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, 2016 | Commission File Number 1-1687

PPG INDUSTRIES, INC.

(Exact name of registrant as specified in its charter)

Pennsylvania	25-0730780
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
One PPG Place, Pittsburgh, Pennsylvania	15272
(Address of principal executive offices)	**(Zip code)**

Registrant's telephone number, including area code: 412-434-3131

Securities Registered Pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
Common Stock – Par Value $1.66 2/3	New York Stock Exchange
0.000% Notes due 2019	New York Stock Exchange
0.875% Notes due 2022	New York Stock Exchange
0.875% Notes due 2025	New York Stock Exchange
1.400% Notes due 2027	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, and (2) has been subject to such filing requirements for the past 90 days. YES ☒ NO ☐

Indicate by checkmark whether the registrant has submitted electronically and posted on its corporate web site, if any, every Interactive Date File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). YES ☒ NO ☐

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

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of "large accelerated filer," "accelerated filer" and "smaller reporting company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ☒	Accelerated filer ☐
Non-accelerated filer ☐ (Do not check if a smaller reporting company)	Smaller reporting company ☐

Indicate by check mark whether the Registrant is a shell company (as defined by Rule 12b-2 of the Act). YES ☐ NO ☒

The aggregate market value of common stock held by non-affiliates as of June 30, 2016 , was $27,771 million .

As of January 31, 2017, 257,094,500 shares of the Registrant's common stock, with a par value of $1.66 2/3 per share, were outstanding. As of that date, the aggregate market value of common stock held by non-affiliates was $25,682 million .

DOCUMENTS INCORPORATED BY REFERENCE

Document	Incorporated By Reference In Part No.
Portions of PPG Industries, Inc. Proxy Statement for its 2017 Annual Meeting of Shareholders	III

PPG INDUSTRIES, INC.
AND CONSOLIDATED SUBSIDIARIES

As used in this report, the terms "PPG," "Company," "Registrant," "we," "us" and "our" refer to PPG Industries, Inc., and its subsidiaries, taken as a whole, unless the context indicates otherwise.

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Note on Incorporation by Reference

Throughout this report, various information and data are incorporated by reference from the Company's 2016 Annual Report (hereinafter referred to as "the Annual Report"). Any reference in this report to disclosures in the Annual Report shall constitute incorporation by reference only of that specific information and data into this Form 10-K.

Part I

Item 1. Business

PPG Industries, Inc., manufactures and distributes a broad range of coatings and specialty materials. PPG was incorporated in Pennsylvania in 1883.

PPG's vision is to be the world's leading coatings company by consistently delivering high-quality, innovative and sustainable solutions that customers trust to protect and beautify their products and surroundings.

PPG's business is comprised of three reportable business segments: Performance Coatings, Industrial Coatings and Glass.

In October 2016, PPG completed the sale of its flat glass business. As such, all historical information has been recast to present the flat glass business as discontinued operations and assets held for sale. Refer to Note 2, "Acquisitions and Divestitures" under Item 8 of this Form 10-K for further information relating to this transaction.

Performance Coatings and Industrial Coatings

PPG is a major global supplier of coatings. The Performance Coatings and Industrial Coatings reportable segments supply coatings and specialty materials for customers in a wide array of end-use markets, including industrial equipment and components, packaging material; aircraft and marine equipment; automotive original equipment ("automotive OEM"); as well as for other industrial and consumer products. In addition to supplying coatings to the automotive OEM market, PPG supplies refinishes to the automotive aftermarket. PPG also serves commercial and residential new build and maintenance markets by supplying coatings to painting and maintenance contractors and directly to consumers for decoration and maintenance. The coatings industry is highly competitive and consists of several large firms with global presence and many smaller firms serving local or regional markets. PPG competes in its primary markets with the world's largest coatings companies, most of which have global operations, and many smaller regional coatings companies.

Performance Coatings

The Performance Coatings reportable segment is comprised of the refinish, aerospace, protective and marine, architectural – Americas and Asia Pacific and architectural – EMEA coatings businesses.

The refinish coatings business supplies coatings products for automotive and commercial transport/fleet repair and refurbishing, light industrial coatings and specialty coatings for signs. These products are sold primarily through independent distributors.

The aerospace coatings business supplies coatings, sealants and transparencies for commercial, military, regional jet and general aviation aircraft, and transparent armor for specialty applications and provides chemical management services for the aerospace industry. PPG supplies products to aircraft manufacturers and maintenance and aftermarket customers around the world both on a direct basis and through a company-owned distribution network.

The protective and marine coatings business supplies coatings and finishes for the protection of metals and structures to metal fabricators, heavy duty maintenance contractors and manufacturers of ships, bridges and rail cars. These products are sold through company-owned architectural coatings stores, independent distributors and directly to customers.

The architectural coatings-Americas and Asia Pacific business primarily produces coatings used by painting and maintenance contractors and by consumers for decoration and maintenance of residential and commercial building structures. These coatings are sold under a number of brands, including PPG ®, GLIDDEN ®, COMEX ®, OLYMPIC ®, DULUX ® (in Canada), SIKKENS ®, PPG PITTSBURGH PAINTS ®, MULCO ®, FLOOD ®, LIQUID NAILS ®, SICO ®, CIL ®, RENNER ®, TAUBMANS ®, WHITE KNIGHT ®, BRISTOL ®, and HOMAX ®. Architectural coatings – Americas and Asia Pacific products are sold through a combination of company-owned stores, home centers and other regional or national consumer retail outlets, paint dealers, concessionaires, independent distributors and directly to customers. At the end of 2016, the architectural coatings-Americas and Asia Pacific business operated about 920 company-owned stores in North America, about 40 company-owned stores in Australia and about 75 company-owned stores in Central America. In addition, PPG sells coatings and related products through more than 4,200 stores that are independently owned and operated by approximately 700 concessionaires, primarily in Mexico.

The architectural coatings – EMEA business supplies a variety of coatings and purchased sundries to painting contractors and consumers in Europe, the Middle East and Africa. The coatings are sold under a number of brands, including SIGMA ®, HISTOR ®, SEIGNEURIE ®, GUITTET ®, PEINTURES GAUTHIER ®, RIPOLIN ®, JOHNSTONE'S ®, LEYLAND ®, PRIMALEX ®, DEKORAL ®, TRILAK ®, PROMINENT PAINTS ®, GORI ®, and BONDEX ®. Architectural coatings – EMEA products are sold through a combination of about 690 company-owned stores, regional home centers, paint dealers, and independent distributors and directly to customers.

Price, product performance, technology, quality, distribution, brand recognition and technical and customer service are major competitive factors in the performance coatings businesses.

The major global competitors of the Performance Coatings reportable segment are Akzo Nobel N.V., Axalta Coating Systems Ltd., BASF Corporation, Benjamin Moore, Hempel A/S, the Jotun Group, Masco Corporation, Materis Paints, Nippon Paint; RPM International Inc, the Sherwin-Williams Company, and Valspar Corporation. The average number of persons employed by the Performance Coatings reportable segment during 2016 was about 28,400.

Industrial Coatings

The Industrial Coatings reportable segment is comprised of the automotive OEM, industrial coatings, packaging coatings, coatings services and specialty coatings and materials businesses. Industrial, automotive OEM, packaging coatings, and specialty coatings and materials products are formulated specifically for the customers' needs and application methods.

The industrial and automotive OEM coatings businesses sell directly to a variety of manufacturing companies. PPG also supplies adhesives and sealants for the automotive industry and metal pretreatments and related chemicals for industrial and automotive applications. PPG's industrial coatings business

produces coatings for appliances, agricultural and construction equipment, consumer electronics, automotive parts and accessories, building products (including residential and commercial construction), transportation vehicles and numerous other finished products. PPG's automotive OEM coatings business was the first to introduce breakthrough automotive coating technologies such as cathodic electrocoat, powder clearcoat, compact paint systems and factory-applied spray-in bedliners, and the Company has a continued focus on innovation leadership. PPG has established alliances with Kansai Paints to serve Japanese-based automotive OEM customers in North America and Europe and Asian Paints Ltd. to serve certain aftermarket customers and automotive OEMs in India.

The packaging coatings business supplies coatings to a variety of manufacturing companies. Packaging coatings are widely used for the protection, performance and decoration of metal cans, closures, plastic tubes, industrial packaging, and promotional and specialty packaging.

The coatings services business applies coatings to customers' manufactured parts and assembled products. It operates on-site coatings services within several customer manufacturing locations, as well as at regional service centers. Customers ship parts to service centers where they are treated to enhance paint adhesion and painted with electrocoat, powder or liquid coatings technologies. Coated parts are then shipped to the customer's next stage of assembly.

Price, product performance, technology, cost effectiveness, quality and technical and customer service are major competitive factors in the industrial, automotive OEM, packaging coatings, and coatings services businesses.

The primary specialty coatings and materials products are amorphous precipitated silicas for tire, battery separator and other end-use markets; TESLIN ® substrate used in such applications as radio frequency identification (RFID) tags and labels, e-passports, drivers' licenses and identification cards; Organic Light Emitting Diode (OLED) materials for use in displays and lighting; optical lens materials and photochromic dyes for optical lenses and color-change products. Product quality and performance, distribution and technical service are the most critical competitive factors to the specialty coatings and materials business.

The major global competitors of the Industrial Coatings reportable segment are Akzo Nobel N.V., Axalta Coating Systems Ltd., BASF Corporation, Kansai Paints, Nippon Paint and Valspar Corporation. The average number of persons employed by the Industrial Coatings reportable segment during 2016 was about 13,400.

Glass

The Glass reportable segment is comprised of the North American fiber glass business. During 2016, PPG divested its European fiber glass business and its ownership interest in two Asian fiber glass joint ventures. Refer to Note 2, "Acquisitions and Divestitures" under Item 8 of this Form 10-K for further information relating to these transactions. PPG's major fiber glass markets are commercial and residential construction and the wind energy, energy infrastructure, transportation and electronics industries. Most fiber glass products are sold directly to manufacturing companies. PPG manufactures fiber glass by the continuous-strand process.

Price, quality, technology and customer service are the key competitive factors in the North American fiber glass business. The Company competes with many major producers of fiber glass, including CPIC Fiberglass, Johns Manville Corporation, Jushi Group, Owens Corning and Taishan Fiberglass.

Excluding divested businesses, the average number of persons employed by the Glass reportable segment during 2016 was about 1,100.

Strategic Acquisitions

Since the filing of our 2015 Form 10-K, the Performance Coatings and Industrial Coatings segments announced and completed several strategic acquisitions, as follows:

Performance Coatings

On January 20, 2017, PPG acquired certain assets of automotive refinish coatings company Futian Xinshi (Futian), based in the Guangdong province of China. Futian distributes its products in China through a network of more than 200 distributors. Futian had sales of approximately $15 million in 2016.

On January 5, 2017, PPG completed the acquisition of DEUTEK S.A., a leading Romanian paint and architectural coatings manufacturer, from the Emerging Europe Accession Fund. DEUTEK, established in 1993, manufactures and markets a large portfolio of well-known professional and consumer paint brands, including OSKAR and Danke!. The company's products are sold in more than 120 do-it-yourself stores and 3,500 independent retail outlets in Romania. DEUTEK reported sales of 30 million euros in 2015.

On November 11, 2016, PPG purchased the 50% ownership interest in PPG Univer S.p.A from its joint-venture partner, Univer Italiana S.r.l. PPG Univer S.p.A manufactures architectural and liquid industrial coatings employs about 150 people. It operates a network of 12 retail stores in Italy and maintains administrative offices and a production facility in the town of Cavallirio, Italy. PPG Univer S.p.A. had sales of approximately 30 million euros in 2016.

Industrial Coatings

In July 2016, PPG completed the acquisition of MetoKote Corporation. MetoKote is a U.S.-based coatings services business with 2015 global sales of approximately $200 million. MetoKote applies coatings to customers' manufactured parts and assembled products. It operates on-site coatings services within several customer manufacturing locations, as well as at regional service centers, located throughout the U.S., Canada, Mexico, the United Kingdom, Germany, Hungary and the Czech Republic. Customers ship parts to MetoKote service centers where they are treated to enhance paint adhesion and painted with electrocoat, powder or liquid coatings technologies. MetoKote coats an average of more than 1.5 million parts per day. Beginning in July 2016, the financial results of MetoKote are reported as the coatings services operating segment.

Raw Materials and Energy

The effective management of raw materials and energy is important to PPG's continued success. The Company's most significant raw materials are epoxy and other resins, titanium dioxide and other pigments, and solvents in the coatings businesses; sand and soda ash for the specialty coatings and materials business; and sand and clay in the North American

fiber glass business. Coatings raw materials, which include both organic, primarily petroleum based, materials and inorganic materials, including titanium dioxide, comprise between 70% and 80% of the Company's cost of sales, excluding depreciation and amortization, in most coatings formulations and represent PPG's single largest production cost component.

Most of the raw materials and energy used in production are purchased from outside sources, and the Company has made, and plans to continue to make, supply arrangements to meet the planned operating requirements for the future. Supply of critical raw materials and energy is managed by establishing contracts, multiple sources, and identifying alternative materials or technology whenever possible. Our products use both petroleum-derived and bio-based materials as part of a product renewal strategy. While prices for these raw materials typically fluctuate with energy prices, such fluctuations are impacted by the fact that the manufacture of our raw materials is several steps downstream from crude oil and natural gas.

The Company is continuing its aggressive sourcing initiatives to broaden our supply of high quality raw materials. These initiatives include qualifying multiple and local sources of supply, including suppliers from Asia and other lower cost regions of the world, adding on-site resin production at certain manufacturing locations and a reduction in the amount of titanium dioxide used in our product formulations.

Our global efforts to reduce titanium dioxide consumption have been successful to date and are expected to continue. Titanium dioxide is a raw material widely used in the paint and coatings industry as a pigment to provide hiding, durability and whiteness characteristics. PPG purchases both sulfate-grade and chloride-grade titanium dioxide from suppliers for use in coatings formulations. The Company has undertaken a strategic initiative to secure and enhance PPG's supply of titanium dioxide, as well as to minimize PPG's use of this raw material. PPG possesses intellectual property and expertise in the production and finishing of titanium dioxide pigment. PPG intends to continue to leverage this technology and intends to develop innovative supply solutions through technical collaborations, joint ventures and licensing arrangements with other interested parties.

PPG signed a license agreement with Henan Billions Chemicals Co., Ltd. ("Billions"), under which PPG has licensed certain chloride-based titanium dioxide technologies for use at Billions' titanium dioxide refinement facilities in China. In addition, PPG has signed long-term purchase agreements for chloride-grade and sulfate-grade titanium dioxide with Billions. In late 2015, PPG began using chloride-grade titanium dioxide produced by Billions using PPG's licensed chloride-based technology. PPG's usage of Billions' chloride-grade titanium dioxide increased in 2016. PPG is using the chloride-grade titanium dioxide to produce standard grades of coatings products. Under the license agreement, Billions has the right to sell chloride-based titanium dioxide to other parties.

We are subject to existing and evolving standards relating to the registration of chemicals which could potentially impact the availability and viability of some of the raw materials we use in our production processes. Our ongoing global product stewardship efforts are directed at maintaining our compliance with these standards.

