	—	64.4
Fixed income	95.7	138.8	—	—	234.5
Private equity securities (c)	—	—	3.3	—	3.3
Total securities at fair value	$388.0	$ 396.5	$ 3.3	$ 84.1	$871.9
Receivables and accrued expenses					1.3
Total fair value of plan assets					$873.2

	Fair Value Measurements at December 31, 2017				
Asset Category	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	Net Asset Value (NAV) (a)	Total
Cash and short-term investments (b)	$602.4	$ 5.7	$ —	$ —	$608.1
Mutual funds:					
International equities	56.1	—	—	—	56.1

Fixed income	95.4	—	—	—	95.4
Common/collective trust funds:					
Domestic equities	—	84.1	—	—	84.1
International equities	—	5.6	—	—	5.6
Fixed income	—	59.8	—	—	59.8
Corporate and government bonds:					
Fixed income	41.3	—	—	—	41.3
Private equity securities (c)	—	—	4.2	—	4.2
Total securities at fair value	$795.2	$ 155.2	$ 4.2	$ —	$954.6
Receivables and accrued expenses					0.2
Total fair value of plan assets					$954.8

(a) In accordance with ASC 820, Fair Value Measurement, certain investments that do not have readily-determinable fair values are measured at fair value using the net asset value (NAV) per share practical expedient and are not classified within the fair value hierarchy.

(b) As of December 31, 2017, the cash and short-term investments asset category contained both short-term investments and the Boise pension plan assets classified as cash. Of the $551.3 million of Boise pension plan assets classified as Level 1 at December 31, 2017, $449.8 million of the pension plan assets were reclassified to Level 2 equities and fixed income securities on or about January 5, 2018 after consolidating with the PCA pension plan assets under one trustee.

(c) Investments in this category are invested in the Pantheon Global Secondary Fund IV, LP. The fund specializes in investments in the private equity secondary market and occasionally directly in private companies to maximize capital growth. Fund investments are carried at fair value as determined quarterly using the market approach to estimate the fair value of private investments. The market approach utilizes prices and other relevant information generated by market transactions, type of security, size of the position, degree of liquidity, restrictions on the disposition, latest round of financing data, current financial position, and operating results, among other factors. In circumstances where fair values are not provided with respect to any of the company's fund investments, the investment advisor will seek to determine the fair value of such investments based on information provided by the general partners or managers of such funds or from other sources. Audited financial statements are provided by fund management annually. Notwithstanding the above, the variety of valuation bases adopted and quality of management data of the ultimate underlying investee companies means that there are inherent difficulties in determining the value of the investments. Amounts realized on the sale of these investments may differ from the calculated values. Boise had originally committed to a $15.0 million investment, with $5.0 million of the commitment unfunded at December 31, 2018.

The following table sets forth a summary of changes in the fair value of the pension plans' Level 3 assets for the year ended December 31, 2018 (dollars in millions):

	2018
Balance, beginning of year	$4.2
Acquisitions	—
Purchases	—
Sales	(0.9)
Unrealized gain	—
Balance, end of year	$3.3

Funding and Cash Flows

PCA makes pension plan contributions that are sufficient to fund its actuarially determined costs, generally equal to the minimum amounts required by the Employee Retirement Income Security Act (ERISA). From time to time, PCA may make discretionary contributions based on the funded status of the plans, tax deductibility, income from operations, and other factors. In 2018, 2017, and 2016, we made contributions of $21.8 million, $42.1 million, and $57.1 million, respectively, to our qualified pension plans. We expect to contribute at least the estimated required minimum contributions to our qualified pension plans of approximately $15.8 million in 2019.

The following are estimated benefit payments to be paid to current plan participants by year (dollars in millions). Qualified pension benefit payments are paid from plan assets, while nonqualified pension benefit payments are paid by the Company.

	Pension	Postretirement
	Plans	Plans
2019	$48.5	$ 0.8
2020	52.3	0.8
2021	56.2	0.8

2022	59.8	0.9
2023 - 2028	421.4	5.5

Defined Contribution Plans

Some of our employees participate in contributory defined contribution savings plans, available to most of our salaried and hourly employees. The defined contribution plans permit participants to make contributions by salary reduction pursuant to Section 401(k) of the Code. PCA made employer-matching contributions of $45.6 million, $42.8 million, and $40.4 million in 2018, 2017, and 2016, respectively. All company-matching contributions to all employees were made in cash. We expense employer matching contributions and charge dividends on shares held by the ESOP to retained earnings. Shares of company stock held by the ESOP are included in basic shares for earnings-per-share computations. At December 31, 2018 and 2017, the ESOP held 1.9 million and 1.8 million shares of Company stock, respectively.

Certain salaried and hourly employees that are not participating in a PCA sponsored defined benefit pension plan receive a service-related company retirement contribution to their defined contribution plan account in addition to any employer matching contribution. This contribution increases with years of service and ranges from 3% to 5% of base pay. We contributed $24.5 million, $22.4 million, and $14.9 million for this retirement contribution during the years ended December 31, 2018, 2017, and 2016, respectively.

Deferred Compensation Plans

Key managers can elect to participate in a deferred compensation plan. The deferred compensation plan is unfunded; therefore, benefits are paid from our general assets. At December 31, 2018 and 2017, we had $14.2 million and $13.6 million, respectively, of liabilities attributable to participation in our deferred compensation plan on our Consolidated Balance Sheets.

12. Asset Retirement Obligations

Our asset retirement obligations relate predominantly to landfill closure, wastewater treatment pond dredging, closed-site monitoring costs, and certain leasehold improvements. In accordance with ASC 410, Asset Retirement and Environmental Obligations, we recognize the fair value of these liabilities as an asset retirement obligation and capitalize that cost as part of the cost basis of the related asset in the period in which the costs are incurred if sufficient information is available to reasonably estimate the fair value of the obligation. Fair value estimates are determined using Level 3 inputs in the fair value hierarchy. The fair value of our asset retirement obligations is measured using expected future cash outflows discounted using the company's credit-adjusted risk-free interest rate. Over time, the liability is accreted to its settlement value, and the capitalized cost is depreciated over the useful life of the related asset. These liabilities are based on the best estimate of costs and are updated periodically to reflect current technology, laws and regulations, inflation, and other economic factors. Occasionally, we become aware of events or circumstances that require us to revise our future estimated cash flows. When revisions become necessary, we recalculate our obligation and adjust our asset and liability accounts utilizing appropriate discount rates. No assets are legally restricted for purposes of settling asset retirement obligations. Upon settlement of the liability, we will recognize a gain or loss for any difference between the settlement amount and the liability recorded.

The following table describes changes to the asset retirement obligation liability (dollars in millions):

	Year Ended December 31,	
	2018	2017
Asset retirement obligation at beginning of period	$ 35.1	$ 28.0
Accretion expense	1.6	1.3
Payments	(7.9)	(2.3)
Revisions in estimated cash flows	1.2	7.9
Liabilities incurred	—	0.2
Asset retirement obligation at end of period	$ 30.0	$ 35.1

We have additional asset retirement obligations with indeterminate settlement dates. The fair value of these asset retirement obligations cannot be estimated due to the lack of sufficient information to estimate the settlement dates of the obligations. These asset retirement obligations include, for example, (i) removal and disposal of potentially hazardous materials related to equipment and/or an operating facility if the equipment and/or facilities were to undergo major maintenance, renovation, or demolition and (ii) storage sites or owned facilities for which removal and/or disposal of chemicals and other related materials are required if the operating facility is closed. We will recognize a liability in the period in which sufficient information becomes available to reasonably estimate the fair value of these obligations.

13. Share-Based Compensation

The Company has a long-term equity incentive plan, which allows for grants of stock options, stock appreciation rights, restricted stock, and performance awards to directors, officers, and employees, as well as others who engage in services for PCA. The plan, as amended, terminates May 1, 2023, and authorizes 10.6 million shares of common stock for grant over the life of the plan. As of December 31, 2018, 0.7 million shares remained available for future issuance under the plan. Forfeitures are added back to the pool of shares of common stock available to be granted at a future date.