Changes to chemical registration regulations have been proposed or implemented in the EU and many other countries, including China, Canada, the United States, and Korea. Because implementation of many of these programs has not been finalized, the financial impact cannot be estimated at this time. We anticipate that the number of chemical registration regulations will continue to increase globally, and we have implemented programs to track and comply with these regulations.

Given the recent volatility in certain energy-based input costs and foreign currencies, the Company is not able to predict with certainty the 2017 full year impact of related changes in raw material pricing; however, PPG currently expects overall coatings raw material prices to increase modestly in 2017, with impacts varied by region and commodity. Further, given the distribution nature of many of our businesses, logistics and distribution costs are sizable, as are wages and benefits but to a lesser degree. In aggregate, raw material feedstock prices in 2016 were lower, including oil-related products, although some products experienced price inflation late in the year. Since oil is traded in U.S. dollars globally, the strengthening of the dollar against a wide variety of foreign currencies reduced some of the oil-related benefits in certain regions, and in certain cases resulted in inflationary raw material prices.

Research and Development

Technology innovation has been a hallmark of PPG's success throughout its history. Research and development costs, including depreciation of research facilities, were $487 million, $494 million and $499 million during 2016, 2015 and 2014, respectively, and totaled approximately 3% of annual sales in each year. We have obtained government funding for a small portion of the Company's research efforts, and we will continue to pursue government funding where appropriate.

PPG owns and operates several facilities to conduct research and development relating to new and improved products and processes. In addition to the Company's centralized principal research and development centers (See Item 2 of this Form 10-K), operating segments manage their development through centers of excellence. As part of our ongoing efforts to manage our formulations and raw material costs effectively, we operate a global competitive sourcing laboratory in China. Because of the Company's broad array of products and customers, PPG is not materially dependent upon any single technology platform.

The Company seeks to optimize its investment in research and development to create new products to drive profitable growth. We align our product development with the macro trends in the end-use markets we serve and leverage core technology platforms to develop products for unmet market needs. Our history of successful technology introductions is based on a commitment to an efficient and effective innovation process and disciplined portfolio management.

Patents

PPG considers patent protection to be important; however, the Company's reportable business segments are not materially dependent upon any single patent or group of related patents. PPG earned $15 million, $20 million and $29 million in 2016, 2015 and 2014, respectively, from royalties and the sale of technical know-how.

Backlog

In general, PPG does not manufacture its products against a backlog of orders. Production and inventory levels are geared primarily to projections of future demand and the level of incoming orders.

Global Operations

PPG has a significant investment in non-U.S. operations. This broad geographic footprint serves to lessen the significance of economic impacts occurring in any one region on PPG's total net sales and income from continuing operations. As a result of our expansion outside the U.S., we are subject to certain inherent risks, including economic and political conditions in international markets and fluctuations in foreign currency exchange rates. During 2016, unfavorable foreign currency reduced net sales by approximately $400 million.

Our net sales in the developed and emerging regions of the world for the years ended December 31 st are summarized below:

($ in millions)	Net Sales		
	2016	2015	2014
United States, Canada, Western Europe	$ 10,196	$ 10,145	$ 10,657
Latin America, Central and Eastern Europe, Middle East, Africa, Asia Pacific	4,555	4,621	4,134
Total	$ 14,751	$ 14,766	$ 14,791

Refer to Note 19, "Reportable Business Segment Information" under Item 8 of this Form 10-K for geographic information related to PPG's property, plant and equipment, and for additional geographic information pertaining to sales.

Seasonality

PPG's income from continuing operations has typically been greater in the second and third quarters and cash from operating activities has been greatest in the fourth quarter due to end-use market seasonality, primarily in PPG's architectural coatings businesses. Demand for PPG's architectural coatings products is typically the strongest in the second and third quarters due to higher home improvement, maintenance and construction activity during the spring and summer months in the U.S. and Canada and Europe. The Latin America paint season is the strongest in the fourth quarter. These higher activity levels result in higher outstanding receivables that are collected in the fourth quarter generating higher fourth quarter cash from operating activities.

Employee Relations

The average number of persons employed worldwide by PPG during 2016 was about 47,000. The Company has numerous collective bargaining agreements throughout the world. We observe local customs, laws and practices in labor relations when negotiating collective bargaining agreements. There were no significant work stoppages in 2016. While we have experienced occasional work stoppages as a result of the collective bargaining process and may experience some work stoppages in the future, we believe that we will be able to negotiate all labor agreements on satisfactory terms. To date, these work stoppages have not had a significant impact on PPG's results of operations. Overall, the Company believes it has good relationships with its employees.

Environmental Matters

PPG is subject to existing and evolving standards relating to protection of the environment. PPG is negotiating with various government agencies concerning 126 current and former manufacturing sites and offsite waste disposal locations, including 24 sites on the National Priority List. While PPG is not generally a major contributor of wastes to these offsite waste disposal locations, each potentially responsible party may face governmental agency assertions of joint and several liability. Generally, however, a final allocation of costs is made based on relative contributions of wastes to the site. There is a wide range of cost estimates for cleanup of these sites, due largely to uncertainties as to the nature and extent of their condition and the methods that may have to be employed for their remediation. The Company has established reserves for onsite and offsite remediation of those sites where it is probable that a liability has been incurred and the amount of loss can be reasonably estimated.

The Company's experience to date regarding environmental matters leads it to believe that it will have continuing expenditures for compliance with provisions regulating the protection of the environment and for present and future remediation efforts at waste and plant sites. Management anticipates that such expenditures will occur over an extended period of time.

In addition to the $285 million currently reserved for environmental remediation efforts, we may be subject to loss contingencies related to environmental matters estimated to be approximately $100 million to $200 million. These reasonably possible unreserved losses relate to environmental matters at a number of sites, none of which are individually significant. The loss contingencies related to these sites include significant unresolved issues such as the nature and extent of contamination at these sites and the methods that may have to be employed to remediate them.

Capital expenditures for environmental control projects were $18 million, $15 million and $14 million in 2016, 2015, and 2014, respectively. It is expected that expenditures for such projects in 2017 will be in the range of $10 million to $20 million. Although future capital expenditures are difficult to estimate accurately because of constantly changing regulatory standards and policies, it can be anticipated that environmental control standards will become increasingly stringent and the cost of compliance will increase.

In management's opinion, the Company operates in an environmentally sound manner, is well positioned, relative to environmental matters, within the industries in which it operates and the outcome of these environmental contingencies will not have a material adverse effect on PPG's financial position or liquidity; however, any such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized. See Note 13, "Commitments and Contingent Liabilities," under Item 8 of this Form 10-K for additional information related to environmental matters and our accrued liability for estimated environmental remediation costs.

Public and governmental concerns related to climate change continue to grow, leading to efforts to limit the greenhouse gas ("GHG") emissions believed to be responsible. While PPG has operations in many countries, a substantial portion of PPG's

GHG emissions are generated by locations in the U.S., where considerable legislative and regulatory activity has been taking place. PPG has, and will continue to, annually report our global GHG emissions to the voluntary Carbon Disclosure project.

Since PPG's GHG emissions arise principally from combustion of fossil fuels and the purchase of electricity, PPG has for some time recognized the desirability of reducing energy consumption and GHG generation. For the three year period ended December 31, 2016, including the flat glass facilities divested October 1, 2016, energy consumption intensity was reduced by 30% and GHG emission generation intensity was reduced by 22%.

PPG participates in both the U.S. Department of Energy, BETTER BUILDINGS®, BETTER PLANTS® program, formerly the SAVE ENERGY NOW® Leadership program, and the Environmental Protection Agency ENERGY STAR® Industrial Partnership program, both reinforcing the company's voluntary efforts to significantly reduce its industrial energy intensity. These programs include developing and implementing energy management processes and setting energy savings targets while providing a suite of educational, training, and technical resources to help meet those targets. Recognizing the continuing importance of this matter, PPG has a senior management group with a mandate to guide the Company's progress in this area.

PPG's public disclosure on energy security and climate change can be viewed in our Sustainability Report at *sustainability.ppg.com* or at the Carbon Disclosure Project *www.cdp.net.*

Available Information

The Company's website address is *www.ppg.com* . The Company posts, and shareholders may access without charge, the Company's recent filings and any amendments thereto of its annual reports on Form 10-K, quarterly reports on Form 10-Q and its proxy statements as soon as reasonably practicable after such reports are filed with the Securities and Exchange Commission ("SEC"). The Company also posts all financial press releases, including earnings releases, to its website. All other reports filed or furnished to the SEC, including reports on Form 8-K, are available via direct link on PPG's website to the SEC's website, *www.sec.gov.* Reference to the Company's and the SEC's websites herein does not incorporate by reference any information contained on those websites and such information should not be considered part of this Form 10-K.

Item 1A. Risk Factors

As a global manufacturer of coatings, specialty materials and fiber glass products, we operate in a business environment that includes risks. These risks are not unlike the risks we have faced in the recent past nor are they unlike risks faced by our competitors. Each of the risks described in this section could adversely affect our results of operations, financial position and liquidity. While the factors listed here are considered to be the more significant factors, no such list should be considered to be a complete statement of all potential risks and uncertainties. Unlisted factors may present significant additional obstacles which may adversely affect our businesses and our results of operations.

Increases in prices and declines in the availability of raw materials could negatively impact our financial results.

Our financial results are significantly affected by the cost of raw materials. Coatings raw materials, which include both organic, primarily petroleum based, materials and inorganic materials, including titanium dioxide, comprise between 70% and 80% of the Company's cost of sales, exclusive of depreciation and amortization, sold in most coatings formulations and represent PPG's single largest production cost component.

While not our customary practice, we also import raw materials and intermediates, particularly for use at our manufacturing facilities in the emerging regions of the world. In most cases, those imports are priced in the currency of the supplier and, therefore, if that currency strengthens against the currency of our manufacturing facility, our margins may be lower.

Most of our raw materials are purchased from outside sources, and the Company has made, and plans to continue to make, supply arrangements to meet the planned operating requirements for the future. Adequate supply of critical raw materials is managed by establishing contracts, procuring from multiple sources, and identifying alternative materials or technology whenever possible. The Company is continuing its aggressive sourcing initiatives to effectively broaden our supply of high quality raw materials. These initiatives include qualifying multiple and local sources of supply, including suppliers from Asia and other lower cost regions of the world, adding on-site resin production at certain manufacturing locations, and a reduction in the amount of titanium dioxide and other raw materials used in our product formulations. Our products use both petroleum-derived and bio-based materials as part of a product renewal strategy.

An inability to obtain critical raw materials would adversely impact our ability to produce products. Increases in the cost of raw materials may have an adverse effect on our income from continuing operations or cash from operating activities in the event we are unable to offset these higher costs in a timely manner.

The pace of economic growth and level of uncertainty could have a negative impact on our results of operations and cash flows.

During 2016, overall economic conditions remained mixed among the major global economies. PPG provides products and services to a variety of end-use markets in many geographies. This broad end-use market exposure and expanded geographic presence lessens the significance of any individual decrease in activity levels; nonetheless, lower demand levels may result in lower sales, which would result in reduced income from continuing operations and cash from operating activities.

Refer to Item 7. "Management's Discussion and Analysis of Financial Condition and Results of Operations" of this Form 10-K for discussion of the economic conditions in 2016 and our outlook on certain economic conditions in 2017.

We are subject to existing and evolving standards relating to the protection of the environment.

Environmental laws and regulations control, among other things, the discharge of pollutants into the air and water, the

handling, use, treatment, storage and clean-up of hazardous and non-hazardous waste, the investigation and remediation of soil and groundwater affected by hazardous substances, and regulate various health and safety matters. The environmental laws and regulations we are subject to impose liability for the costs of, and damages resulting from, cleaning up current sites, past spills, disposals and other releases of hazardous substances. Violations of these laws and regulations can also result in fines and penalties. Future environmental laws and regulations may require substantial capital expenditures or may require or cause us to modify or curtail our operations, which may have a material adverse impact on our business, financial condition and results of operations.

As described in Note 13, "Commitments and Contingent Liabilities," under Item 8 of this Form 10-K, we are currently undertaking environmental remediation activities at a number of our current and former facilities and properties, the cost of which is substantial. In addition to the amounts currently reserved, we may be subject to loss contingencies related to environmental matters estimated to be as much as $100 million to $200 million. Such unreserved losses are reasonably possible but are not currently considered to be probable of occurrence.

We are involved in a number of lawsuits and claims, and we may be involved in future lawsuits and claims, in which substantial monetary damages are sought.

PPG is involved in a number of lawsuits and claims, both actual and potential, in which substantial monetary damages are sought. Those lawsuits and claims relate to contract, patent, environmental, product liability, asbestos exposure, antitrust, employment and other matters arising out of the conduct of PPG's current and past business activities. Any such claims, whether with or without merit, could be time consuming, expensive to defend and could divert management's attention and resources. We maintain insurance against some, but not all, of these potential claims, and the levels of insurance we do maintain may not be adequate to fully cover any and all losses. We believe that, in the aggregate, the outcome of all current lawsuits and claims involving PPG, including those described in Note 13, "Commitments and Contingent Liabilities" under Item 8 of this Form 10-K, will not have a material effect on PPG's consolidated financial position or liquidity; however, such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized. Nonetheless, the results of any future litigation or claims are inherently unpredictable, but such outcomes could have a material adverse effect on our results of operations, cash from operating activities or financial condition.

Fluctuations in foreign currency exchange rates could affect our financial results.

We earn revenues, pay expenses, own assets and incur liabilities in countries using currencies other than the U.S. dollar. Because our consolidated financial statements are presented in U.S. dollars, we must translate revenues and expenses into U.S. dollars at the average exchange rate during each reporting period, as well as assets and liabilities into U.S. dollars at exchange rates in effect at the end of each reporting period. Therefore, increases or decreases in the value of the U.S. dollar against other currencies will affect our net sales, net income and the value of balance sheet items denominated in foreign currencies. We may use derivative financial instruments to reduce our net exposure to currency exchange rate fluctuations related to foreign currency transactions. However, fluctuations in foreign currency exchange rates, particularly the strengthening of the U.S. dollar against major currencies, could adversely affect our financial condition and results of operations expressed in U.S. dollars. In 2016, this U.S. dollar strengthening had an unfavorable impact on full year net sales and income before income taxes from the translation of foreign earnings into U.S. dollars of approximately $400 million and $70 million, respectively.

We are subject to a variety of complex U.S. and non-U.S. laws and regulations which could increase our compliance costs.

We are subject to a wide variety of complex U.S. and non-U.S. laws and regulations, and legal compliance risks, including securities laws, tax laws, environmental laws, employment and pension-related laws, competition laws, U.S. and foreign export and trading laws, and laws governing improper business practices, including bribery. We are affected by new laws and regulations and changes to existing laws and regulations, including interpretations by courts and regulators. These laws and regulations effectively expand our compliance obligations and potential enforcement actions by governmental authorities or litigation related to them.

New laws and regulations or changes in existing laws or regulations or their interpretation could increase our compliance costs. For example, regulations concerning the composition, use and transport of chemical products continue to evolve. Developments concerning these regulations could potentially impact the availability or viability of some of the raw materials we use in our product formulations and/or our ability to supply certain products to some customers or markets. Import/export regulations also continue to evolve and could result in increased compliance costs, slower product movements or additional complexity in our supply chains.

Our international operations expose us to additional risks and uncertainties that could affect our financial results.

PPG has a significant investment in global operations. This broad geographic footprint serves to lessen the significance of economic impacts occurring in any one region. Notwithstanding the benefits of geographic diversification, our ability to achieve and maintain profitable growth in international markets is subject to risks related to the differing legal, political, social and regulatory requirements and economic conditions of many countries. As a result of our operations outside the U.S., we are subject to certain inherent risks, including political and economic uncertainty, inflation rates, exchange rates, trade protection measures, local labor conditions and laws, restrictions on foreign investments and repatriation of earnings, and weak intellectual property protection. Our percentage of sales generated in 2016 by products sold outside the U.S. was approximately 60% .

Changes in the tax regimes and related government policies and regulations in the countries in which we operate could adversely affect our results and our effective tax rate.

As a multinational corporation, we are subject to various taxes in both the U.S. and non-U.S. jurisdictions. Due to economic and political conditions, tax rates in these various jurisdictions may be subject to significant change. Our future

effective income tax rate could be affected by changes in the mix of earnings in countries with differing statutory tax rates, changes in the valuation of deferred tax assets or changes in tax laws or their interpretation. Recent developments, including potential U.S. tax reform discussions, the European Commission's investigations on illegal state aid as well as the Organisation for Economic Co-operation and Development project on Base Erosion and Profit Shifting may result in changes to long-standing tax principles, which could adversely affect our effective tax rate or result in higher cash tax liabilities. If our effective income tax rate was to increase, our cash from operating activities, financial condition and results of operations would be adversely affected.

Although we believe that our tax filing positions are appropriate, the final determination of tax audits or tax disputes may be different from what is reflected in our historical income tax provisions and accruals. If future audits find that additional taxes are due, we may be subject to incremental tax liabilities, possibly including interest and penalties, which could have a material adverse effect on our cash from operating activities, financial condition and results of operations.

Business disruptions could have a negative impact on our results of operations and financial condition.

Unexpected events, including supply disruptions, temporary plant and/or power outages, work stoppages, natural disasters and severe weather events, computer system disruptions, fires, war or terrorist activities, could increase the cost of doing business or otherwise harm the operations of PPG, our customers and our suppliers. It is not possible for us to predict the occurrence or consequence of any such events. However, such events could reduce our ability to supply products, reduce demand for our products or make it difficult or impossible for us to receive raw materials from suppliers or to deliver products to customers.

Failure to successfully integrate acquired businesses into our existing operations could adversely affect our financial results.

Part of the Company's strategy is growth through acquisitions, and we will likely acquire additional businesses and enter into additional joint ventures in the future. Growth through acquisitions and the formation of joint ventures involve risks, including:

- difficulties in assimilating acquired companies and products into our existing business;
- delays in realizing the benefits from the acquired companies or products;
- diversion of our management's time and attention from other business concerns;
- difficulties due to lack of or limited prior experience in any new markets we may enter;
- unforeseen claims and liabilities, including unexpected environmental exposures or product liability;
- unexpected losses of customers or suppliers of the acquired or existing business;
- difficulty in conforming the acquired business' standards, processes, procedures and controls to those of our operations; and
- difficulties in retaining key employees of the acquired businesses.

Our failure to address these risks or other problems encountered in connection with our past or future acquisitions and joint ventures could cause us to fail to realize the anticipated benefits of such acquisitions or joint ventures and could adversely affect our results of operations, cash from operating activities or financial condition.

Our ability to understand our customers' specific preferences and requirements, and to innovate, develop, produce and market products that meet customer demand is critical to our business results.

Our business relies on continued global demand for our brands and products. To achieve business goals, we must develop and sell products that appeal to customers. This is dependent on a number of factors, including our ability to produce products that meet the quality, performance and price expectations of our customers and our ability to develop effective sales, advertising and marketing programs.

We believe the automotive industry will experience significant and continued change in the coming years. Vehicle manufacturers continue to develop new safety features such as collision avoidance technology and self-driving vehicles that may reduce vehicle collisions in the future, potentially lowering demand for our refinish coatings. In addition, through the introduction of new technologies, new business models or new methods of travel, such as ridesharing, the number of automotive OEM new-builds may decline, potentially reducing demand for our automotive OEM coatings.

Our future growth will depend on our ability to continue to innovate our existing products and to develop and introduce new products. If we fail to keep pace with product innovation on a competitive basis or to predict market demands for our products, our businesses, financial condition and results of operations could be adversely affected.

The industries in which we operate are highly competitive.

With each of our businesses, an increase in competition may cause us to lose market share, lose a large regional or global customer, or compel us to reduce prices to remain competitive, which could result in reduced margins for our products. Competitive pressures may not only reduce our margins but may also impact our revenues and our growth which could adversely affect our results of operations.

The security of our information technology systems could be compromised, which could adversely affect our ability to operate.

Increased global information technology security requirements, threats and sophisticated and targeted computer crime pose a risk to the security of our systems, networks and the confidentiality, availability and integrity of our data. Despite our efforts to protect sensitive information and confidential and personal data, our facilities and systems may be vulnerable to security breaches. This could lead to negative publicity, theft, modification or destruction of proprietary information or key information, manufacture of defective products, production downtimes and operational disruptions, which could adversely affect our reputation, competitiveness and results of operations.

Item 1B. Unresolved Staff Comments

None.

Item 2. Properties

The Company's corporate headquarters is located in Pittsburgh, Pa. The Company's manufacturing facilities, sales offices, research and development centers and distribution centers are located throughout the world. As of February 16, 2017, the Company operated 140 manufacturing facilities in 40 countries, and the principal manufacturing and distribution facilities were as follows:

Performance Coatings:	Amsterdam, Netherlands; Birstall, United Kingdom; Budapest, Hungary; Clayton, Australia; Delaware, Ohio; Dover, Del.; Gonfreville, France; Huntsville, Ala.; Huron, Ohio; Kunshan, China; Little Rock, Ark.; Milan, Italy; Mojave, Calif.; Moreuil, France; Shildon, United Kingdom; Sylmar, Calif.; Soborg, Denmark; Stowmarket, United Kingdom; and Wroclaw, Poland.
Industrial Coatings:	Barberton, Ohio; Busan, South Korea; Cieszyn, Poland; Cleveland, Ohio; Lake Charles, La.; Oak Creek, Wis.; Quattordio, Italy; San Juan del Rio, Mexico; Sumaré, Brazil; Tianjin, China, and Zhangjiagang, China
Glass:	Chester, N.C.; Lexington, N.C.; and Shelby, N.C.

Including the principal manufacturing facilities noted above, the Company has manufacturing facilities in the following geographic areas:

United States:	39 manufacturing facilities in 19 states.
Other Americas:	18 manufacturing facilities in 5 countries.
EMEA:	56 manufacturing facilities in 25 countries.
Asia:	27 manufacturing facilities in 9 countries.

The Company's principal research and development centers are located in Allison Park, Pa.; Cheswick, Pa.; Monroeville, Pa.; Shelby, N.C.; Burbank, Calif. and Tepexpan, Mexico.

The Company's headquarters, certain distribution centers and substantially all company-owned paint stores are located in facilities that are leased while the Company's other facilities are generally owned. Our facilities are considered to be suitable and adequate for the purposes for which they are intended and overall have sufficient capacity to conduct business in the upcoming year.

Item 3. Legal Proceedings

PPG is involved in a number of lawsuits and claims, both actual and potential, including some that it has asserted against others, in which substantial monetary damages are sought. These lawsuits and claims may relate to contract, patent, environmental, product liability, asbestos exposure, antitrust, employment and other matters arising out of the conduct of PPG's current and past business activities. To the extent that these lawsuits and claims involve personal injury and property damage, PPG believes it has adequate insurance; however, certain of PPG's insurers are contesting coverage with respect to some of these claims, and other insurers may contest coverage. PPG's lawsuits and claims against others include claims against insurers and other third parties with respect to actual and contingent losses related to environmental, asbestos and other matters.

The results of any future litigation and claims are inherently unpredictable. However, management believes that, in the aggregate, the outcome of all lawsuits and claims involving PPG, including asbestos-related claims, will not have a material effect on PPG's consolidated financial position or liquidity; however, such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized.

For many years, PPG has been a defendant in lawsuits involving claims alleging personal injury from exposure to asbestos. For a description of asbestos litigation affecting the Company, see Note 13, "Commitments and Contingent Liabilities" under Item 8 of this Form 10-K.

In the past, the Company and others have been named as defendants in several cases in various jurisdictions claiming damages related to exposure to lead and remediation of lead-based coatings applications. PPG has been dismissed as a defendant from most of these lawsuits and has never been found liable in any of these cases.

In March 2016, the Natural Resource Trustees for the Calcasieu River Estuary (the United States Department of the Interior, acting through the United States Fish and Wildlife Service, the National Oceanic and Atmospheric Administration of the United States Department of Commerce, the Louisiana Department of Environmental Quality and the Louisiana Department of Wildlife and Fisheries) reached an agreement in principle with PPG and two other potentially responsible parties to resolve the Trustees' claims for natural resource damages alleged to have been caused by the release of hazardous substances into the Estuary. PPG's share of this settlement is $3,600,000.

In December 2011, the United States Environmental Protection Agency ("EPA") issued a Finding of Violation alleging that PPG's Delaware, Ohio facility violated certain leak detection and repair ("LDAR") requirements of the federal Clean Air Act. In 2016, PPG and the EPA reached an agreement in principle to settle this matter with a total civil penalty of $225,000 and certain enhancements to the facility's LDAR program. PPG and the EPA are in the process of finalizing the terms of a Consent Decree for this matter which will memorialize the terms of this settlement.

Executive Officers of the Company

Set forth below is information related to the Company's executive officers as of February 16, 2017 .

Name	*Age*	*Title*
Michael H. McGarry [(a)]	58	Chairman and Chief Executive Officer since September 2016
Viktoras R. Sekmakas [(b)]	56	Executive Vice President since September 2012
Frank S. Sklarsky [(c)]	60	Executive Vice President and Chief Financial Officer since August 2013
Glenn E. Bost II [(d)]	64	Senior Vice President and General Counsel since July 2010
Jean-Marie Greindl [(e)]	54	Senior Vice President, Architectural Coatings and President PPG EMEA since March 2016
Timothy M. Knavish [(f)]	51	Senior Vice President, Automotive Coatings since March 2016
Ramaparasad Vadlamannati [(g)]	54	Senior Vice President, Protective and Marine Coatings since March 2016
Vincent J. Morales [(h)]	51	Senior Vice President and Chief Financial Officer effective March 1, 2017

(a) Mr. McGarry served as President and Chief Executive Officer from September 2015 through August 2016, President and Chief Operating Officer from March 2015 through August 2015; Chief Operating Officer from August 2014 through February 2015; Executive Vice President from September 2012 through July 2014; and Senior Vice President, Commodity Chemicals from July 2008 through August 2012.

(b) Mr. Sekmakas served as Senior Vice President, Industrial Coatings and President, Europe from September 2011 through August 2012; Senior Vice President, Industrial Coatings and President, Asia Pacific Coatings from August 2010 through August 2011; and Vice President Industrial Coatings and President, Asia Pacific Coatings from March 2010 through July 2010.

(c) Mr. Sklarsky was appointed Executive Vice President, Finance, in April 2013 when he joined PPG. Prior to joining PPG, Mr. Sklarsky was Executive Vice President and Chief Financial Officer of Tyco International, Ltd. from December 2010 through September 2012. Mr. Sklarsky has announced his intention to retire effective March 1, 2017.

(d) Mr. Bost served as Vice President and Associate General Counsel from July 2006 through June 2010.

(e) Mr. Greindl served as Vice President, Automotive Coatings, EMEA and President, PPG EMEA from February 2013 through February 2016, Vice President, Automotive Coatings, EMEA from January 2011 through January 2013 and Vice President, Automotive Coatings, Europe from October 2010 through December 2010.

(f) Mr. Knavish served as Vice President, Protective and Marine Coatings from August 2012 through February 2016 and Vice President, Automotive Coatings, Americas from March 2010 through July 2012.

(g) Mr. Vadlamannati served as Vice President, Architectural Coatings, EMEA and Asia/Pacific from August 2014 through February 2016, Vice President, Architectural Coatings, EMEA from February 2012 through July 2014, Vice President, Architectural Coatings, EMEA for Region Western Europe from March 2011 through January 2012 and Vice President, Automotive Refinish, EMEA from September 2010 through February 2011.

(h) Mr. Morales will become Senior Vice President and Chief Financial Officer on March 1, 2017 upon Mr. Sklarsky's retirement. Since June 2016, he served as Vice President, Finance. From June 2015 to June 2016, he served as Vice President Investor Relations and Treasurer and Vice President, Investor Relations from October 2007 to June 2015.

Item 4. Mine Safety Disclosures

Not Applicable.

Part II

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

The information required by Item 5 regarding market information, including stock exchange listings and quarterly stock market prices, dividends and holders of common stock is included in Exhibit 13.1 filed with this Form 10-K and is incorporated herein by reference. This information is also included in the PPG Shareholder Information on page 5 of the Annual Report to shareholders.

Directors who are not also officers of the Company receive common stock equivalents pursuant to the PPG Industries, Inc. Deferred Compensation Plan for Directors ("PPG Deferred Compensation Plan for Directors"). Common stock equivalents are hypothetical shares of common stock having a value on any given date equal to the value of a share of common stock. Common stock equivalents earn dividend equivalents that are converted into additional common stock equivalents but carry no voting rights or other rights afforded to a holder of common stock. The common stock equivalents credited to directors under this plan are exempt from registration under Section 4(a)(2) of the Securities Act of 1933 as private offerings made only to directors of the Company in accordance with the provisions of the plan.

Under the PPG Deferred Compensation Plan for Directors, each director may elect to defer the receipt of all or any portion of the compensation paid to such director for serving as a PPG director. All deferred payments are held in the form of common stock equivalents. Payments out of the deferred accounts are made in the form of common stock of the Company (and cash as to any fractional common stock equivalent). The directors, as a group, were credited with 17,807; 15,445; and 25,724 common stock equivalents in 2016, 2015 and 2014, respectively, under this plan. The values of the common stock equivalents, when credited, ranged from $95.63 to $116.07 in 2016, $90.13 to $98.73 in 2015, and $95.59 to $109.91 in 2014.

Issuer Purchases of Equity Securities - Fourth Quarter, 2016

Month	*Total Number of Shares Purchased*	*Avg. Price Paid per Share*	*Total Number of Shares Purchased as Part of Publicly Announced Programs*	*Max. Number of Shares That May Yet Be Purchased Under the Programs* [1],[2]
October 2016				
Repurchase program	1,043,300	$ 92.71	1,043,300	26,019,358
November 2016				
Repurchase program	2,893,131	$ 95.70	2,893,131	22,373,733
December 2016				
Repurchase program	2,876,564	$ 96.20	2,876,564	19,729,601
Total quarter ended December 31, 2016				
Repurchase program	6,812,995	$ 95.45	6,812,995	19,729,601

[1] In April 2014, PPG's board of directors authorized a $2 billion repurchase program which was completed during the fourth quarter 2016.