Restricted Stock

Restricted stock awards granted to officers and employees generally vest at the end of a four-year period, and restricted stock awards granted to directors vest immediately. The fair value of restricted stock is determined based on the closing price of the Company's stock on the grant date. A summary of the Company's restricted stock activity follows:

	2018		2017		2016	
		Weighted Average Grant- Date Fair		Weighted Average Grant- Date Fair		Weighted Average Grant- Date Fair
	Shares	Value	Shares	Value	Shares	Value
Restricted stock at January 1	739,732	$ 77.23	786,079	$ 63.44	1,007,794	$ 49.47
Granted	173,144	114.63	173,199	107.57	242,835	67.48
Vested (a)	(165,547)	72.84	(213,992)	51.37	(443,627)	34.11
Forfeitures	(3,738)	78.66	(5,554)	69.03	(20,923)	59.63
Restricted stock at December 31	743,591	$ 86.90	739,732	$ 77.23	786,079	$ 63.44

(a) The total fair value of awards upon vesting for the years ended December 31, 2018, 2017, and 2016 was $18.9 million, $23.3 million, and $28.8 million, respectively.

Performance Units

Performance unit awards granted to certain key employees are earned based on the achievement of defined performance rankings of Return on Invested Capital (ROIC) or Total Shareholder Return (TSR) compared to ROIC and TSR for peer companies. ROIC performance unit awards vest four years after the grant date, while TSR performance unit awards vest approximately three years after the grant date. Both ROIC and TSR performance units are paid out entirely in shares of the Company's common stock. The ROIC performance unit awards are valued at the closing price of the Company's stock on the grant date and expensed over the requisite service period based on the most probable number of awards expected to vest. The TSR performance unit awards are valued using a Monte Carlo simulation, as the TSR component contains a market condition. A summary of the Company's performance unit activity follows:

	2018		2017		2016	
	Units	Weighted Average Grant-	Units	Weighted Average Grant-	Units	Weighted Average Grant-

		Date Fair		Date Fair		Date Fair
		Value		Value		Value
Performance units at January 1	226,558	$ 77.07	232,088	$ 62.68	175,675	$ 59.94
Granted	83,515	115.35	53,070	108.19	77,017	67.57
Vested (a)	(43,369)	71.19	(58,600)	56.08	(20,604)	57.58
Performance units at December 31	266,704	$ 90.01	226,558	$ 77.07	232,088	$ 62.68

(a) The total fair value of awards upon vesting for the years ended December 31, 2018, 2017, and 2016 was $5.4 million, $7.5 million, and $1.1 million, respectively. Upon vesting of the awards in 2018, 2017, and 2016, PCA issued 46,876 shares, 67,391 shares, and 21,111 shares, respectively. For 2018, 2017, and 2016, these amounts included 3,507 shares, 8,791 shares, and 507 shares, respectively, for dividends accrued during the vesting period.

Compensation Expense

Our share-based compensation expense is recorded in “Selling, general, and administrative expenses.” Compensation expense for share-based awards recognized in the Consolidated Statements of Income, net of forfeitures was as follows (dollars in millions):

	Year Ended December 31,		
	2018	2017	2016
Restricted stock	$18.6	$15.0	$15.8
Performance units	4.9	5.6	3.9
Impact on income before income taxes	23.5	20.6	19.7
Income tax benefit	(5.9)	(7.9)	(7.7)
Impact on net income	$17.6	$12.7	$12.0

The fair value of restricted stock is determined based on the closing price of the Company’s common stock on the grant date. As PCA’s Board of Directors has the ability to accelerate vesting of share-based awards upon an employee’s retirement, the Company accelerates the recognition of compensation expense for certain employees approaching normal retirement age.

For performance unit awards made in 2018, 50% used TSR as the performance measure and 50% used ROIC as the performance measure. All units awarded before 2018 used ROIC as the performance measure. The ROIC component of performance unit awards are valued based on the closing price of the stock on the grant date. As the ROIC component contains a performance condition, compensation expense, net of estimated forfeitures, is recorded over the requisite service period based on the most probable number of awards expected to vest. The TSR component of performance unit awards is valued using a Monte Carlo simulation as the TSR component contains a market condition. The Monte Carlo simulation estimates the fair value of the TSR component based on the expected term of the award, a risk-free interest rate, expected dividends, and expected volatility of the Company’s common stock and the common stock of the peer companies. Compensation expense is recorded ratably over the expected term of the award.

The unrecognized compensation expense for all share-based awards was as follows (dollars in millions):

	December 31, 2018	
	Unrecognized Compensation Expense	Remaining Weighted Average Recognition Period (in years)
Restricted stock	$31.7	2.4
Performance units	14.1	2.6
Total unrecognized share-based compensation expense	$45.8	2.5

We evaluate share-based compensation expense on a quarterly basis based on our estimate of expected forfeitures, review of recent forfeiture activity, and expected future turnover. We recognize the effect of adjusting the forfeiture rate for all expense amortization in the period that we change the forfeiture estimate. The effect of forfeiture adjustments was insignificant in all periods presented.

14. Derivative Instruments and Hedging Activities

Hedging Strategy

When appropriate, we use derivatives as a risk management tool to mitigate the potential impact of certain market risks. The primary risks managed by using derivative financial instruments are interest rate risks. We do not enter into derivative financial instruments for trading or speculative purposes.

Interest Rate Risk

The Company has used treasury lock derivative instruments to manage interest costs and the risk associated with changing interest rates. In connection with contemplated issuances of ten-year debt securities, PCA entered into interest rate protection agreements with counterparties in 2008, 2010, and 2011 to protect against increases in the ten-year U.S. Treasury Note rate. These treasury rates served as references in determining the interest rates applicable to the debt securities the

Company issued in March 2008, February 2011, and June 2012. As a result of changes in the interest rates on those treasury securities between the time PCA entered into the derivative agreements and the time PCA priced and issued the debt securities, the Company: (1) made a payment of $4.4 million to the counterparty upon settlement of the 2008 interest rate protection agreement on March 25, 2008; (2) received a payment of $9.9 million from the counterparties upon settlement of the 2010 interest rate protection agreements on February 4, 2011; and (3) made a payment of $65.5 million to the counterparty upon settlement of the 2011 interest rate protection agreement on June 26, 2012. The Company recorded the effective portion of the settlements in accumulated OCI, and these amounts are being amortized over the terms of the respective notes.

Derivative Instruments

The impact of derivative instruments on the consolidated statements of income and accumulated OCI was as follows (dollars in millions):

	Net Loss Recognized in Accumulated OCI (Effective Portion)	
	December 31,	
	2018	2017
Treasury locks, net of tax	$(10.2)	$(14.2)

	Loss Reclassified from Accumulated OCI into Income (Effective Portion)		
	Year Ended December 31,		
	2018	2017	2016
Amortization of treasury locks (included in interest expense, net and other)	$(5.3)	$(5.7)	$(5.7)

The net amount of settlement gains or losses on derivative instruments included in accumulated OCI to be amortized over the next 12 months is a net loss of $5.2 million ($3.9 million after-tax).

15. Stockholders' Equity
Dividends

During the year ended December 31, 2018, we paid $268.1 million of dividends to shareholders. On December 4, 2018, PCA's Board of Directors approved a regular quarterly cash dividend of $0.79 per share of common stock, which was paid on January 15, 2019 to shareholders of record as of December 17, 2018. The dividend payment was $74.7 million.

On May 15, 2018, PCA announced an increase of its quarterly cash dividend on its common stock from an annual payout of $2.52 per share to an annual payout of $3.16 per share. The first quarterly dividend of $0.79 per share was paid on July 13, 2018 to shareholders of record as of June 15, 2018.