[2] In October 2016, PPG's board of directors approved a $2 billion share repurchase program. The remaining shares yet to be purchased under the 2016 program have been calculated using PPG's closing stock price on the last business day of the respective month. This repurchase program has no expiration date.

No shares were withheld in satisfaction of the exercise price and/or tax withholding obligation by holders of employee stock options who exercised options granted under the Company's equity compensation plans in the fourth quarter of 2016.

Item 6. Selected Financial Data

The information required by Item 6 regarding the selected financial data for the five years ended December 31, 2016 is included in Exhibit 13.2 filed with this Form 10-K and is incorporated herein by reference. This information is also reported in the Five-Year Digest on page 86 of the Annual Report to shareholders.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations

Executive Overview

Below are our key financial results from continuing operations for the fiscal year ended December 31, 2016:

- Net sales were $14.8 billion, consistent with the prior year, despite unfavorable foreign currency translation (3%).
- Cost of sales, exclusive of depreciation and amortization decreased 2% to $8.1 billion, including the effects of foreign currency translation.
- Selling, general and administrative expenses increased 1% to $3.7 billion, inclusive of a $46 million pension settlement charge associated with the sale of the European fiber glass business.
- In December 2016, PPG approved a business restructuring program and recorded a $197 million charge consisting of approximately $140 million of severance and other cash charges and nearly $60 million of asset write-downs and other non-cash charges. The actions have anticipated annual savings of approximately $125 million once fully implemented.
- Income before income taxes was $827 million.
- The effective tax rate for 2016 was 29.1%.
- Net income from continuing operations was $564 million and earnings per diluted share was $2.11.
- Cash and short-term investments were approximately $1.9 billion at year-end.
- Cash from operating activities - continuing operations was $1.2 billion, net of $630 million (after-tax) paid to fund the Pittsburgh Corning asbestos trust (the "Trust").
- Capital expenditures for modernization and other improvements, was $402 million.
- Cash used for business acquisitions (net of cash acquired), was $349 million.
- In April 2016, the Company raised the per-share dividend by 11%. In 2016, the Company paid approximately $415 million in dividends and also repurchased $1.05 billion of its outstanding common stock.
- The Company achieved the top-end of its cash deployment target for acquisitions and share repurchases, deploying $2.5 billion in 2015 and 2016 combined.
- The Company announced a new cash deployment target for acquisitions and share repurchases for 2017 and 2018 combined of $2.5 billion to $3.5 billion.

Performance Overview

Net Sales

($ in millions, except percentages)	December 31, 2016	2015	2014	% Change 2016 vs. 2015	2015 vs. 2014
United States and Canada	$ 6,595	$ 6,589	$ 6,624	0.1 %	(0.5)%
Europe, Middle East and Africa (EMEA)	4,304	4,270	4,802	0.8 %	(11.1)%
Asia Pacific	2,431	2,434	2,517	(0.1)%	(3.3)%
Latin America	$ 1,421	$ 1,473	$ 848	(3.5)%	73.7 %
Total	$ 14,751	$ 14,766	$ 14,791	(0.1)%	(0.2)%

2016 vs. 2015

Net sales decreased $15 million due to the following:

- *Unfavorable foreign currency translation (3%)*

Partially offset by:

- *Net sales from acquired businesses (+2%)*
- *Higher sales volumes (+1%)*

Unfavorable foreign currency translation reduced net sales by approximately $400 million as the U.S. dollar strengthened against most foreign currencies year-over-year, notably the British pound, the Mexican peso, and the Chinese yuan.

Acquired businesses added approximately $275 million of sales in 2016, primarily due to the partial year sales from businesses acquired in 2015, including Revocoat, IVC Industrial Coatings, Le Joint Francais and Cuming Microwave, as well as the 2016 acquisitions of MetoKote and Univer.

Sales volume growth, excluding acquisition related sales, grew 1% led by growth in Asia Pacific and EMEA, while U.S. and Canada sales volumes as a percentage of sales, declined modestly.

2015 vs. 2014

Net sales decreased $25 million due to the following:

- *Unfavorable foreign currency translation (7%)*

Partially offset by:

- *Net sales from acquired businesses (+6%)*
- *Higher sales volumes (+1%)*

Foreign currency translation unfavorably impacted net sales by $1.1 billion as the U.S. dollar strengthened against most foreign currencies versus the prior year.

Acquired businesses added $941 million of sales in 2015, primarily Consorcio Comex S.A. de C.V. ("Comex"), supplemented by several other smaller acquisitions made in 2014 and 2015. In November 2015, Comex reached its one year anniversary and its net sales and income are reported as organic growth subsequent to its anniversary date.

Sales volume growth occurred primarily in the emerging regions and EMEA, while North America sales volumes declined approximately 1%.

Cost of sales, exclusive of depreciation and amortization

($ in millions, except percentages)	December 31, 2016	2015	2014	% Change 2016 vs. 2015	2015 vs. 2014
Cost of sales, exclusive of depreciation and amortization	$ 8,063	$ 8,206	$ 8,348	(1.7)%	(1.7)%
Cost of sales as a % of net sales	54.7%	55.6%	56.4%	(0.9)%	(0.8)%

2016 vs. 2015

Cost of sales, exclusive of depreciation and amortization, decreased $143 million (2%) due to the following:

- *Foreign currency translation*
- *Lower manufacturing costs*

Partially offset by:

- *Cost of sales from acquired businesses*
- *Higher sales volumes*

2015 vs. 2014

Cost of sales, exclusive of depreciation and amortization, decreased $142 million (2%) due to the following:

- *Foreign currency translation*
- *Lower manufacturing costs*

Partially offset by:

- *Cost of sales from acquired businesses*
- *Higher sales volumes*

Selling, general and administrative expenses

($ in millions, except percentages)	December 31, 2016	2015	2014	% Change 2016 vs. 2015	2015 vs. 2014
Selling, general and administrative expenses	$ 3,662	$ 3,624	$ 3,696	1.0%	(1.9)%
Selling, general and administrative expenses as a % of net sales	24.8%	24.5%	25.0%	0.3%	(0.5)%

2016 vs. 2015

Selling, general and administrative expenses increased $38 million (+1%) primarily due to:

- *Pension settlement charge of $46 million associated with the divestiture of the European fiber glass business*
- *Selling, general and administrative expenses from acquired businesses*
- *Overhead cost inflation*

Partially offset by:

- *Foreign currency translation*
- *Restructuring cost savings*

2015 vs. 2014

Selling, general and administrative expenses decreased $73 million (2%) due to the following:

- *Foreign currency translation*
- *Restructuring cost savings*

Partially offset by:

- *Selling, general and administrative expenses from acquired businesses*
- *Overhead cost inflation*

Other costs and income

($ in millions, except percentages)	December 31, 2016	2015	2014	% Change 2016 vs. 2015	2015 vs. 2014
Interest expense, net of Interest income	$ 99	$ 86	$ 137	15.1%	(37.2)%
Business restructuring	$ 197	$ 140	$ —	40.7%	NA
Debt refinancing charge	$ —	$ —	$ 317	—%	NA
Pension settlement charges	$ 968	$ —	$ —	NA	NA
Other charges	$ 178	$ 93	$ 217	91.4%	(57.1)%
Other income	$ (176)	$ (125)	$ (215)	40.8%	(41.9)%

Interest expense, net of Interest income

Interest expense, net of Interest income increased $13 million in 2016 versus 2015 as interest income decreased year-over-year due to lower interest rates and lower average cash deposits on hand. Interest expense, net of Interest income decreased $51 million in 2015 versus the prior year primarily due to a debt refinancing undertaken in the fourth quarter of 2014.

Business restructuring

In December 2016, PPG's Board of Directors approved a business restructuring program which includes actions necessary to reduce its global cost structure. The program is focused on certain regions and end-use markets where business conditions are the weakest, as well as reductions in production capacity and various global functional and administrative costs. A pre-tax restructuring charge of $197 million was recorded in December 2016, of which about $140 million represents employee severance and other cash costs and nearly $60 million is related to the write-down of certain assets held for sale and other non-cash costs. In addition to the aforementioned pre-tax charge and cash costs, approximately $15 million of incremental restructuring-related cash costs are expected during 2017 for certain items that are required to be expensed on an as-incurred basis. The restructuring actions will result in the net reduction of approximately 1,700 positions, with substantially all actions to be complete by the first quarter 2018. The actions have anticipated annual savings of approximately $125 million once fully implemented. Refer to Note 7, "Business Restructuring" in Item 8 of this Form 10-K for additional information.

In 2015, PPG recorded a pre-tax restructuring charge of $140 million, of which about 85% represents employee severance and other cash charges. PPG expects these restructuring actions will result in full year, pre-tax savings of approximately $105 million in 2017. As of December 31, 2016, substantially all actions have been completed.

Debt refinancing charge

In 2014, the Company recorded a pre-tax charge of $317 million representing costs related to a debt refinancing undertaken to lower the Company's future interest costs. Refer to Note 8, "Borrowings and Lines of Credit" in Item 8 of this Form 10-K for additional information.

Pension settlement charges

During 2016, PPG permanently transferred approximately $1.8 billion of its U.S. and Canadian pension obligations and assets to several highly rated insurance companies. These actions triggered remeasurement and partial settlement of certain of the Company's defined benefit pension plans. PPG recognized a $968 million pre-tax settlement charge in connection with these transactions. Refer to Note 12, "Employee Benefit Plans" in Item 8 of this Form 10-K for additional information.

Other charges

Other charges in 2016 were higher than in 2015 and Other charges in 2015 were lower than in 2014, due to pre-tax environmental charges of $82 million in 2016 and $138 million in 2014. These charges were principally for environmental remediation at a former chromium manufacturing plant and associated sites in New Jersey.

Other income

Other income in 2016 was higher than in 2015 due to gains totaling $82 million resulting from the sale of PPG's ownership interests in two Asian fiber glass joint ventures, a legacy U.S. automotive glass and services business and a U.S. business affiliate. Other income in 2015 was lower than 2014 due to a $94 million pre-tax gain representing PPG's share of the gain recognized from the sale of an equity affiliate's business in 2014.

Effective tax rate and earnings per diluted share, continuing operations

	December 31,			% Change	
($ in millions, except percentages)	2016	2015	2014	2016 vs. 2015	2015 vs. 2014
Income tax expense	$ 241	$ 424	$ 237	(43.2)%	78.9%
Effective tax rate	29.1%	23.8%	17.6%	5.3 %	6.2%
Adjusted effective tax rate*	24.5%	24.1%	23.8%	0.4 %	0.3%
Earnings per diluted share	$ 2.11	$ 4.89	$ 3.88	(56.9)%	26.0%
Adjusted earnings per diluted share*	$ 5.82	$ 5.43	$ 4.75	7.2 %	14.3%

*See the Regulation G reconciliations - results of operations

The effective tax rate for the year-ended December 31, 2016 was 29.1% and increased 5.3% from the prior year primarily due to the inclusion of the tax effects of significant transactions during the year, including the tax effects of funding the Pittsburgh Corning asbestos trust.

As reported, earnings per diluted share from continuing operations for the year ended December 31, 2016 declined year-over-year from 2015, primarily due to significant pension settlement charges and other charges for items that cannot reasonably be expected to recur or that are not attributable to our primary operations. Refer to the Regulation G Reconciliations - Results of Operations for additional information. The Company's earnings per diluted share and adjusted earnings per diluted share both benefited from the 10.7 million, 7.0 million and 7.6 million shares of stock repurchased in 2016, 2015 and 2014, respectively.

Regulation G Reconciliations - Results of Operations

PPG Industries believes investors' understanding of the company's operating performance is enhanced by the disclosure of net income, earnings per diluted share and the effective tax rate adjusted for certain charges. PPG's management considers this information useful in providing insight into the company's ongoing operating performance because it excludes the impact of items that cannot reasonably be expected to recur on a quarterly basis or that are not attributable to our primary operations. Net income and earnings per diluted share adjusted for these items are not recognized financial measures determined in accordance with U.S. generally accepted accounting principles (GAAP) and should not be considered a substitute for net income or earnings per diluted share or other financial measures as computed in accordance with U.S. GAAP. In addition, adjusted net income, earnings per diluted share and the effective tax rate may not be comparable to similarly titled measures as reported by other companies.

Income before income taxes is reconciled to adjusted income before income taxes, the effective tax rate from continuing operations is reconciled to the adjusted effective tax rate from continuing operations and net income (attributable to PPG) and earnings per share – assuming dilution (attributable to PPG) are reconciled to adjusted net income (attributable to PPG) and adjusted earnings per share – assuming dilution below:

Year-ended December 31, 2016

($ in millions, except percentages and per share amounts)	Income Before Income Taxes	Tax Expense	Effective Tax Rate	Net income from continuing operations (attributable to PPG)	Earnings per diluted share
As reported, continuing operations	$ 827	$ 241	29.1 %	$ 564	$ 2.11
Includes:					
Charges related to transaction-related costs [1]	9	3	37.6 %	6	0.03
Charges related to pension settlements	968	352	36.4 %	616	2.31
Charge related to business restructuring	197	51	25.8 %	146	0.55
Charge related to environmental remediation	82	31	37.6 %	51	0.20
Loss on divestiture of European fiber glass business	42	(2)	(4.8)%	44	0.17
Net gain on disposals of ownership interests in business affiliates	(82)	(27)	32.9 %	(55)	(0.21)
Net tax effect of asbestos settlement funding	—	(151)	N/A	151	0.57
Charge related to early retirement of debt	8	3	37.6 %	5	0.02
Charges related to asset write-downs	27	8	29.6 %	20	0.07
Adjusted, continuing operations, excluding certain charges	$ 2,078	$ 509	24.5 %	$ 1,548	$ 5.82

Year-ended December 31, 2015

($ in millions, except percentages and per share amounts)	Income Before Income Taxes	Tax Expense	Effective Tax Rate	Net income from continuing operations (attributable to PPG)	Earnings per diluted share
As reported, continuing operations	$ 1,783	$ 424	23.8%	$ 1,338	$ 4.89
Includes:					
Charge related to business restructuring	140	34	24.3%	106	0.39
Charges related to transaction-related costs [1]	44	14	33.3%	30	0.10
Charge related to pension settlement	7	2	28.6%	5	0.02
Charge related to equity affiliate debt refinancing	11	4	37.6%	7	0.03
Adjusted, continuing operations, excluding certain charges	$ 1,985	$ 478	24.1%	$ 1,486	$ 5.43

Year-ended December 31, 2014

($ in millions, except percentages and per share amounts)	Income Before Income Taxes	Tax Expense	Effective Tax Rate	Net income from continuing operations (attributable to PPG)	Earnings per diluted share
As reported, continuing operations	$ 1,346	$ 237	17.6%	$ 1,085	$ 3.88
Includes:					
Charge related to debt refinancing	317	117	36.9%	200	0.72
Charges related to environmental remediation	138	52	37.7%	86	0.30
Charges related to transaction-related costs [1]	61	20	32.8%	41	0.15
Gain on asset dispositions	(94)	(35)	37.2%	(59)	(0.21)
Charge related to pension settlement	7	2	28.6%	5	0.02
Benefit from favorable foreign tax ruling	—	29	N/A	(29)	(0.11)
Adjusted, continuing operations, excluding certain charges	$ 1,775	$ 422	23.8%	$ 1,329	$ 4.75

(1) *Transaction-related costs include advisory, legal, accounting, valuation, and other professional or consulting fees incurred to effect significant acquisitions, as well as similar fees and other costs to effect divestitures not classified as discontinued operations. These costs also include the flow-through cost of sales impact for the step up to fair value of inventory acquired in acquisitions. These costs also include certain nonrecurring severance costs and charges associated with the Company's business portfolio transformation.*

Performance of Reportable Business Segments

Performance Coatings

	December 31,			$ Change		% Change	
($ in millions, except percentages)	2016	2015	2014	2016 vs. 2015	2015 vs. 2014	2016 vs. 2015	2015 vs. 2014
Net sales	$ 8,580	$ 8,765	$ 8,698	$ (185)	$ 67	(2.1)%	0.8%
Segment income	$ 1,314	$ 1,302	$ 1,205	$ 12	$ 97	0.9 %	8.0%

2016 vs. 2015

Performance Coatings net sales decreased (2%) due to the following:

- *Unfavorable foreign currency translation of approximately $260 million (3%)*

Partially offset by:

- *Net sales from acquisitions (+1%)*

Architectural coatings - EMEA sales volumes were flat year-over-year. Growth in western Europe was offset by reduced demand levels in central Europe and in Africa, where economies are closely linked to depressed commodity prices. Acquisition-related sales from Univer in Italy added about $10 million in the fourth quarter 2016.

Protective and marine coatings net sales volumes declined a low-to-mid-single-digit-percentage year-over-year as growth in protective coatings was offset by declines in marine coatings, primarily due to lower shipbuilding activity in Asia Pacific and the ongoing impact of decreased capital investment and maintenance in the oil and gas sector. Protective coatings sales volumes grew versus the prior year, led by the U.S. and Canada and Latin America regions, including benefits from expanded distribution through the PPG-Comex concessionaire network.

Aerospace coatings sales volumes increased modestly year-over-year, in line with industry growth rates. Sales growth occurred in all major regions.

Automotive refinish coatings organic sales grew at a low-single-digit percentage rate year-over-year, outperforming end-use market demand levels in the U.S. and Canada and Asia Pacific, as customers continue to adopt PPG's industry leading technologies.

Architectural coatings - Americas and Asia Pacific organic sales were flat versus the prior year. In the U.S. and Canada, sales volumes advanced in the company-owned store channel versus the prior year, mainly due to recent growth-related investments and initiatives. The increase in the company-owned stores channel was more than offset by sales volume declines in national retail (DIY) accounts and U.S. independent dealer channel year-over-year, despite DIY channel strengthening in the second half of 2016. Latin America organic sales were up year-over-year, led by Mexico which grew at more than double the Mexican GDP growth rate.

Segment income increased $12 million (+1%) primarily due to the benefits from prior year business restructuring initiatives, modestly higher selling prices, lower manufacturing costs, acquisition-related income (Cumings Microwave, Le Joint Francais, Univer), partially offset by unfavorable foreign currency translation and higher growth-related spending in the U.S. architectural coatings business. Segment income margins expanded, increasing 40 basis points year-over-year.

2015 vs. 2014

Performance Coatings net sales increased (1%) due to the following:

- *Net sales from acquisitions (+9%), largely Comex*
- *Modestly higher selling prices*

Partially offset by:

- *Unfavorable foreign currency translation of approximately $700 million (8%)*
- *Lower sales volumes (1%)*

Architectural coatings - EMEA sales volumes declined 1%. Demand was inconsistent throughout the region with modest growth continuing in certain countries, including the U.K., while several other countries experienced lower demand, including France.

Protective and marine coatings net sales volumes were slightly higher year-over-year. Sales for the business increased due to acquisition-related sales synergies from the Comex acquisition offset by unfavorable foreign currency translation.

Organic sales growth continued in aerospace coatings, aided by increased end-use market demand, but moderated versus the prior period reflecting the strong growth the business has delivered over the past several years. Automotive refinish coatings sales volume growth was higher, with solid growth trends in the U.S. and Canada.

Excluding the impacts of acquisitions and currency, architectural coatings - Americas and Asia Pacific net sales were lower versus 2014. The year-over-year sales comparison was negatively impacted in the U.S. and Canada by several new PPG product pipeline fills at major customers in the previous year, as well as customer inventory management by most U.S. and Canadian retail customers and independent dealers at the end of a modest paint season. Organic sales growth in the acquired Comex architectural coatings business was a high-single-digit percentage, but was partially mitigated by unfavorable foreign currency translation caused by the impact of a weaker Mexican peso versus the U.S. dollar.

Segment income increased $97 million (+8%) primarily due to acquisition-related income, lower manufacturing costs and modestly higher selling prices, partially offset by unfavorable foreign currency translation and lower sales volumes.

Looking Ahead

In the first quarter of 2017, we expect year-over-year growth in our automotive refinish business as customers continue to adopt PPG's industry-leading technologies in most major regions. We expect aerospace coatings sales volume growth to be modest, as overall industry demand remains tepid. Architectural coatings - EMEA sales volume growth is expected to improve modestly in the first quarter 2017, with results remaining uneven by country. Architectural coatings - Americas and Asia Pacific sales volumes are seasonally-lower in the first quarter; however, PPG expects overall volume trends by customer channel to be consistent with the fourth quarter 2016. The protective and marine coatings business is expected to continue to experience sales volumes declines in aggregate for the first quarter 2017 as weakness in marine shipbuilding is expected to continue and is likely to more than offset protective coatings gains. Looking ahead, acquisition-related sales are expected to add approximately $10 million to segment net sales in first quarter 2017. Additionally, based on mid-January exchange rates, we expect foreign currency translation on segment net sales and income to be a similar headwind as experienced in the fourth quarter 2016.

Industrial Coatings

	December 31,			$ Change		% Change	
($ in millions, except percentages)	2016	2015	2014	2016 vs. 2015	2015 vs. 2014	2016 vs. 2015	2015 vs. 2014
Net sales	$ 5,690	$ 5,476	$ 5,552	$ 214	$ (76)	3.9%	(1.4)%
Segment income	$ 1,042	$ 985	$ 951	$ 57	$ 34	5.8%	3.6 %

2016 vs. 2015

Industrial Coatings segment net sales increased (4%) due to the following:

- *Net sales from acquired businesses (+4%)*
- *Higher sales volumes (+3%)*

Partially offset by:

- *Unfavorable foreign currency translation of approximately $125 million (2%)*
- *Lower selling prices (1%)*

PPG's automotive OEM coatings business sales volumes increased a low-single-digit-percentage over the prior year, consistent with modest global automotive industry production growth. PPG's sales volumes differed by region, led by year-over-year growth in Europe and Asia Pacific, while U.S. and Canada sales volumes declined.

General industrial coatings and specialty coatings and materials sales volumes, in aggregate, increased a mid-single-digit percentage year-over-year, marking four consecutive quarters of above-market growth. Sales volume growth was led by Asia Pacific and EMEA, and was driven by strong end-market demand for automotive components, electronic materials, coil and extrusion products. Latin America sales volumes advanced moderately, while volumes in the U.S. and Canada declined modestly.

Packaging coatings sales volumes were up a mid-to-high single-digit percentage year-over-year, primarily driven by continued strong sales growth momentum related to the adoption of PPG's new can coatings technologies. This above market sales volume growth was led by U.S. and Canada and Asia Pacific regions.

Segment income increased $57 million (+6%) primarily due to lower manufacturing costs, higher sales volumes, acquisition-related income (MetoKote, IVC Industrial Coatings, Revocoat) and the benefits from prior year restructuring initiatives, partially offset by unfavorable foreign currency translation and modestly lower selling prices. Late in 2016, PPG experienced higher transportation and logistics costs required to meet increasing customer demand levels in Asia Pacific. Segment income margins continued to improve, increasing 30 basis points year-over-year.

2015 vs. 2014

Industrial Coatings segment net sales decreased (1%) due to the following:

- *Unfavorable foreign currency translation of nearly $400 million (7%)*
- *Lower selling prices (1%)*

Partially offset by:

- *Net sales from acquired businesses (+4%)*
- *Higher sales volumes (+3%), with growth in all regions, led by Asia Pacific and EMEA*

PPG's automotive OEM coatings business achieved sales volume growth in all regions, with an aggregate business unit growth rate of a high-mid-single-digit percentage year-over-year in comparison with the global auto industry production growth rate of approximately 2%. PPG sales volume growth was led by strong European and Asian demand. PPG continued to benefit from the adoption of new technologies and ongoing focus on customer service and customer process improvement initiatives.

Sales volumes declined modestly in PPG's general industrial coatings and specialty coatings and materials businesses in comparison to strong volume growth in the prior year period. Demand was mixed across various end-use markets and regions.

Packaging coatings sales volumes were up a high-mid-single-digit percentage, aided by new product introductions and continued emerging region growth.

Segment income increased $34 million (+4%) primarily due to lower manufacturing costs, higher sales volumes and acquisition-related income, partially offset by unfavorable foreign currency translation.

Looking ahead

In the first quarter of 2017, we expect low-single-digit global automotive industry growth led by Europe and Mexico, with continued declines in the U.S. and Canada. We expect moderate general industrial demand growth trends to continue in aggregate but to remain mixed by geography and end-use market. We anticipate sales volume growth to continue in packaging coatings due to the ongoing industry conversion to BPA non-intent interior can coatings. Additionally, we expect the increased transportation and logistic costs experienced during the fourth quarter 2016 to meet increasing customer demand levels in Asia Pacific to continue during the first quarter 2017. Looking ahead, we anticipate MetoKote acquisition-related sales to add approximately $50 million in the first quarter 2017. Additionally, based on mid-January exchange rates, we expect foreign currency translation on segment net sales and income to be a similar headwind as experienced in the fourth quarter 2016.

Glass

	December 31,			$ Change		% Change	
($ in millions, except percentages)	2016	2015	2014	2016 vs. 2015	2015 vs. 2014	2016 vs. 2015	2015 vs. 2014
Net sales	$ 481	$ 525	$ 541	$ (44)	$ (16)	(8.4)%	(3.0)%
Segment income	$ 53	$ 38	$ 35	$ 15	$ 3	39.5 %	8.6 %

2016 vs. 2015

Glass segment net sales decreased (8%) due to the following:

- *Absence of net sales from divested business (7%)*
- *Unfavorable foreign currency translation of approximately $5 million (1%)*

Fiber glass sales volumes were flat as weaker U.S. volumes were offset by stronger European volumes. The October 1, 2016 sale of the European fiber glass business negatively impacted net sales by approximately 7%.

Segment income increased $15 million (+39%) primarily due to improved manufacturing performance and strong cost-management efforts, including business restructuring benefits, and despite the absence of fourth quarter 2016 income related to the divested European fiber glass business and Asia fiber glass joint ventures.

2015 vs. 2014

Glass segment net sales decreased (3%) due to the following:

- *Unfavorable foreign currency translation (5%)*

Partially offset by:

- *Higher selling prices (+1%)*
- *Higher sales volumes (+1%)*

Fiber glass sales volumes increased a low-single-digit percentage in the U.S. market. Selling prices improved modestly year-over-year in the U.S. and Europe.

Segment income increased $3 million (+9%) due to higher selling prices and higher volumes and despite the impact of unfavorable foreign currency translation. Segment income was also unfavorably impacted by higher pension costs.

Looking ahead

In the first quarter of 2017, we expect a similar industry demand environment and consistent PPG sales sequentially due to normal business seasonality. Year-over-year comparisons in 2017 will continue to reflect the absence of sales and income from the divested European fiber glass business and two Asian fiber glass joint ventures until their one-year anniversaries in the fourth quarter 2017. We do not anticipate any significant impact from foreign currency translation.

Review and Outlook

During 2016, economic conditions remained mixed by geography and end-use market. Despite a subdued and uneven economic backdrop, PPG's aggregate sales volumes grew modestly versus the prior year. Acquisition-related sales from the six acquisitions completed in 2015 and the two completed in 2016 contributed to net sales growth year-over-year. These net sales increases were offset by significant unfavorable foreign currency translation as the U.S. dollar strengthened against most foreign currencies throughout the year, primarily the Mexican peso, the British pound, and the Chinese yuan.

U.S. and Canada

During 2016, the pace of economic activity remained mixed by end-use market in the U.S. and Canada region, with contraction in industrial production, including lower automotive industry builds versus prior year, coupled with growth in other end-use markets. Demand increased in the residential and commercial construction markets albeit at a slower pace versus 2015. New home starts advanced about 5% in 2016 versus approximately 10% in 2015 with similar growth rate declines experienced in residential remodeling and commercial construction. PPG's packaging coatings business continued to expand well ahead of the industry end-use market growth due to continued strong sales growth momentum related to customer adoption of PPG's new interior can coatings technologies. The refinish coatings business benefited from higher miles driven aided by continued low gasoline prices. PPG's automotive OEM business lagged industry demand levels due to a customer-driven market-share shift away from PPG that was offset in other regions of the world. The U.S. and Canada region remained PPG's largest, representing approximately 45% of 2016 sales, consistent with the prior year.

EMEA

European economic activity continued to strengthen modestly in 2016 despite regional uncertainty due to the United Kingdom's vote to exit the European Union. Overall GDP and industrial production improved modestly in the region but at a slower pace versus 2015. Regional demand continued to be mixed by country and end-use market. PPG experienced sales volume growth in each 2016 quarter, with the first half of the year growing faster than the second half due, in part, to a comparison to more robust growth in the second half of 2015. Demand for PPG's products in several end-use markets drove the regional growth rate, including above market performance in automotive OEM and general industrial coatings.

Europe, Middle East, Africa (EMEA) remains a large region for PPG, representing approximately 30% of PPG's 2016 sales, similar to prior year levels. Regional coatings volumes remain approximately 16% below their pre-recession levels in 2008. The modest volume recovery reflects the slow pace of economic growth in the region. PPG expects continued volume growth over time at attractive incremental margins due to significant cost structure improvements and available capacity to satisfy additional demand. The euro and other regional currencies were relatively stable throughout the first half of 2016. In the second half of the year, the British pound declined meaningfully versus the U.S. dollar due to the economic uncertainty surrounding the vote to exit the European Union. In addition, the euro experienced a moderate decline versus the U.S. dollar after the American presidential election in November.

Asia Pacific and Latin America

The emerging regional markets of Asia Pacific and Latin America represented 25% of PPG's 2016 sales in aggregate, in line with the prior year, which increased from 22% in 2014 primarily due to the Comex acquisition in Mexico.

Asia remained the largest emerging region, with sales of approximately $2.4 billion, led by China which continued as PPG's second largest country by revenue. Sales volume growth in Asia was led by the Industrial Coatings segment, in part due to strong automotive industry build growth, general industrial growth and continued adoption of PPG's interior can coatings technologies within the packaging industry. These increases were partially offset by the continued demand decline in the marine shipbuilding industry.