Share Repurchase Program

On February 25, 2016, PCA announced that its Board of Directors authorized the repurchase of $200.0 million of the Company's outstanding common stock. Repurchases may be made from time to time in open market or privately negotiated transactions in accordance with applicable securities regulations. The timing and amount of repurchases will be determined by the Company in its discretion based on factors such as PCA’s stock price and market and business conditions.

The Company did not repurchase any shares of its common stock under this authority during the twelve months ended December 31, 2018 and 2017. Share repurchase activity in 2016 follows (in millions, except share and per share amounts).

		Weighted Average Price	
	Shares	Per Share	Total
2016	1,987,187	$ 50.49	$ 100.3

All shares repurchased have been retired. At December 31, 2018, $193.0 million of the authorized amount remained available for repurchase of the Company's common stock.

Accumulated Other Comprehensive Income (Loss)

Changes in AOCI, net of taxes, by component follows (dollars in millions). Amounts in parentheses indicate losses.

	Foreign Currency Translation Adjustments	Unrealized Loss On Treasury Locks, Net	Unrealized Loss on Foreign Exchange Contracts	Unfunded Employee Benefit Obligations	Total
Balance at December 31, 2017	$ (0.3)	$ (14.2)	$ (0.3)	$ (142.1)	$(156.9)
Other comprehensive income before reclassifications	—	—	—	2.4	2.4
Amounts reclassified from AOCI	(0.1)	4.0	—	11.8	15.7
Net current-period other comprehensive income	(0.1)	4.0	—	14.2	18.1
Balance at December 31, 2018	$ (0.4)	$ (10.2)	$ (0.3)	$ (127.9)	$(138.8)

The following table presents information about reclassifications out of AOCI (dollars in millions). Amounts in parentheses indicate expenses in the Consolidated Statements of Income.

	Amounts Reclassified from AOCI Year Ended December 31,		
Details about AOCI Components	2018	2017	
Unrealized loss on treasury locks, net (a)	$(5.3)	$(5.7)	
	1.3	2.2	Tax benefit
	$(4.0)	$(3.5)	Net of tax
Unfunded employee benefit obligations (b)			
Amortization of prior service costs	$(6.6)	$(5.6)	
Amortization of actuarial gains / (losses)	(9.2)	(7.5)	
	(15.8)	(13.1)	Total before tax
	4.0	4.9	Tax benefit
	$(11.8)	$(8.2)	Net of tax

(a) This AOCI component is included in interest expense, net and other. Amount relates to the amortization of the effective portion of treasury lock derivative instruments recorded in AOCI. The net amount of settlement gains or losses on derivative instruments included in AOCI to be amortized over the next 12 months is a net loss of $5.2 million ($3.9 million after-tax). For a discussion of treasury lock derivative instrument activity, see Note 14, Derivative Instruments and Hedging Activities, for additional information.

(b) These AOCI components are included in the computation of net pension and postretirement benefit costs. See Note 11, Employee Benefit Plans and Other Postretirement Benefits, for additional information.

16. Concentrations of Risk

Our Paper segment has had a long-standing commercial and contractual relationship with Office Depot, our largest customer in the paper business. This relationship exposes us to a significant concentration of business and financial risk. Our sales to Office Depot represented 7% of our total company sales for both 2018 and 2017 and about 47% and 43% of our Paper segment sales revenue for those periods, respectively. At December 31, 2018 and 2017, we had $66.7 million and $33.3 million of accounts receivable due from Office Depot, respectively, which represents 7% and 4% of our total Company receivables, respectively.

In 2018, sales to Office Depot represented 47% of our Paper segment sales. If these sales are reduced, we would need to find new customers. We may not be able to fully replace any lost sales, and any new sales may be at lower prices or higher costs. Any significant deterioration in the financial condition of Office Depot affecting its ability to pay or any other change that affects its willingness to purchase our products will harm our business and results of operations.

Labor

At December 31, 2018, we had approximately 15,000 employees and approximately 44% of these employees worked pursuant to collective bargaining agreements. Approximately 63% of our hourly employees are represented by unions. The majority of our unionized employees are represented by the United Steel Workers (USW), the International Brotherhood of Teamsters (IBT), the International Association of Machinists (IAM), and the Association of Western Pulp and Paper Workers

(AWPPW). Approximately 11% of our employees work pursuant to collective bargaining agreements that will expire within the next twelve months.

17. Transactions With Related Parties

Louisiana Timber Procurement Company, L.L.C. (LTP) is a variable-interest entity that is 50% owned by PCA and 50% owned by Boise Cascade Company (Boise Cascade). LTP procures sawtimber, pulpwood, residual chips, and other residual wood fiber to meet the wood and fiber requirements of PCA and Boise Cascade in Louisiana. PCA is the primary beneficiary of LTP and has the power to direct the activities that most significantly affect the economic performance of LTP. Therefore, we consolidate 100% of LTP in our financial statements in our Corporate and Other segment. The carrying amounts of LTP's assets and liabilities (which relate primarily to non-inventory working capital items) on our Consolidated Balance Sheets were both $2.7 million at December 31, 2018 and $3.0 million at December 31, 2017. For 2018, 2017, and 2016, we recorded $83.1 million, $86.4 million, and $86.9 million, respectively, of LTP sales to Boise Cascade in “Net Sales” in the Consolidated Statements of Income and approximately the same amount of expenses in “Cost of Sales”.

For 2018, 2017, and 2016, fiber purchases from related parties were $16.8 million, $16.6 million, and $17.2 million, respectively. Most of these purchases related to chip and log purchases by LTP from Boise Cascade's wood products business. These purchases are recorded in “Cost of Sales” in the Consolidated Statements of Income.

18. Segment Information

We report our business in three reportable segments: Packaging, Paper, and Corporate and Other. These segments represent distinct businesses that are managed separately because of differing products and services. Each of these businesses requires distinct operating and marketing strategies.

During the second quarter of 2018, the Company discontinued the production of uncoated free sheet and coated one-side grades at the Wallula, Washington mill and converted the No. 3 machine to a virgin kraft linerboard machine. Subsequent to the date of conversion in May 2018, operating results for the Wallula mill are primarily included in the Packaging segment.

Packaging. We manufacture and sell a wide variety of corrugated packaging products, including conventional shipping containers used to protect and transport manufactured goods, multi-color boxes and displays with strong visual appeal that help to merchandise the packaged product in retail locations. In addition, we are a large producer of packaging for meat, fresh fruit and vegetables, processed food, beverages, and other industrial and consumer products.

Paper. We manufacture and sell a range of white papers, including communication-based papers, and pressure sensitive papers. Our white papers can be manufactured as either commodity papers or specialty papers with specialized or custom features, such as colors, coatings, high brightness, or recycled content. Sales for market pulp decreased in 2016 as we ceased softwood market pulp operations at our Wallula, Washington mill with the permanent shutdown of the No.1 machine.

Corporate and Other. Our Corporate and Other segment includes corporate support staff services and related assets and liabilities, and foreign exchange gains and losses. This segment also includes transportation assets, such as rail cars and trucks, which we use to transport our products from some of our manufacturing sites and assets related to LTP. See Note 17, Transactions with Related Parties, for more information related to LTP. Sales in this segment relate primarily to LTP and our rail and truck business. We provide transportation services not only to our own facilities but also, on a limited basis, to third parties when geographic proximity and logistics are favorable. Rail cars and trucks are generally leased.

Each segments' profits and losses are measured on operating profits before interest expense, net and other and income taxes. For many of these allocated expenses, the related assets and liabilities remain in the Corporate and Other segment.

Segment sales to external customers by product line were as follows (dollars in millions):

	Year Ended December 31,		
	2018	2017	2016
Packaging sales			
Packaging sales	$5,938.5	$5,312.3	$4,584.8
Paper			
White papers	1,002.0	1,051.8	1,065.8
Market pulp	—	—	28.1
	1,002.0	1,051.8	1,093.9
Corporate and Other	74.1	80.8	100.3
	$7,014.6	$6,444.9	$5,779.0

Sales to foreign unaffiliated customers during the years ended December 31, 2018, 2017, and 2016 were $487.8 million, $390.3 million, and $289.5 million, respectively. At December 31, 2018 and 2017, we did not have any significant long-lived assets held by foreign operations.