Overall, demand in Latin America remained subdued, with continued above market growth in Mexico and Central America, offset by slow overall demand growth in South America, primarily Brazil. In Mexico, the PPG-Comex business added over 200 new retail outlets, and automotive industry production accelerated in the second half of the year due to the opening of new automotive assembly plants within the country. Sales volumes continued to increase year-over-year, despite significant unfavorable foreign currency translation, principally from the Mexican peso. In Central America, the company continued to grow organically following a 2015 acquisition to expand its presence in the architectural end-use market.

Regional Outlook

Looking ahead to 2017, we expect to continue to operate in an evolving macroeconomic and regulatory environment. We anticipate improved momentum in overall global economic growth, including gradually higher growth rates in developed regions and continuing but uneven growth in emerging regions. We expect economic growth rates to improve in the U.S. and Canada and Latin America regions led by underlying improvements in GDP and industrial production. We anticipate PPG's U.S. and Canada regional growth will be led by industrial and packaging coatings partially offset by a decline in automotive industry builds. We continue to expect growth in the housing and commercial construction markets but at a slower pace than 2016. In Latin America, we anticipate economic expansion will be led by Mexico, albeit at a slower pace than 2016, and for South America to return to flat or slightly positive year-over-year growth following a multi-year contraction in economic output.

We expect growth rates to expand versus prior year in EMEA and Asia Pacific. In Europe, economic growth rates will remain mixed by sub-region and country. Favorable end-use market trends are expected to continue, particularly in automotive OEM coatings as industry build growth rates are anticipated to remain positive. In Asia Pacific, we expect continued industrial production growth in China as well as gains in Southeast Asia and India. Automotive build growth is expected to remain positive, but at a more modest growth rate versus 2016.

Significant other factors

During 2016, PPG finalized the divestiture of its flat glass and European fiber glass businesses as well as the sale of other businesses and business affiliates. The company received total cash proceeds of approximately $1.1 billion from these transactions.

In December 2016, PPG initiated a $197 million global restructuring program, with anticipated annual savings of approximately $125 million once fully implemented. The expected cost savings are broadly spread across all regions and all business units. The company expects to achieve $40 million to $50 million in savings in 2017 with the remainder of the projected annual savings to be substantially realized by year-end 2018. The company finalized all actions related to its 2015 restructuring program, achieving approximately $60 million of incremental savings during 2016. PPG will continue to aggressively manage the company's cost structure to ensure alignment with the overall demand environment, and make adjustments as required to remain competitive in the marketplace.

Raw materials are a significant input cost to the process of manufacturing coatings. PPG typically experiences fluctuating prices for energy and raw materials driven by various factors, including changes in supplier feedstock costs and inventories, global industry activity levels, foreign currency exchange rates, and global supply and demand factors. In aggregate, average raw material costs were lower in 2016 versus 2015, with certain raw materials experiencing price inflation late in the year. These savings were partially offset by unfavorable foreign currency transaction costs as some key raw materials are traded in U.S. dollars globally. PPG currently expects overall coatings raw material prices to increase modestly in 2017, with impacts varied by region and commodity.

Pension and post-retirement benefit costs, excluding settlements, curtailments and special termination benefits, were $120 million in 2016, down approximately $55 million from 2015. In 2017, we expect pension and other postretirement benefit costs to decrease by approximately $15 million to $20 million due to U.S. postretirement medical plan design changes made in 2016.

During 2016, the company took significant steps to reduce financial risk and settle long-term obligations. First, PPG contributed approximately $800 million (pre-tax) to complete its long-standing involvement in the Pittsburgh Corning bankruptcy by fully funding its obligations to the Pittsburgh Corning asbestos settlement trust, which included the prepayment of all future obligations at a 5.5% discount. The company has no further obligations for the trust's operation, management, or funding. Second, PPG permanently transferred approximately $1.8 billion of its U.S. and Canadian pension obligations and assets to several highly rated insurance companies. These actions are expected to reduce volatility in PPG's financial statements related to changes in pension discount rates and assumed participant mortality. As a result of these changes, PPG contributed $146 million to its U.S. pension plans in the second half of 2016 and $29 million in January 2017. In 2016, the Company made contributions aggregating $204 million to its U.S. and non-U.S. pension plans. In 2017, mandatory contributions to PPG's non-U.S. pension plans are expected to be between $20 million and $30 million.

In 2016, aggregate selling prices were nearly flat year-over-year, reflecting lower raw material prices which were partly offset by increases in employee-related costs. Selective pricing actions are planned for 2017, including announced price increases in architectural coatings company-owned stores in various parts of the world to reflect higher input costs on certain commodities experienced during 2016. In aggregate, the company expects selling prices to remain generally flat in 2017. The company will carefully monitor the price of oil-based raw materials, as the price of oil rose modestly in the later part of 2016, and other significant coatings feedstock prices throughout the year and assess the need to increase selling prices to compensate for increases in raw material costs.

In 2016, unfavorable foreign currency translation reduced sales by approximately $400 million and pre-tax income by about $70 million as the U.S. dollar strengthened against most foreign currencies throughout the year, primarily the Mexican peso, British pound, and Chinese yuan. Based on mid-January 2017 exchange rates, the company expects year-over-year unfavorable foreign currency translation to reduce 2017 sales by $375 million to $425 million and 2017 pre-tax income by about $70 million to $90 million. These unfavorable impacts will be greater in the first half of 2017 as the U.S. dollar strengthened significantly versus most foreign currencies in the second half of 2016. The foreign currency environment continues to be volatile and the impact on 2017 net sales and pre-tax income could differ from the guidance. The Company generally purchases raw materials, incurs manufacturing costs and sells finished goods in the same currency, so we typically incur only modest foreign currency transaction costs.

The Company expects interest expense, net of interest income, in 2017 to be approximately $5 million to $10 million higher than 2016 due to a $110 million increase in PPG's outstanding debt obligations, despite a lower overall interest rate on it's aggregate debt portfolio. In the fourth quarter of 2016, PPG issued approximately €900 million of public notes at rates below 1% with terms ranging from three to nine years.

The Company's 2017 effective tax rate from continuing operations is expected to be in the range of 24.5% and 25.5%. This is slightly higher than the equivalent rate in 2016 primarily due to a shift in the mix of earnings to jurisdictions with higher statutory tax rates. Other factors may impact the expected 2017 effective tax rate positively or negatively throughout the year, including changes to various statutory tax rates and regulations around the world.

Over the past five years, the Company used $3.6 billion of cash to repurchase about 39 million shares of PPG stock including over $1.0 billion in 2016. The Company ended the year with approximately $1.9 billion remaining under its current share repurchase authorization. During 2016, the Company deployed approximately $350 million for acquisitions and approximately $415 million for dividends. PPG increased its annual per-share dividend by 11% in 2016, marking the 45th annual increase and the 117th consecutive year of dividend payments. The Company achieved the top end of its 2015 and 2016 cash deployment target for acquisitions and share

repurchases, set at $1.5 billion to $2.5 billion, deploying $2.5 billion.

In January 2017, the Company announced a new cash deployment target for acquisitions and share repurchases of between $2.5 billion and $3.5 billion for the years 2017 and 2018 combined. PPG ended 2016 with approximately $1.9 billion in cash and short term investments, including the benefit of $1 billion of total proceeds from the business divestitures completed in late 2016. The Company expects continued strong free cash generation in 2017.

Accounting Standards Adopted in 2016

Note 1, "Summary of Significant Accounting Policies," under Item 8 of this Form 10-K describes the Company's recently adopted accounting pronouncements.

Accounting Standards to be Adopted in Future Years

Note 1, "Summary of Significant Accounting Policies," under Item 8 of this Form 10-K describes accounting pronouncements that have been promulgated prior to December 31, 2016 but are not effective until a future date.

Commitments and Contingent Liabilities, including Environmental Matters

PPG is involved in a number of lawsuits and claims, both actual and potential, including some that it has asserted against others, in which substantial monetary damages are sought. See Item 3, "Legal Proceedings" and Note 13, "Commitments and Contingent Liabilities," under Item 8 of this Form 10-K for a description of certain of these lawsuits.

As discussed in Item 3 and Note 13, although the result of any future litigation of such lawsuits and claims is inherently unpredictable, management believes that, in the aggregate, the outcome of all lawsuits and claims involving PPG, including asbestos-related claims, will not have a material effect on PPG's consolidated financial position or liquidity; however, any such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized.

It is PPG's policy to accrue expenses for contingencies when it is probable that a liability has been incurred and the amount of loss can be reasonably estimated. Reserves for environmental contingencies are exclusive of claims against third parties and are generally not discounted. In management's opinion, the Company operates in an environmentally sound manner and the outcome of the Company's environmental contingencies will not have a material effect on PPG's financial position or liquidity; however, any such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized. Management anticipates that the resolution of the Company's environmental contingencies will occur over an extended period of time.

The Company continues to analyze, assess and remediate the environmental issues associated with PPG's former chromium manufacturing plant in Jersey City, N.J. and associated sites ("New Jersey Chrome"). Information will continue to be generated from the ongoing groundwater remedial investigation activities related to New Jersey Chrome and will be incorporated into a final draft remedial action work plan for groundwater expected to be submitted to the New Jersey Department of Environmental Protection no later than 2020.

There are multiple, future events yet to occur, including further remedy selection and design, remedy implementation and execution and applicable governmental agency or community organization approvals. Considerable uncertainty exists regarding the timing of these future events for the New Jersey Chrome sites. Final resolution of these events is expected to occur over the next several years. As these events occur and to the extent that the cost estimates of the environmental remediation remedies change, the existing reserve for this environmental remediation matter will be adjusted.

Liquidity and Capital Resources

During the past three years, PPG has had sufficient financial resources to meet its operating requirements, to fund our capital spending, including acquisitions, share repurchases and pension plans and to pay increasing dividends to shareholders.

Cash and cash equivalents and short term investments

($ in millions)	December 31,	
	2016	2015
Cash and cash equivalents	$ 1,820	$ 1,311
Short term investments	43	144
Total	$ 1,863	$ 1,455

Summary cash flow information - continuing operations

($ in millions, except percentages)	December 31,			% Change	
	2016	2015	2014	2016 vs. 2015	2015 vs. 2014
Cash from operating activities	$ 1,241	$ 1,735	$ 1,718	(28.5)%	1.0 %
Cash from (used for) investing activities	$ 450	$ (373)	$ (889)	(220.6)%	(58.0)%
Cash used for financing activities	$ (1,184)	$ (754)	$ (929)	57.0 %	(18.8)%

Cash from operating activities - continuing operations

The decrease in cash from operating activities - continuing operations in 2016 compared to 2015, was primarily due to fully funding PPG's portion of the Pittsburgh Corning asbestos trust (the "Trust") in 2016. The slight increase in cash from continuing operating activities in 2015 compared to 2014 was driven by higher income from continuing operations, largely offset by higher cash contributions to pension plans.

Operating working capital

Operating Working Capital is a subset of total working capital and represents (1) receivables from customers, net of allowance for doubtful accounts, (2) inventories, and (3) trade liabilities. See Note 3, "Working Capital Detail" under Item 8 of this Form 10-K for further information related to the components of the Company's Operating Working Capital. We believe Operating Working Capital represents the key components of working capital under the operating control of our businesses. Operating Working Capital at December 31, 2016 and 2015 was $2.1 billion and $2.3 billion , respectively.

A key metric we use to measure our working capital management is Operating Working Capital as a percentage of sales (fourth quarter sales annualized).

($ in millions, except percentages)	2016	2015
Trade Receivables, net	$ 2,324	$ 2,343
Inventories, FIFO	1,666	1,803
Trade Creditor's Liabilities	1,940	1,886
Operating Working Capital	$ 2,050	$ 2,260
Operating Working Capital as % of Sales	14.7%	15.9%

Operating working capital at December 31, 2016 decreased $210 million compared with the prior year. Trade receivables from customers, net, as a percentage of 2016 fourth quarter sales, annualized, was 16.6%, up slightly from 16.5% for 2015. Days sales outstanding was 54 days in 2016, up 2 days from 2015. Inventories on a FIFO basis as a percentage of 2016 fourth quarter sales, annualized, was 11.9% compared to 12.7% in 2015. Inventory turnover was 4.6 times in 2016 and 4.4 times in 2015.

Environmental cash expenditures

Cash outlays related to environmental remediation activities were $47 million , $109 million, and $165 million in 2016, 2015 and 2014, respectively. We expect cash outlays for environmental remediation activities in 2017 to be between $50 million and $70 million.

Defined benefit pension plan contributions

($ in millions)	December 31,		
	2016	2015	2014
U.S. defined benefit pension contributions	$ 146	$ 234	$ 2
Non-U.S. defined benefit pension plans	$ 58	$ 39	$ 39

Following the transfer of certain U.S. retiree obligations and assets to third party insurers, PPG contributed $146 million and $29 million to its U.S. plans during 2016 and in January 2017, respectively. Some contributions to PPG's non-U.S. defined benefit pension plans in 2016 were required by local funding requirements. PPG expects to make mandatory contributions to its non-U.S. plans in the range of $20 million to $30 million in 2017. PPG may make voluntary contributions to its defined benefit pension plans in 2017 and beyond.

Asbestos settlement trust funding

In June 2016, PPG fully funded its portion of the trust that was established by the U.S. Bankruptcy Court for the Western District of Pennsylvania in May 2016. PPG's total cash obligations to fund the Trust totaled $813 million (pre-tax). The obligations included cash funding of $506 million (pre-tax) and the transfer of about 2.78 million shares of PPG common stock, which were hedged at approximately $22 per share. Cash paid to settle the derivative instrument totaled $49 million. These shares were already included in the Company's outstanding diluted share count. Lastly, PPG relinquished any claim to its equity interest in Pittsburgh Corning and conveyed to the Trust its ownership interest in Pittsburgh Corning's European subsidiary. In addition to the initial funding obligation, the company exercised an option to prepay all future cash obligations, totaling a net of $258 million (pre-tax), including a 5.5% prepayment discount of $61 million. All payments were applied against a previously established PPG reserve for the total asbestos trust obligation. The company utilized cash on hand for the payments, and this funding had no impact on PPG's previously stated cash-deployment targets. Refer to Note 13, "Commitments and Contingent Liabilities" under Item 1 of this Form 10-Q for additional information.

Cash used for investing activities - continuing operations

Capital expenditures, including business acquisitions

($ in millions, except percentages)	December 31,			% Change	
	2016	2015	2014	2016 vs. 2015	2015 vs. 2014
Capital expenditures [1]	$ 402	$ 454	$ 564	(11.5)%	(19.5)%
Business acquisitions, net of cash acquired [2]	$ 349	$ 320	$ 2,113	9.1 %	(84.9)%
Total capital expenditures, including acquisitions	$ 751	$ 774	$ 2,677	(3.0)%	(71.1)%
Capital expenditures, excluding acquisitions as a % of sales	2.7%	3.1%	3.8%	(12.9)%	(18.4)%

(1) Includes modernization and productivity improvements, expansion of existing businesses and environmental control projects.

(2) Excluding cash acquired, business acquisitions totaled $362 million, $440 million, and $2,183 million in 2016 , 2015 and 2014 , respectively.

Capital expenditures related to modernization and productivity improvements, expansion of existing businesses and environmental control projects is expected to be in the range of 2.5% to 3.0% of sales during 2017.

A primary focus for the Company in 2017 will continue to be cash deployment focused on profitable income growth, including pursuing opportunities for additional strategic acquisitions.

In 2016, the Company acquired MetoKote and several other smaller companies. The total cost of the 2016 acquisitions, net of cash acquired, was $349 million.

In 2015, the Company spent $320 million, net of cash acquired, to make several strategic bolt-on business acquisitions. PPG also acquired approximately $40 million of third party debt.

In November 2014, the Company acquired Comex, an architectural coatings company with headquarters in Mexico City, Mexico. In 2014, PPG also completed the acquisition of several smaller companies. The total cost of the 2014 acquisitions, including acquired debt repaid, was $2,427 million, net of cash acquired.

Cash proceeds from divestitures

During 2016, PPG finalized the sale of its flat glass business and several other businesses and business affiliates. The Company received total cash proceeds of approximately $1.1 billion from the following business divestitures.

On October 1, 2016, PPG sold the assets and liabilities of its flat glass manufacturing and glass coatings operations to Vitro S.A.B. de C.V. PPG received approximately $740 million in cash proceeds. PPG reported the assets and liabilities of the flat glass business as "Assets held for sale" and "Liabilities held for sale" in the accompanying consolidated balance sheet at December 31, 2015 and the results of operations of the flat glass business as discontinued operations in the consolidated statements of income and cash flows for all periods presented.

On October 1, 2016, PPG sold its European fiber glass operations to glass manufacturer Nippon Electric Glass Co. Ltd. Manufacturing facilities in Hoogezand, Netherlands, and Wigan, England, and a research and development facility in Hoogezand were included in the transaction. The European fiber glass business manufactures reinforcement materials for thermoset and thermoplastic composite applications for the transportation, energy, infrastructure and consumer markets.

On November 18, 2016, PPG divested its 50% ownership interests in its two PFG fiber glass joint ventures to Nan Ya Plastics Corporation ("Nan Ya"), which currently controlled the other 50% ownership interest in the joint ventures. Nan Ya is affiliated with Taiwan-based Formosa Plastics Group.

In April 2016, PPG sold its minority ownership interest in Pittsburgh Glass Works LLC ("PGW") to LKQ Corporation concurrent with the majority partner's sale of its ownership interest.

In March 2014, PPG received $1.735 billion in cash proceeds for the sale of its 51% ownership interest in its Transitions Optical joint venture and 100% of its optical sunlens business to Essilor.

Cash used for financing activities - continuing operations

Share repurchase activity

($ in millions, except number of shares)	December 31,		
	2016	2015	2014
Number of shares repurchased (millions)	10.7	7.0	7.6
Cost of shares repurchased	$ 1,050	$ 751	$ 750

We anticipate completing additional share repurchases during 2017. The Company has approximately $1.9 billion remaining under the current authorization from the Board of Directors, which was approved in 2016. The current authorized repurchase program has no expiration date.

Dividends paid to shareholders

($ in millions)	December 31,		
	2016	2015	2014
Dividends paid to shareholders	$ 414	$ 383	$ 361

PPG has paid uninterrupted annual dividends since 1899, and 2016 marked the 45th consecutive year of increased annual per-share dividend payments to shareholders. The Company raised its per-share dividend by 11% to $0.40 per share in April 2016.

Debt issued and repaid

In December 2016, PPG paid $133 million, using cash on hand to redeem its $125 million 6.65% notes due 2018.

In the fourth quarter 2016, PPG prepaid two $250 million Term Loan Credit Agreements which PPG entered into during May 2016, using cash on hand.

In November 2016, PPG completed a public offering of €300 million 0.000% Notes due 2019 and €600 million 0.875% Notes due 2025 (together, the "Notes"). These Notes were issued pursuant to PPG's existing shelf registration statement. The aggregate cash proceeds from the Notes, net of discounts and fees, was $987 million. The proceeds were used to repay outstanding borrowings and for general corporate purposes. The Notes are denominated in Euro and have been designated as hedges of net investments in the Company's European operations.

In January 2016, PPG repaid its $250 million 1.9% notes upon their maturity, using cash on hand.

In June 2015, PPG's €300 million notes matured, upon which the Company paid $336 million to settle these obligations using cash on hand.

In March 2015, PPG completed a public offering of €600 million 0.875% Notes due 2022 and €600 million 1.400% Notes due 2027. These notes were issued pursuant to PPG's existing shelf registration statement. The aggregate cash proceeds from the notes, net of discounts and fees, was approximately $1.24 billion. The proceeds were used to repay outstanding borrowings and for general corporate purposes.

In December 2014, PPG completed a debt refinancing which involved paying approximately $1.7 billion to redeem public notes which was funded by cash on hand and cash proceeds of approximately $1.2 billion from several debt issuances described below.

In November 2014, PPG completed a public offering of $300 million in principal amount of its 2.30% Notes due 2019. These notes were issued pursuant to PPG's existing shelf registration statement. Also in November 2014, PPG entered into three Euro-denominated borrowings as follows:

- 3-year €500 million, EURIBOR based variable rate bank loan
- 15-year €80 million 2.5% fixed interest note
- 30-year €120 million 3.0% fixed interest note.

The ratio of total debt, including capital leases, to total debt and equity was 47% at December 31, 2016 up from 46% in 2015.

Credit agreements and lines of credit

In December 2015, PPG entered into a five-year credit agreement (the "Credit Agreement") with several banks and financial institutions as further discussed in Note 8, "Borrowings and Lines of Credit" under Item 8 of this Form 10-K. The Credit Agreement replaced the Company's existing Five Year Credit Agreement dated as of September 12, 2012. The Credit Agreement provides for a $1.8 billion unsecured revolving credit facility. The Credit Agreement will terminate on December 18, 2020. During the years ended December 31, 2016 and 2015, there were no borrowings outstanding under the existing or the prior Credit Agreement.

In addition to the amounts available under the lines of credit, the Company has an automatic shelf registration statement on file with the SEC pursuant to which it may issue, offer and sell from time to time on a continuous or delayed basis any combination of securities in one or more offerings.

See Note 8, "Borrowings and Lines of Credit," under Item 8 of this Form 10-K for information regarding notes entered entered into and repaid as well as details regarding the use and availability of committed and uncommitted lines of credit, letters of credit, guarantees and debt covenants.

Contractual obligations

We continue to believe that our cash on hand and short term investments, cash from operations and the Company's available debt capacity will continue to be sufficient to fund our operating activities, capital spending, including acquisitions, dividend payments, debt service, share repurchases, contributions to pension plans, and PPG's significant contractual obligations. These significant contractual obligations are presented in the following table.

		Obligations Due In:			
($ in millions)	*Total*	*2017*	*2018-2019*	*2020-2021*	*There-after*
Contractual Obligations					
Long-term debt	$ 4,299	$ 526	$ 612	$ 627	$ 2,534
Short-term debt	99	99	—	—	—
Capital lease obligations	18	4	6	3	5
Operating leases	854	200	295	159	200
Interest payments [1]	1,038	95	175	133	635
Pension contributions [2]	59	59	—	—	—
Unconditional purchase commitments [3]	144	66	45	11	22
Other commitments	38	—	—	38	—
Total	$ 6,549	$ 1,049	$ 1,133	$ 971	$ 3,396

(1) Includes interest on all outstanding debt.

(2) Includes the high end of the range of the expected mandatory pension contributions for 2017 only, as PPG is unable to estimate the pension contributions beyond 2017. Also includes $29 million of contributions made to PPG's U.S. plans in January 2017, following the transfer of U.S. retiree obligations and assets to third party insurers.

(3) The unconditional purchase commitments are principally take-or-pay obligations related to the purchase of certain materials, including industrial gases and electricity, consistent with customary industry practice.

Other liquidity matters

At December 31, 2016, the total amount of unrecognized tax benefits for uncertain tax positions, including an accrual of related interest and penalties along with positions only impacting the timing of tax benefits, was $103 million. The timing of payments will depend on the progress of examinations with tax authorities. PPG does not expect a significant tax payment related to these obligations within the next year. The Company is unable to make a reasonably reliable estimate as to when any significant cash settlements with taxing authorities may occur.

The Company had $5.3 billion of undistributed earnings of non-U.S. subsidiaries as of December 31, 2016 and $5.0 billion as of December 31, 2015. These amounts relate to approximately 250 subsidiaries in more than 75 taxable jurisdictions. Over the past several years, PPG has established deferred tax liabilities on specific undistributed earnings, namely in connection with divestitures and the funding of the Trust. At December 31, 2016 and 2015, the expected future tax cost to repatriate these foreign earnings which are not permanently reinvested totaled $189 million and $158 million , respectively. No significant deferred U.S. income taxes have been provided on the remaining $3.5 billion and $4.2 billion of PPG's undistributed earnings as they are considered to be reinvested for an indefinite period of time or will be repatriated when it is tax effective to do so. The Company estimates repatriation of undistributed earnings of non-U.S. subsidiaries as of December 31, 2016 and 2015 would have resulted in a U.S. tax cost of approximately $350 million and $375 million , respectively.

Off-Balance Sheet Arrangements

The Company's off-balance sheet arrangements include the operating leases and unconditional purchase commitments disclosed in the "Liquidity and Capital Resources" section in the contractual obligations table as well as letters of credit and guarantees as discussed in Note 8, "Borrowings and Lines of Credit," under Item 8 of this Form 10-K.

Critical Accounting Estimates

Management has evaluated the accounting policies used in the preparation of the financial statements and related notes presented under Item 8 of this Form 10-K and believes those policies to be reasonable and appropriate. We believe that the most critical accounting estimates made in the preparation of our financial statements are those related to accounting for contingencies, under which we accrue a loss when it is probable that a liability has been incurred and the amount can be reasonably estimated, and to accounting for pensions, other postretirement benefits, business combinations, goodwill and other identifiable intangible assets with indefinite lives because of the importance of management judgment in making the estimates necessary to apply these policies.

Contingencies

Contingencies, by their nature, relate to uncertainties that require management to exercise judgment both in assessing the likelihood that a liability has been incurred as well as in estimating the amount of potential loss. The most important contingencies impacting our financial statements are those related to the collectability of accounts receivable, to environmental remediation, to pending, impending or overtly threatened litigation against the Company and to the resolution of matters related to open tax years. For more information on these matters, see Note 3, "Working Capital Detail," Note 11, "Income Taxes" and Note 13, "Commitments and Contingent Liabilities" under Item 8 of this Form 10-K.

Defined Benefit Pension and Other Postretirement Benefit Plans

Accounting for pensions and other postretirement benefits involves estimating the cost of benefits to be provided well into the future and attributing that cost over the time period each employee works. To accomplish this, we make extensive use of assumptions about inflation, investment returns, mortality, turnover, medical costs and discount rates. The Company has established a process by which management reviews and selects these assumptions annually. See Note 12, "Employee Benefit Plans," under Item 8 for information on these plans and the assumptions used.

Business Combinations

In accordance with the accounting guidance for business combinations, the Company uses the acquisition method of accounting to allocate costs of acquired businesses to the assets acquired and liabilities assumed based on their estimated fair values at the dates of acquisition. The excess costs of acquired businesses over the fair values of the assets acquired and liabilities assumed were recognized as goodwill. The valuations of the acquired assets and liabilities will impact the determination of future operating results. In addition to using

management estimates and negotiated amounts, the Company uses a variety of information sources to determine the estimated fair values of acquired assets and liabilities including: third-party appraisals for the estimated value and lives of identifiable intangible assets and property, plant and equipment; third-party actuaries for the estimated obligations of defined benefit pension plans and similar benefit obligations; and legal counsel or other experts to assess the obligations associated with legal, environmental and other contingent liabilities. The business and technical judgment of management was used in determining wh ich intangible assets have indefinite lives and in determining the useful lives of finite-lived intangible assets in accordance with the accounting guidance for goodwill and other intangible assets.

Goodwill and Intangible Assets

The Company tests indefinite-lived intangible assets and goodwill for impairment annually by either performing a qualitative evaluation or a quantitative test. The qualitative evaluation is an assessment of factors to determine whether it is more likely than not that the fair values of a reporting unit or asset is less than its carrying amount. Fair values under the quantitative test are estimated using discounted cash flow methodologies that are based on projections of the amounts and timing of future revenues and cash flows. For more information on these matters, see Note 1, "Summary of Significant Accounting Policies," under Item 8 of this Form 10-K.

We believe that the amounts recorded in the financial statements under Item 8 of this Form 10-K related to these contingencies, pensions, other postretirement benefits, business combinations, goodwill and other identifiable intangible assets with indefinite lives are based on the best estimates and judgments of the appropriate PPG management, although actual outcomes could differ from our estimates.

Currency

Comparing exchange rates from December 31, 2015 to December 31, 2016 and December 31, 2014 to December 31, 2015, the U.S. dollar strengthened against the currencies in most countries in which PPG operates, most notably the Mexican peso, British pound, Chinese yuan and euro. As a result, consolidated net assets at December 31, 2016 and 2015 decreased by approximately $465 million and $705 million, respectively.

Comparing exchange rates during 2016 to those of 2015, in the countries in which PPG operates, the U.S. dollar was stronger overall, which had an unfavorable impact of approximately $70 million on full year 2016 income before income taxes from the translation of this foreign income into U.S. dollars.

Comparing exchange rates during 2015 to those of 2014, in the countries in which PPG operates, the U.S. dollar was stronger overall, which had an unfavorable impact of approximately $120 million on full year 2015 income before income taxes from the translation of this foreign income into U.S. dollars.

Forward-Looking Statements

The Private Securities Litigation Reform Act of 1995 provides a safe harbor for forward-looking statements made by or on behalf of the Company. Management's Discussion and Analysis and other sections of this Annual Report contain forward-looking statements that reflect the Company's current views with respect to future events and financial performance.

You can identify forward-looking statements by the fact that they do not relate strictly to current or historic facts. Forward-looking statements are identified by the use of the words "aim," "believe," "expect," "anticipate," "intend," "estimate," "project," "outlook," "forecast" and other expressions that indicate future events and trends. Any forward-looking statement speaks only as of the date on which such statement is made, and the Company undertakes no obligation to update any forward looking statement, whether as a result of new information, future events or otherwise. You are advised, however, to consult any further disclosures we make on related subjects in our reports to the Securities and Exchange Commission. Also, note the following cautionary statements.

Many factors could cause actual results to differ materially from the Company's forward-looking statements. Such factors include global economic conditions, increasing price and product competition by foreign and domestic competitors, fluctuations in cost and availability of raw materials, our ability to maintain favorable supplier relationships and arrangements, the timing of and the realization of anticipated cost savings from restructuring initiatives, difficulties in integrating acquired businesses and achieving expected synergies therefrom, economic and political conditions in the markets we serve, ability to penetrate existing, developing and emerging foreign and domestic markets, foreign exchange rates and fluctuations in such rates, fluctuations in tax rates, the impact of future legislation, the impact of environmental regulations, unexpected business disruptions and the unpredictability of existing and possible future litigation. However, it is not possible to predict or identify all such factors.