An analysis of operations by reportable segment is as follows (dollars in millions):

	Sales, net			Operating		Depreciation, Amortization,	Capital	
Year Ended		Inter-		Income		and	Expenditures	
December 31, 2018	Trade	segment	Total	(Loss) (a)		Depletion	(l)	Assets
Packaging	$5,912.3	$26.2	$5,938.5	$1,045.4	(b)	$ 342.0	$ 504.0	$5,347.0
Paper	1,002.0	—	1,002.0	97.7	(c)	62.0	12.6	760.1
Corporate and Other	100.3	129.4	229.7	(75.4)	(d)	6.9	34.8	462.6
Intersegment eliminations	—	(155.6)	(155.6)	—		—	—	—
	$7,014.6	$—	$7,014.6	1,067.7		$ 410.9	$ 551.4	$6,569.7
Interest expense, net and other				(97.2)				
Income before taxes				$970.5				

	Sales, net			Operating		Depreciation, Amortization,	Capital	
Year Ended		Inter-		Income		and	Expenditures	
December 31, 2017	Trade	segment	Total	(Loss) (a)		Depletion	(l)	Assets
Packaging	$5,288.6	$23.7	$5,312.3	$950.3	(e)	$ 317.5	$ 305.1	$4,933.6
Paper	1,051.8	—	1,051.8	54.0	(f)	67.6	22.6	945.2
Corporate and Other	104.5	124.7	229.2	(71.8)	(g)	6.3	15.3	318.7
Intersegment eliminations	—	(148.4)	(148.4)	—		—	—	—
	$6,444.9	$—	$6,444.9	932.5		$ 391.4	$ 343.0	$6,197.5
Interest expense, net and other				(103.9)	(h)			

Income before taxes				$ 828.6			

Year Ended December 31, 2016	Sales, net Trade	Inter- segment	Total	Operating Income (Loss) (a)	Depreciation, Amortization, and Depletion	Capital Expenditures (l)	Assets
Packaging	$4,577.4	$7.4	$4,584.8	$ 718.5 (i)	$ 293.3	$ 239.9	$4,530.5
Paper	1,093.9	—	1,093.9	131.7 (j)	59.6	31.6	946.2
Corporate and Other	107.7	139.2	246.9	(66.9)(k)	5.1	2.8	300.3
Intersegment eliminations	—	(146.6)	(146.6)	—	—	—	—
	$5,779.0	$—	$5,779.0	783.3	$ 358.0	$ 274.3	$5,777.0
Interest expense, net and other				(94.8)			
Income before taxes				$ 688.5			

(a) Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost and applied this standard retrospectively to the prior period reflected herein. This new standard requires the presentation of non-service cost components of net periodic benefits expense to be shown separately outside the subtotal of operating income in the income statement. See Note 2, Summary of Significant Accounting Policies, for more information.

The components of our financial statements affected by the change in presentation of operating and non-operating pension expense as originally reported in 2017 and 2016 and as adjusted for the requirements per the new standard are as follows (dollars in millions):

	Year Ended December 31, 2017		Year Ended December 31, 2017
Segment income (loss)	As Reported	Non-Operating Pension Adjustment	Adjusted
Packaging	$ 943.7	$ 6.6	$ 950.3
Paper	61.5	(7.5)	54.0
Corporate	(74.0)	2.2	(71.8)
Income from operations	931.2	1.3	932.5
Interest expense, net and other	(102.6)	(1.3)	(103.9)
Income before taxes	$ 828.6	$ —	$ 828.6

	Year Ended December 31, 2016		Year Ended December 31, 2016
Segment income (loss)	As Reported	Non-Operating Pension Adjustment	Adjusted
Packaging	$ 711.1	$ 7.4	$ 718.5
Paper	138.1	(6.4)	131.7
Corporate	(68.9)	2.0	(66.9)
Income from operations	780.3	3.0	783.3
Interest expense, net and other	(91.8)	(3.0)	(94.8)
Income before taxes	$ 688.5	$ —	$ 688.5

(b) Includes the following:

- $12.3 million of charges related to the second quarter discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine.
- $1.6 million of charges consisting of closure costs related to corrugated products facilities.
- $0.5 million of costs for the property damage insurance deductible for a weather-related incident at one of the corrugated products facilities.
- $0.2 million of charges for acquisition and integration costs related to recent acquisitions.

(c) Includes $17.7 million of charges related to the second quarter discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine.

(d) Includes $0.2 million of charges consisting of closure costs related to a corporate administration facility.

(e) Includes the following:

- o $7.2 million of income, net, primarily related to the sale of land corresponding to the closure of a corrugated products facility, partially offset by closure costs related to corrugated products facilities, and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities.
- o $1.7 million of charges for acquisition and integration costs related to recent acquisitions.
- o $2.0 million gain related to the expiration of a repurchase option corresponding to timberland previously sold.
- o $1.6 million of income related to a working capital adjustment from the April 2015 sale of our Hexacomb corrugated manufacturing operations in Europe and Mexico.
- o $5.0 million of costs for the property damage and business interruption insurance deductible corresponding to the February 2017 explosion at our DeRidder, Louisiana mill.

(f) Includes $33.4 million of charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine and $0.4 million of charges related to the closure costs of a paper administration facility.

(g) Includes $1.0 million of charges related to the closure costs of a corporate administration facility and $0.7 million of income related to a working capital adjustment from the April 2015 sale of our Hexacomb corrugated manufacturing operations in Europe and Mexico.

(h) Includes $1.8 million of expense related to the write-off of deferred debt issuance costs in connection with the December 2017 debt refinancing.

(i) Includes $10.2 million of closure costs related to corrugated product facilities and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities and $4.2 million of acquisition-related costs for recent acquisitions.

(j) Includes $2.7 million of costs related to ceased softwood market pulp operations at our Wallula, Washington mill and the permanent shut down of the No.1 machine and $1.7 million of closure costs related to a paper products facility.
(k) Includes $0.3 million of acquisition-related costs related to recent acquisitions.
(l) Includes "Additions to property, plant, and equipment" and excludes cash used for "Acquisitions of businesses, net of cash acquired" as reported on our Consolidated Statements of Cash Flows.

19. Commitments, Guarantees, Indemnifications, and Legal Proceedings

We have financial commitments and obligations that arise in the ordinary course of our business. These include long-term debt (discussed in Note 10, Debt), capital commitments, lease obligations, purchase commitments for goods and services, and legal proceedings (discussed below).

Capital Commitments

The Company had capital commitments of approximately $112.8 million and $281.3 million as of December 31, 2018 and 2017, respectively, in connection with the expansion and replacement of existing facilities and equipment.

Lease Obligations

PCA leases space for certain facilities, cutting rights to approximately 75,000 acres of timberland, land for a fiber farm, and equipment, primarily vehicles and rolling stock. Remaining lease terms average four years and may contain renewal options or escalation clauses. Substantially all lease agreements have fixed payment terms based on the passage of time. Some lease agreements provide us with the option to purchase the leased property. Additionally, some agreements contain renewal options averaging approximately six years. Some leases may require the Company to pay executory costs, which may include property taxes, maintenance and insurance. The minimum lease payments under non-cancelable operating leases with lease terms in excess of one year were as follows (dollars in millions):

2019	$70.1
2020	58.7
2021	47.4
2022	29.9
2023	17.8
Thereafter	46.4
Total	$270.3

Total lease expense, including base rent on all leases and executory costs, such as insurance, taxes, and maintenance, for the years ended December 31, 2018, 2017, and 2016, was $115.1 million, $100.6 million and $88.3 million, respectively. These costs are included in "Cost of sales" and "Selling, general, and administrative expenses" in our Consolidated Statements of Income. We had no sublease rental income for the years ended December 31, 2018 and 2017 and an insignificant amount of sublease rental income in the year ended December 31, 2016.

PCA was obligated under capital leases covering buildings and machinery and equipment in the amount of $19.0 million and $20.3 million at December 31, 2018 and 2017, respectively. Assets held under capital lease obligations were included in property, plant, and equipment as follows (dollars in millions):

	Year Ended December 31,	
	2018	2017
Buildings	$0.3	$0.3
Machinery and equipment	28.5	28.5
Total	28.8	28.8
Less accumulated amortization	(16.7)	(15.2)
Total	$12.1	$13.6

Amortization of assets under capital lease obligations is included in depreciation expense.

The future minimum payments under capitalized leases at December 31, 2018 were as follows (dollars in millions):

2019	$2.7
2020	2.7
2021	2.7
2022	2.7
2023	2.7
Thereafter	12.4
Total minimum capital lease payments	25.9
Less amounts representing interest	(6.9)
Present value of net minimum capital lease payments	19.0
Less current maturities of capital lease obligations	(1.4)
Total long-term capital lease obligations	$17.6

Interest expense related to capital lease obligations for the years ended December 31, 2018, 2017, and 2016 was $1.3 million, $1.4 million, and $1.5 million, respectively.

Purchase Commitments

In the table below, we set forth our enforceable and legally binding purchase obligations as of December 31, 2018. Some of the amounts are based on management's estimates and assumptions about these obligations, including their duration, the possibility of renewal, anticipated actions by third parties, and other factors. Because these estimates and assumptions are necessarily subjective, our actual payments may vary from those reflected in the table. Purchase orders made in the ordinary course of business are excluded below. Any amounts for which we are liable under purchase orders are reflected on the Consolidated Balance Sheets as accounts payable and accrued liabilities. These obligations relate to various purchase agreements for items such as minimum amounts of energy and fiber purchases over periods ranging from one year to 22 years. Total purchase commitments were as follows (dollars in millions):

2019	$75.3
2020	48.6
2021	43.1
2022	42.6
2023	43.7
Thereafter	117.5
Total	$370.8

The Company purchased a total of $341.9 million, $339.1 million, and $362.0 million during the years ended December 31, 2018, 2017, and 2016, respectively, under these purchase agreements.

Environmental Liabilities

The potential costs for various environmental matters are uncertain due to such factors as the unknown magnitude of possible cleanup costs, the complexity and evolving nature of governmental laws and regulations and their interpretations, and the timing, varying costs and effectiveness of alternative cleanup technologies. From 2006 through 2018, there were no significant environmental remediation costs at PCA's mills and corrugated plants. At December 31, 2018, the Company had $27.3 million of environmental-related reserves recorded on its Consolidated Balance Sheet. Of the $27.3 million, approximately $18.3 million related to environmental-related asset retirement obligations discussed in Note 12, Asset Retirement Obligations, and $9.0 million related to our estimate of other environmental contingencies. The Company recorded $5.0 million in “Accrued liabilities” and $22.3 million in “Other long-term liabilities” on the Consolidated Balance Sheet. Liabilities recorded for environmental contingencies are estimates of the probable costs based upon available information and assumptions. Because of these uncertainties, PCA’s estimates may change. The Company believes that it is not reasonably possible that future environmental expenditures for remediation costs and asset retirement obligations above the $27.3 million accrued as of December 31, 2018, will have a material impact on its financial condition, results of operations, or cash flows.

Guarantees and Indemnifications

We provide guarantees, indemnifications, and other assurances to third parties in the normal course of our business. These include tort indemnifications, environmental assurances, and representations and warranties in commercial agreements. At December 31, 2018, we are not aware of any material liabilities arising from any guarantee, indemnification, or financial assurance we have provided. If we determined such a liability was probable and subject to reasonable determination, we would accrue for it at that time.

DeRidder Mill Incident

On February 8, 2017, a tank located in the pulp mill at the Company's DeRidder, Louisiana facility exploded, resulting in three contractor fatalities and other injuries. The Company has been served with multiple lawsuits involving the decedents and other allegedly injured parties, alleging negligence on the part of the Company and claiming compensatory and punitive damages. The Company is vigorously defending these lawsuits. The Company believes that these suits are covered by its liability insurance policies, subject to an aggregate $1.0 million deductible. The incident remains under investigation and all lawsuits are in the early stages. Accordingly, the Company is unable to estimate a range of reasonable possible losses at this time.

The Company has also incurred property damage and business interruption losses and has claimed these losses, subject to a $5.0 million deductible, under its property damage and business interruption insurance policy. As of December 31, 2017, the Company finalized the claim with the insurance carrier and received $17.0 million in insurance proceeds during the first quarter of 2018. The insurance proceeds are included in net cash provided by operating activities ($14.5 million) and in net cash used for investing activities ($2.5 million) based on the nature of the reimbursement.

The Company has cooperated with investigations from the U.S. Occupational Health and Safety Administration (OSHA), the U.S. Chemical Safety Board (CSB) and the U.S. Environmental Protection Agency (EPA). The U.S. Chemical Safety Board completed its investigation and issued its report during the second quarter of 2018. The Company settled with OSHA during the second quarter of 2018 and paid approximately $40,000 in penalties for citations. The EPA investigation is ongoing.

Legal proceedings

We are also a party to various legal actions arising in the ordinary course of our business. These legal actions include commercial liability claims, premises liability claims, and employment-related claims, among others. As of the date of this filing, we believe it is not reasonably possible that any of the legal actions against us will, either individually or in the aggregate, have a material adverse effect on our financial condition, results of operations, or cash flows.

20. Quarterly Results of Operations (unaudited, dollars in millions, except per-share and stock price information)

2018:	First (b)	Second (c)	Third (d)	Fourth (e)	Total
Net sales	$1,690.6	$1,767.5	$1,809.9	$1,746.6	$7,014.6
Gross profit	356.1	420.6	443.2	425.4	1,645.3
Income from operations	212.9	269.6	298.5	286.7	1,067.7
Net income	140.1	186.6	206.7	204.6	738.0
Basic earnings per share	1.48	1.98	2.19	2.17	7.82
Diluted earnings per share	1.48	1.97	2.18	2.16	7.80
Stock price - high	131.13	124.70	118.88	110.62	131.13
Stock price - low	109.04	107.96	107.39	77.90	77.90

2017:	First (f)	Second (g)	Third (h)	Fourth (i)	Total
Net sales	$1,536.5	$1,584.0	$1,640.1	$1,684.3	$6,444.9
Gross profit (a)	338.2	364.3	397.0	371.4	1,470.8
Income from operations (a)	203.4	234.1	242.6	252.3	932.5
Net income	117.4	143.2	139.1	268.9	668.6
Basic earnings per share	1.25	1.52	1.47	2.85	7.09
Diluted earnings per share	1.24	1.52	1.47	2.84	7.07
Stock price - high	96.87	113.52	119.43	121.38	121.38
Stock price - low	84.01	89.73	105.81	108.49	84.01

Note: The sum of the quarters may not equal the total of the respective year's earnings per share on either a basic or diluted basis due to changes in the weighted average shares outstanding throughout the year.

(a) Effective January 1, 2018, the Company adopted ASU 2017-07, Compensation: Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost and applied this standard retrospectively to the prior period reflected herein. This new standard requires the presentation of non-service cost components of net periodic benefits expense to be shown separately outside the subtotal of operating income in the income statement. See Note 2, Summary of Significant Accounting Policies, for more information.

The components of our financial statements affected by the change in presentation of operating and non-operating pension expense as originally reported in 2017 and as adjusted for the requirements per the new standard are as follows (dollars in millions):

First quarter, 2017	As Reported	Non-Operating Pension Adjustment	Adjusted
Gross profit	$338.5	$ (0.3)	$338.2
Income from operations	203.1	0.3	203.4
Second quarter, 2017			
Gross profit	$364.6	$ (0.3)	$364.3

Income from operations	233.8	0.3	234.1
Third quarter, 2017			
Gross profit	$ 397.3	$ (0.3)	$ 397.0
Income from operations	242.3	0.3	242.6
Fourth quarter, 2017			
Gross profit	$ 371.7	$ (0.3)	$ 371.4
Income from operations	252.0	0.3	252.3
Full year 2017			
Gross profit	$ 1,472.2	$ (1.4)	$ 1,470.8
Income from operations	931.2	1.3	932.5

(b) Includes $0.3 million of charges consisting of closure costs related to corrugated products facilities and a corporate administration facility ($0.2 million after-tax or $0.0 per diluted share) and $8.8 million of charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine ($6.6 million after-tax or $0.07 per diluted share).

(c) Includes $0.2 million of charges consisting of closure costs related to corrugated products facilities and a corporate administration facility ($0.2 million after-tax and $0.0 per diluted share) and $13.6 million of charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine ($10.2 million after-tax or $0.11 per diluted share).

(d) Includes $4.0 million of charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine ($2.9 million after-tax or $0.04 per diluted share) and $1.3 million of charges consisting of closure costs related to corrugated products facilities and a corporate administration facility ($1.0 million after-tax or $0.01 per diluted share). Also includes $0.5 million of costs for the property damage insurance deductible for a weather-related incident at one of the corrugated products facilities ($0.4 million after-tax or $0.0 per diluted share) and $0.1 million of charges for acquisition and integration costs related to recent acquisitions ($0.01 million after-tax or $0.0 per diluted share).

(e) Includes $3.6 million of charges related to the second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula, Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine ($2.7 million after-tax or $0.03 per diluted share) and $0.1 million of charges for acquisition and integration costs related to recent acquisitions ($0.1 million after-tax or $0.0 per diluted share). Also includes $2.0 million of income tax benefit for the re-measurement of our net deferred tax liability to our 2017 measurement period adjustments in accordance with SEC Staff Accounting Bulletin No. 118 (SAB 118), Income Tax Accounting Implications of the Tax Cuts and Jobs Act ($0.02 per diluted share).

(f) Includes $0.6 million of charges related to the closure of corrugated products facilities and lump sum settlement of a multiemployer pension plan withdrawal liability for one of corrugated products facilities ($0.4 million after-tax or $0.01 per diluted share) and $0.2 million of charges for integration costs related to recent acquisitions ($0.1 million after-tax or $0.0 per diluted share). Also includes $5.0 million of costs for the property damage and business interruption insurance deductible corresponding to the February 2017 explosion at our DeRidder, Louisiana mill ($3.1 million after-tax or $0.03 per diluted share) and $2.3 million of income related to a working capital adjustment from the April 2015 sale of our Hexacomb corrugated manufacturing operations in Europe and Mexico ($1.4 million after-tax or $0.01 per diluted share).

(g) Includes $0.3 million of charges related to the closure of corrugated products facilities ($0.3 million after-tax or $0.0 per diluted share) and $0.2 million of charges for integration costs related to recent acquisitions ($0.1 after-tax or $0.0 per diluted share).

(h) Includes $0.9 million of charges related to the closure of corrugated products facilities, a paper administration facility, and a lump sum settlement of a multiemployer pension plan withdrawal liability for one of our corrugated products facilities ($0.6 million after-tax or $0.01 per diluted share) and $0.5 million of charges for acquisition and integration costs related to recent acquisitions ($0.3 million after-tax or $0.0 per diluted share). Also includes $25.3 million of charges related to the announced second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine ($15.5 million after-tax or $0.16 per diluted share) and $3.3 million of tax expense for the change in value of deferred taxes as a result of an internal legal entity consolidation that will simplify future operating activities ($0.04 per diluted share).

(i) Includes $7.6 million of income primarily related to the sale of land corresponding to the closure of a corrugated products facility, partially offset by closure costs related to corrugated products facilities, a paper administration facility, and a corporate administration facility ($4.7 million after-tax or $0.05 per diluted share) and $0.9 million of charges for acquisition and integration costs related to recent acquisitions ($0.5 million after-tax or $0.01 per diluted share), and $8.0 million of charges related to the announced second quarter 2018 discontinuation of uncoated free sheet and coated one-side grades at the Wallula Washington mill associated with the conversion of the No. 3 paper machine to a high-performance 100% virgin kraft linerboard machine ($4.6 million after-tax or $0.05 per diluted share). Also includes $1.8 million of expense related to the write-off of deferred debt issuance costs in connection with the December 2017 debt refinancing ($1.1 million after-tax or $0.01 per diluted share), $2.0 million gain related to the expiration of a repurchase option corresponding to timberland previously sold ($1.2 million after-tax or $0.01 per diluted share), and $122.1 million of estimated income tax benefit related to the enactment in December 2017 of the Tax Cuts and Jobs Act (H.R.1) primarily for the re-measurement of our net deferred tax liability as a result of the reduction in the U.S. corporate income tax rate ($1.29 per diluted share).

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

Not applicable.

Item 9A. CONTROLS AND PROCEDURES

Controls and Procedures

PCA maintains disclosure controls and procedures (as defined in Rule 13a-15(e) of the Securities Exchange Act of 1934) that are designed to provide reasonable assurance that information required to be disclosed in PCA's filings under the Securities Exchange Act is recorded, processed, summarized and reported within the periods specified in the rules and forms of the SEC and that such information is accumulated and communicated to PCA's management, including its Chief Executive Officer and Chief Financial Officer, as appropriate, to allow timely decisions regarding required disclosure.

Prior to filing this report, PCA completed an evaluation under the supervision and with the participation of PCA's management, including PCA's Chief Executive Officer and Chief Financial Officer, of the effectiveness of the design and operation of PCA's disclosure controls and procedures as of December 31, 2018. The evaluation of PCA's disclosure controls and procedures included a review of the controls' objectives and design, PCA's implementation of the controls and the effect of the controls on the information generated for use in this report. Based on this evaluation, PCA's Chief Executive Officer and Chief Financial Officer concluded that PCA's disclosure controls and procedures were effective at the reasonable assurance level as of December 31, 2018.

During the quarter ended December 31, 2018, there were no changes in internal controls over financial reporting that have materially affected, or are reasonably likely to materially affect, PCA's internal control over financial reporting.

Management's Report on Internal Control Over Financial Reporting

PCA's management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rule 13a-15(f). Internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the Company's assets; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures are being made only with proper authorizations; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the Company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, PCA's internal control over financial reporting may not prevent or detect misstatements. A control system, no matter how well conceived and operated, can provide only reasonable, not absolute, assurance that objectives of the control system are met. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, have been detected. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls become inadequate because of changes in conditions, or that the degree of compliance with the policies and procedures may deteriorate.

PCA's management, under the supervision of and with the participation of the Chief Executive Officer and Chief Financial Officer, assessed the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control - Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on this assessment, PCA's management concluded that its internal control over financial reporting was effective as of December 31, 2018, based on the specified criteria.

KPMG LLP, the independent registered public accounting firm that audited PCA's financial statements included in this Form 10-K, has also audited the effectiveness of the Company's internal control over financial reporting. Their attestation report precedes PCA's audited financial statements included elsewhere in this report.

Item 9B. OTHER INFORMATION
None.

PART III

Item 10. DIRECTORS, EXECUTIVE OFFICERS, AND CORPORATE GOVERNANCE

Information regarding PCA’s executive officers required by this Item 10 is set forth in Item 1 of Part I of this report under the caption “Executive Officers of the Registrant.”

The following information required by this Item 10 will be included in PCA’s Proxy Statement for the 2019 Annual Meeting of Stockholders and is incorporated by reference herein:

- Information regarding PCA’s directors included under the caption “Election of Directors”
- Information regarding PCA’s Audit Committee and financial experts included under the caption “Election of Directors - Audit Committee”
- Information regarding PCA’s code of ethics included under the caption “Election of Directors - Code of Ethics”
- Information regarding PCA’s stockholder nominating procedures included under the captions “Election of Directors - Nominating and Governance Committee,” “Other Information - Recommendations for Board - Nominated Director Nominees,” and “Other Information - Procedures for Nominating Directors or Bringing Business Before the 2019 Annual Meeting”
- Information regarding compliance with Section 16(a) of the Securities Exchange Act of 1934 included under the caption “Section 16(a) Beneficial Ownership Reporting Compliance”

Item 11. EXECUTIVE COMPENSATION

Information with respect to executive compensation required by this Item 11 will be included in PCA’s Proxy Statement under the captions “Compensation Discussion and Analysis,” “Executive Officer and Director Compensation” (including all subcaptions and tables thereunder) and “Board Committees - Compensation Committee” and is incorporated herein by reference.

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

Information with respect to security ownership of certain beneficial owners and management required by this Item 12 will be included in PCA’s Proxy Statement under the caption “Ownership of Our Stock” and is incorporated herein by reference.

Authorization of Securities under Equity Compensation Plans — Securities authorized for issuance under our equity compensation plans at December 31, 2018 are as follows:

Plan Category	Column A Number of Securities to Be Issued Upon Exercise	B Weighted Average Exercise Price of Outstanding Options, Warrants, and Rights	C Number of Securities Remaining Available for Future Issuance Under Equity Compensation Plans (Excluding Securities

	of Outstanding Options, Warrants, and Rights (a)		Reflected in Column A)
Equity compensation plans approved by securityholders	—	$ —	741,765
Equity compensation plans not approved by securityholders	N/A	N/A	N/A
Total	—	$ —	741,765

(a) Does not include 1,010,295 shares of unvested restricted stock and performance units granted pursuant to our Amended and Restated 1999 Long-Term Equity Incentive Plan.

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

Information with respect to certain relationships and related transactions and director independence required by this Item 13 will be included in PCA’s Proxy Statement under the captions “Transactions with Related Persons” and “Election of Directors - Determination of Director Independence,” respectively, and is incorporated herein by reference.

Item 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

Information with respect to fees and services of the principal accountant required by this Item 14 will be included in PCA’s Proxy Statement under the caption “Ratification of Appointment of the Independent Registered Public Accounting Firm” under the subcaptions “- Fees to the Independent Registered Public Accounting Firm” and “- Audit Committee Preapproval Policy for Audit and Non-Audit Fees” and are incorporated herein by reference.

PART IV

Item 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

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

(1) The financial statements listed in the “Index to Financial Statements.”

(2) Financial Statement Schedule.

All schedules for which provision is made in the applicable accounting regulations of the Securities and Exchange Commission are not required under the related instructions, are inapplicable or not material, or the information called for thereby is otherwise included in the financial statements or the accompanying notes to the financial statements and therefore, have been omitted.

(3) Exhibits

Exhibit Number Description

2.1 Contribution Agreement, dated as of January 25, 1999, among Pactiv Corporation (formerly known as Tenneco Packaging Inc.) (“Pactiv”), PCA Holdings LLC (“PCA Holdings”) and Packaging Corporation of America (“PCA”). (Incorporated herein by reference to Exhibit 2.1 to PCA’s registration Statement on Form S-4, Registration No. 333-79511).

2.2 Letter Agreement Amending the Contribution Agreement, dated as of April 12, 1999, among Pactiv, PCA Holdings and PCA. (Incorporated herein by reference to Exhibit 2.2 to PCA’s Registration Statement on Form S-4, Registration No. 333-79511).

2.3 Agreement and Plan of Merger, dated September 16, 2013, between PCA, Bee Acquisition Corp. and Boise Inc. (Incorporated herein by reference to Exhibit 2.1 to PCA’s Current Report on Form 8-K filed September 17, 2013, File No. 1-15399). PCA will furnish supplementally a copy of any omitted schedule or exhibit to the SEC upon request; provided, however, that PCA may request confidential treatment pursuant to Rule 24b-2 of the Securities Exchange Act of 1934, as amended, for any schedule or exhibit so furnished.

3.1 Restated Certificate of Incorporation of PCA. (Incorporated herein by reference to Exhibit 3.1 to PCA’s Registration Statement on Form S-4, Registration No. 333-79511).

3.2 Certificate of Amendment to Restated Certificate of Incorporation of PCA. (Incorporated herein by reference to Exhibit 3.2 to PCA’s Registration Statement on Form S-4, Registration No. 333-109437.)

3.3 Amended and Restated By-laws of PCA. (Incorporated herein by reference to Exhibit 3.1 to PCA’s Current Report on Form 8-K filed December 7, 2012, File No. 1-15399.)

4.1 Form of certificate representing shares of common stock. (Incorporated herein by reference to Exhibit 4.9 to PCA’s Registration Statement on Form S-1, Registration No. 333-86963.)

4.2 Indenture, dated as of July 21, 2003, between PCA and U.S. Bank National Association. (Incorporated herein by reference to Exhibit 4.2 to PCA’s Quarterly Report on Form 10-Q for the period ended June 30, 2003, File No. 1-15399.)

4.3

First Supplemental Indenture, dated as of July 21, 2003, between PCA and U.S. Bank National Association. (Incorporated herein by reference to Exhibit 4.3 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2003, File No. 1-15399.)

4.4 Officers' Certificate, dated as of June 26, 2012, pursuant to Section 301 of the Indenture and 3.90% Senior Notes due 2022. (Incorporated herein by reference to Exhibit 4.2 to PCA's Current Report on Form 8-K filed June 26, 2012, File No. 1-15399.)

4.5 Officers' Certificate, dated as of October 22, 2013, pursuant to Section 301 of the Indenture. (Incorporated herein by reference to Exhibit 4.1 to PCA's Current Report on Form 8-K filed October 22, 2013, File No 1-15399.)

4.6 4.500% Senior Notes due 2023. (Incorporated herein by reference to Exhibit 4.2 to PCA's Current Report on Form 8-K filed October 22, 2013, File No 1-15399.)

Exhibit Number	Description
4.7	Officers' Certificate, dated September 5, 2014, pursuant to Section 301 of the Indenture. (Incorporated herein by reference to Exhibit 4.1 to PCA's Current Report on Form 8-K filed September 5, 2014, File No. 1-15399).
4.8	3.650% Senior Notes due 2024 (Incorporated herein by reference to Exhibit 4.2 to PCA's Current Report on Form 8-K filed September 5, 2014, File No. 1-15399).
4.9	Officer's Certificate, dated December 13, 2017, pursuant to Section 301 of the Indenture. (Incorporated herein by reference to Exhibit 4.1 to PCA's Current Report on Form 8-K filed December 13, 2017, File No. 1-15399).
4.10	2.450% Senior Notes due 2020 (Incorporated herein by reference to Exhibit 4.2 to PCA's Current Report on Form 8-K filed December 13, 2017, File No. 1-15399).
4.11	3.400% Senior Notes due 2027 (Incorporated herein by reference to Exhibit 4.3 to PCA's Current Report on Form 8-K filed December 13, 2017, File No. 1-15399).
10.1	Amended and Restated Credit Agreement, dated as of August 29, 2016, by and among PCA and the lenders and agents named therein. (Incorporated herein by reference to Exhibit 10.1 to PCA's Current Report on Form 8-K filed September 1, 2016, File No. 1-15399.)
10.2	Packaging Corporation of America Thrift Plan for Hourly Employees and First Amendment of Packaging Corporation of America Thrift Plan for Hourly Employees, effective February 1, 2000. (Incorporated herein by reference to Exhibit 4.5 to PCA's Registration Statement on Form S-8, Registration No. 333-33176.)
10.3	Packaging Corporation of America Retirement Savings Plan, effective February 1, 2000. (Incorporated herein by reference to Exhibit 4.6 to PCA's Registration Statement on Form S-8, Registration No. 333-33176.)*
10.4	Packaging Corporation of America Supplemental Executive Retirement Plan, as Amended and Restated Effective as of January 1, 2005. (Incorporated herein by reference to Exhibit 10.31 to PCA's Annual Report on Form 10-K for the year ended December 31, 2006, File No. 1-15399.)*
10.5	Packaging Corporation of America Deferred Compensation Plan, effective as of January 1, 2009, conformed to incorporate all amendments. (Incorporated herein by reference to Exhibit 10.6 to PCA's Annual Report on Form 10-K for the year ended December 31, 2016, File No. 1-15399.)*
10.6	First Amendment of Packaging Corporation of America Supplemental Executive Retirement Plan, effective as of January 1, 2008. (Incorporated herein by reference to Exhibit 10.17 to PCA's Annual Report on Form 10-K for the year ended December 31, 2008, file No. 1-15399.)*
10.7	Amended and Restated 1999 Long-Term Equity Incentive Plan, effective as of May 1, 2013, conformed to incorporate all amendments. (Incorporated herein by reference to Exhibit 10.8 to PCA's Annual Report on Form 10-K for the year ended December 31, 2016, File No. 1-15399.)*
10.8	

Amended and Restated Executive Incentive Compensation Plan, effective as of December 29, 2017. (Incorporated herein by reference to Exhibit 10.10 to PCA's Annual Report on Form 10-K for the year ended December 31, 2017, File No. 1-15399.)*

10.9 Second Amendment of Packaging Corporation of America Supplemental Executive Retirement Plan, effective as of February 28, 2013. (Incorporated herein by reference to Exhibit 10.22 to PCA's Annual Report on Form 10-K for the year ended December 31, 2012, File No. 1-15399.)*

10.10 Third Amendment of Packaging Corporation of America Supplemental Executive Retirement Plan, effective as of February 28, 2013. (Incorporated herein by reference to Exhibit 10.23 to PCA's Annual Report on Form 10-K for the year ended December 31, 2012, File No. 1-15399.) *

10.11 Form of Restricted Stock Agreement for executive officer awards made in June 2017. (Incorporated by reference to Exhibit 10.1 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2017, File No. 1-15399).*

Exhibit
Number Description

10.12 Form of Performance Unit Agreement for executive officer awards made in June 2017. (Incorporated by reference to Exhibit 10.2 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2017, File No. 1-15399).*

10.13 Performance Based Equity Award Pool for Executive Officers relating to awards made in June 2017. (Incorporated by reference to Exhibit 10.3 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2017, File No. 1-15399).*

10.14 Paper Purchase Agreement, dated June 25, 2011 (the "Paper Purchase Agreement"), between Boise White Paper, L.L. C. and OfficeMax Incorporated (Incorporated by reference to Exhibit 10.1 to Boise, Inc.'s Quarterly Report on Form 10-Q for the period ended June 30, 2013, File No. 1-33541)**

10.15 First Amendment to Paper Purchase Agreement, dated June 20, 2013, between Boise White Paper, L.L.C. and OfficeMax Incorporated (Incorporated by reference to Exhibit 10.2 to Boise, Inc.'s Quarterly Report on Form 10-Q for the period ended June 30, 2013, File No. 1-33541)**

10.16 Second Amendment to Paper Purchase Agreement, effective January 1, 2015 and executed and delivered August 19, 2015, between Boise White Paper, L.L.C. and Office Depot Inc. (Incorporated by reference to Exhibit 10.1 to PCA's Quarterly Report on Form 10-Q for the period ended September 30, 2015, File No. 1-33541)**

10.17 Form of Performance Unit Agreement for executive officer awards made in June 2014. (Incorporated by reference to Exhibit 10.1 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2014, File No. 1-15399).*

10.18 Form of Restricted Stock Agreement for executive officer awards made in June 2014. (Incorporated by reference to Exhibit 10.2 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2014, File No. 1-15399).*

10.19 Form of Performance Unit Agreement for executive officer awards made in June 2015. (Incorporated by reference to Exhibit 10.1 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2015, File No. 1-15399).*

10.20 Form of Restricted Stock Agreement for executive officer awards made in June 2015. (Incorporated by reference to Exhibit 10.2 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2015, File No. 1-15399).*

10.21 Form of Performance Unit Agreement for executive officer awards made in June 2016. (Incorporated by reference to Exhibit 10.2 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2016, File No. 1-15399).*

10.22 Form of Restricted Stock Agreement for executive officer awards made in June 2016. (Incorporated by reference to Exhibit 10.1 to PCA's Quarterly Report on Form 10-Q for the period ended June 30, 2016, File No. 1-15399).*

10.23

Form of Return on Invested Capital Performance Unit Agreement for executive officer awards made in June 2018. (Incorporated by reference to Exhibit 10.2 to PCA’s Quarterly Report on Form 10-Q for the period ended June 30, 2018, File No. 1-15399).*

10.24 Form of Total Shareholder Return Performance Unit Agreement for executive officer awards made in June 2018. (Incorporated by reference to Exhibit 10.3 to PCA’s Quarterly Report on Form 10-Q for the period ended June 30, 2018, File No. 1-15399).*

10.25 Form of Restricted Stock Agreement for executive officer awards made in and after June 2018. (Incorporated by reference to Exhibit 10.1 to PCA’s Quarterly Report on Form 10-Q for the period ended June 30, 2018, File No. 1-15399).*

21.1 Subsidiaries of the Registrant.†

23.1 Consent of KPMG LLP.†

24.1 Powers of Attorney.†

31.1 Certification of Chief Executive Officer, As Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.†

31.2 Certification of Chief Financial Officer, As Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.†

Exhibit Number	Description
32	Certification of Chief Executive Officer and Chief Financial Officer Pursuant to 18 U.S.C. §1350, As Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.†
101	The following financial information from Packaging Corporation of America's Annual Report on Form 10-K for the year ended December 31, 2018, formatted in XBRL (eXtensible Business Reporting Language): (i) Consolidated Statements of Income for the years ended December 31, 2018, 2017, and 2016, (ii) Consolidated Balance Sheets at December 31, 2018 and 2017, (iii) Consolidated Statements of Cash Flows for the years ended December 31, 2018, 2017, and 2016, (iv) Consolidated Statements of Changes in Stockholders' Equity for the years ended December 31, 2018, 2017, and 2016, (v) the Notes to Consolidated Financial Statements, and (vi) Financial Statement Schedule-Valuation and Qualifying Accounts.

* Management contract or compensatory plan or arrangement.
** Confidential information in this exhibit has been omitted and filed separately with the Securities and Exchange Commission pursuant to a confidential treatment request under Rule 406 of the Securities Act of 1933, as amended.
† Filed herewith.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrants have duly caused this report to be signed on their behalf by the undersigned, thereunto duly authorized on February 28, 2019.

Packaging Corporation of America

/s/ MARK W. KOWLZAN
Mark W. Kowlzan
Chairman of the Board and Chief Executive Officer

/s/ ROBERT P. MUNDY
Robert P. Mundy
Senior Vice President and Chief Financial Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below on February 28, 2019, by the following persons on behalf of the registrants and in the capacities indicated.

Signature	Capacity
/s/ MARK W. KOWLZAN Mark W. Kowlzan	Chairman of the Board and Chief Executive Officer (Principal Executive Officer)
/s/ ROBERT P. MUNDY Robert P. Mundy	Senior Vice President and Chief Financial Officer (Principal Financial and Accounting Officer)
* Cheryl K. Beebe	Director
* Duane Farrington	Director
* Hasan Jameel	Director
* Robert C. Lyons	Director
* Thomas P. Maurer	Director
* Samuel M. Mencoff	Director
* Roger B. Porter	Director
* Thomas S. Souleles	Director
* Paul T. Stecko	Director
* James D. Woodrum	Director

/s/ ROBERT P. MUNDY
Robert P. Mundy

(Attorney-In-Fact)