Consequently, while the list of factors presented here and under Item 1A is considered representative, no such list should be considered to be a complete statement of all potential risks and uncertainties. Unlisted factors may present significant additional obstacles to the realization of forward-looking statements.

Consequences of material differences in the results compared with those anticipated in the forward-looking statements could include, among other things, lower sales or earnings, business disruption, operational problems, financial loss, legal liability to third parties, other factors set forth in Item 1A of this Form 10-K and similar risks, any of which could have a material adverse effect on the Company's consolidated financial condition, results of operations or liquidity.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk

PPG is exposed to market risks related to changes in foreign currency exchange rates, interest rates, and was exposed to changes in PPG's stock price. The Company may enter into derivative financial instrument transactions in order to manage or reduce these market risks. A detailed description of these exposures and the Company's risk management policies are provided in Note 9, "Financial Instruments, Hedging Activities and Fair Value Measurements," under Item 8 of this Form 10-K.

The following disclosures summarize PPG's exposure to market risks and information regarding the use of and fair value of derivatives employed to manage its exposure to such risks. Quantitative sensitivity analyses have been provided to reflect how reasonably possible, unfavorable changes in market rates can impact PPG's consolidated results of operations, cash flows and financial position.

Foreign Currency Risk

We conduct operations in many countries around the world. Our results of operations are subject to both currency transaction and currency translation risk. Foreign currency forward contracts outstanding during 2016 and 2015 were generally designated as a hedge of PPG's exposure to foreign currency transaction risk. As of December 31, 2016 and 2015 , the fair value of these contracts was a net asset of $16 million. The potential reduction in PPG's income from continuing operations resulting from the impact of adverse changes in exchange rates on the fair value of its outstanding foreign currency hedge contracts of 10% for European and Canadian currencies and 20% for Asian and Latin American currencies for the years ended December 31, 2016 and 2015 would have been $105 million and $29 million, respectively.

As of December 31, 2016 and 2015 , PPG had U.S. dollar to Euro cross currency swap contracts with a total notional amount of $560 million outstanding. As of December 31, 2016 and 2015 , the fair value of these contracts was a net asset of $65 million and $41 million, respectively. A 10% increase in the value of the Euro to the U.S. dollar would have had an unfavorable effect on the fair value of these swap contracts by reducing the value of this instrument by $54 million as of December 31, 2016 and increasing the liability by $60 million at December 31, 2015 .

As of December 31, 2016 and 2015 , PPG had non-U.S. dollar denominated debt outstanding of $3.1 billion and $2.1 billion, respectively. A weakening of the U.S. dollar by 10% against European currencies and by 20% against Asian and South American currencies would have resulted in unrealized translation losses of $344 million and $242 million as of December 31, 2016 and 2015 , respectively.

Interest Rate Risk

The Company manages its interest rate risk by balancing its exposure to fixed and variable rates while attempting to minimize its interest costs. A 10% increase in interest rates in the U.S., Canada, Mexico and Europe and a 20% increase in interest rates in Asia and South America would have an insignificant effect on PPG's variable rate debt obligations and interest expense for the years ended December 31, 2016 and 2015 , respectively. Further, a 10% reduction in interest rates would have increased the present value of the Company's fixed rate debt by approximately $65 million and $75 million as of December 31, 2016 and 2015 , respectively; however, such changes would not have had an effect on PPG's annual income from continuing operations or cash flows.

Equity Price Risk

In prior years, PPG entered into equity forward arrangements to hedge the Company's exposure to changes in the fair value of its future obligation to contribute PPG stock to the Trust (see Note 9, "Financial Instruments, Hedging Activities and Fair Value Measurements" and Note 13, "Commitments and Contingent Liabilities," under Item 8 of this Form 10-K). In June 2016, PPG satisfied its funding obligation to the Trust and the equity forward arrangements were settled. At settlement, the aggregated fair value of the equity forward arrangements was an asset of $258 million .

As of December 31, 2015, the aggregated fair value of these instruments was an asset of $223 million. A 10% decrease in PPG's stock price would have had an unfavorable effect on the fair value of these instruments of $27 million as of December 31, 2015 .

Item 8. Financial Statements and Supplementary Data

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of PPG Industries, Inc.

In our opinion, the accompanying consolidated balance sheets and the related consolidated statements of income, comprehensive income, shareholders' equity, and cash flows present fairly, in all material respects, the financial position of PPG Industries, Inc. and its subsidiaries at December 31, 2016 and 2015, and the results of their operations and their cash flows for each of the three years in the period ended December 31, 2016 in conformity with accounting principles generally accepted in the United States of America. In addition, in our opinion, the financial statement schedule listed in the index appearing under Item 15(a)(2) presents fairly, in all material respects, the information set forth therein when read in conjunction with the related consolidated financial statements. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2016, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). The Company's management is responsible for these financial statements and financial statement schedule, for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management Report on Establishing and Maintaining Adequate Internal Control Over Financial Reporting. Our responsibility is to express opinions on these financial statements, on the financial statement schedule, and on the Company's internal control over financial reporting based on our integrated audits. We conducted our audits in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the financial statements are free of material misstatement and whether effective internal control over financial reporting was maintained in all material respects. Our audits of the financial statements included examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. 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.

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

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

/s/ PricewaterhouseCoopers LLP
Pittsburgh, Pennsylvania
February 16, 2017

Responsibility for Preparation of the Financial Statements and Establishing and Maintaining Adequate Internal Control Over Financial Reporting

We are responsible for the preparation of the financial statements included in this Annual Report. The financial statements were prepared in accordance with accounting principles generally accepted in the United States of America and include amounts that are based on the best estimates and judgments of management.

We are also responsible for establishing and maintaining adequate internal control over financial reporting as defined in Rules 13a-15(f) and 15d-15(f) under the Securities Exchange Act of 1934, as amended. Internal control over financial reporting, no matter how well designed, have inherent limitations. Therefore, a system of internal control over financial reporting can provide only reasonable assurance and may not prevent or detect misstatements. In addition, because of changing conditions, there is risk in projecting any evaluation of internal controls to future periods.

We conducted an evaluation of the effectiveness of the Company's internal control over financial reporting as of December 31, 2016 . In making this evaluation, we used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in *Internal Control - Integrated Framework (2013)* . Our evaluation included reviewing the documentation of our controls, evaluating the design effectiveness of our controls and testing their operating effectiveness. Based on this evaluation we have concluded that, as of December 31, 2016 , the Company's internal controls over financial reporting were effective.

PricewaterhouseCoopers LLP, an independent registered public accounting firm, has issued their report, included on page 34 of this Form 10-K, regarding the Company's internal control over financial reporting.

/s/ Michael H. McGarry

Michael H. McGarry
Chairman and
Chief Executive Officer
February 16, 2017

/s/ Frank S. Sklarsky

Frank S. Sklarsky
Executive Vice President and
Chief Financial Officer
February 16, 2017

Consolidated Statement of Income

($ in millions, except per share amounts)	For the Year 2016	2015	2014
Net sales	$ 14,751	$ 14,766	$ 14,791
Cost of sales, exclusive of depreciation and amortization	8,063	8,206	8,348
Selling, general and administrative	3,662	3,624	3,696
Depreciation	341	339	324
Amortization	121	132	126
Research and development, net	466	476	483
Interest expense	125	125	187
Interest income	(26)	(39)	(50)
Asbestos settlement, net	5	12	12
Business restructuring	197	140	—
Debt refinancing charge	—	—	317
Pension settlement charges	968	—	—
Other charges	178	93	217
Other income	(176)	(125)	(215)
Income before income taxes	$ 827	$ 1,783	$ 1,346
Income tax expense	241	424	237
Income from continuing operations	$ 586	$ 1,359	$ 1,109
Income from discontinued operations, net of tax	313	68	1,050
Net income attributable to the controlling and noncontrolling interests	$ 899	$ 1,427	$ 2,159
Less: net income attributable to noncontrolling interests	22	21	57
Net income (attributable to PPG)	$ 877	$ 1,406	$ 2,102
Amounts Attributable to PPG			
Continuing operations	$ 564	$ 1,338	$ 1,085
Discontinued operations	313	68	1,017
Net income	$ 877	$ 1,406	$ 2,102
Earnings per common share			
Continuing operations	$ 2.12	$ 4.93	$ 3.92
Discontinued operations	1.18	0.25	3.68
Net income (attributable to PPG)	$ 3.30	$ 5.18	$ 7.60
Earnings per common share - assuming dilution			
Continuing operations	$ 2.11	$ 4.89	$ 3.88
Discontinued operations	1.17	0.25	3.64
Net income (attributable to PPG)	$ 3.28	$ 5.14	$ 7.52

Consolidated Statement of Comprehensive Income

($ in millions)	For the Year 2016	2015	2014
Net income attributable to the controlling and noncontrolling interests	$ 899	$ 1,427	$ 2,159
Unrealized foreign currency translation adjustment	(476)	(717)	(596)
Defined benefit pension and other postretirement benefit adjustments	808	113	(335)
Net change – derivative financial instruments	4	5	69
Other comprehensive (loss) / income, net of tax	336	(599)	(862)
Total comprehensive income	$ 1,235	$ 828	$ 1,297
Less: amounts attributable to noncontrolling interests:			
Net income	(22)	(21)	(57)
Unrealized foreign currency translation adjustment	10	13	6
Comprehensive income attributable to PPG	$ 1,223	$ 820	$ 1,246

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

Consolidated Balance Sheet

($ in millions)	December 31 2016	2015
Assets		
Current assets		
Cash and cash equivalents	$ 1,820	$ 1,311
Short-term investments	43	144
Receivables	2,692	2,709
Inventories	1,546	1,659
Assets held for sale	30	285
Other	321	604
Total current assets	$ 6,452	$ 6,712
Property, plant and equipment, net	2,759	2,822
Goodwill	3,572	3,669
Identifiable intangible assets, net	1,983	2,178
Deferred income taxes	154	711
Investments	179	367
Other assets	670	617
Total	$ 15,769	$ 17,076
Liabilities and Shareholders' Equity		
Current liabilities		
Accounts payable and accrued liabilities	$ 3,510	$ 3,419
Asbestos settlement	—	796
Restructuring reserves	101	87
Short-term debt and current portion of long-term debt	629	281
Liabilities held for sale	—	112
Total current liabilities	$ 4,240	$ 4,695
Long-term debt	3,787	4,026
Accrued pensions	740	695
Other postretirement benefits	731	1,015
Asbestos settlement	—	252
Deferred income taxes	417	460
Other liabilities	941	864
Total liabilities	$ 10,856	$ 12,007
Commitments and contingent liabilities (See Note 13)		
Shareholders' equity		
Common stock	$ 969	$ 969
Additional paid-in capital	701	635
Retained earnings	15,984	15,521
Treasury stock, at cost	(10,472)	(9,440)
Accumulated other comprehensive loss	(2,356)	(2,702)
Total PPG shareholders' equity	$ 4,826	$ 4,983
Noncontrolling interests	87	86
Total shareholders' equity	$ 4,913	$ 5,069
Total	$ 15,769	$ 17,076

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

Consolidated Statement of Shareholders' Equity

($ in millions)	*Common Stock*	*Additional Paid-In Capital*	*Retained Earnings*	*Treasury Stock*	*Accumulated Other Comprehensive Income/(Loss)*	*Total PPG*	*Non-controlling Interests*	*Total*
Balance, January 1, 2014	$ 484	$ 953	$ 12,757	$ (8,002)	$ (1,260)	$ 4,932	$ 266	$ 5,198
Net income attributable to the controlling and noncontrolling interests	—	—	2,102	—	—	2,102	57	2,159
Other comprehensive loss, net of tax	—	—	—	—	(856)	(856)	(6)	(862)
Cash dividends	—	—	(361)	—	—	(361)	—	(361)
Purchase of treasury stock	—	—	—	(750)	—	(750)	—	(750)
Issuance of treasury stock	—	39	—	38	—	77	—	77
Stock-based compensation activity	—	64	—	—	—	64	—	64
Dividends paid on subsidiary common stock to noncontrolling interests	—	—	—	—	—	—	(50)	(50)
Reductions in noncontrolling interests	—	(28)	—	—	—	(28)	(182)	(210)
Balance, December 31, 2014	$ 484	$ 1,028	$ 14,498	$ (8,714)	$ (2,116)	$ 5,180	$ 85	$ 5,265
Net income attributable to the controlling and noncontrolling interests	—	—	1,406	—	—	1,406	21	1,427
Other comprehensive loss, net of tax	—	—	—	—	(586)	(586)	(13)	(599)
Cash dividends	—	—	(383)	—	—	(383)	—	(383)
2:1 Stock split	485	(485)	—	—	—	—	—	—
Purchase of treasury stock	—	—	—	(751)	—	(751)	—	(751)
Issuance of treasury stock	—	46	—	25	—	71	—	71
Stock-based compensation activity	—	46	—	—	—	46	—	46
Dividends paid on subsidiary common stock to noncontrolling interests	—	—	—	—	—	—	(4)	(4)
Reductions in noncontrolling interests	—	—	—	—	—	—	(3)	(3)
Balance, December 31, 2015	$ 969	$ 635	$ 15,521	$ (9,440)	$ (2,702)	$ 4,983	$ 86	$ 5,069
Net income attributable to the controlling and noncontrolling interests	—	—	877	—	—	877	22	899
Other comprehensive income, net of tax	—	—	—	—	346	346	(10)	336
Cash dividends	—	—	(414)	—	—	(414)	—	(414)
Purchase of treasury stock	—	—	—	(1,050)	—	(1,050)	—	(1,050)
Issuance of treasury stock	—	37	—	18	—	55	—	55
Stock-based compensation activity	—	29	—	—	—	29	—	29
Dividends paid on subsidiary common stock to noncontrolling interests	—	—	—	—	—	—	(4)	(4)
Other transactions	—	—	—	—	—	—	(7)	(7)
Balance, December 31, 2016	$ 969	$ 701	$ 15,984	$ (10,472)	$ (2,356)	$ 4,826	$ 87	$ 4,913

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

Consolidated Statement of Cash Flows

($ in millions)	For the Year 2016	2015	2014
Operating activities			
Net income attributable to the controlling and noncontrolling interests	$ 899	$ 1,427	$ 2,159
Less: Income from discontinued operations	313	68	1,050
Income from continuing operations	$ 586	$ 1,359	$ 1,109
Adjustments to reconcile to cash from operations:			
Depreciation and amortization	462	471	450
Defined benefit pension expense	86	91	58
Pension settlement charge	968	—	—
Business restructuring charge	197	140	—
Environmental remediation charge	82	—	138
Stock-based compensation expense	39	54	71
Net gain, from sale of businesses	(40)	—	—
Equity affiliate (earnings)/losses, net of dividends	(4)	63	(56)
Deferred income taxes	155	(1)	(87)
Cash contributions to pension plans	(204)	(273)	(41)
Restructuring cash expenditures	(78)	(45)	(57)
Cash paid for asbestos settlement funding	(813)	—	—
Debt refinancing charge	—	—	317
Change in certain asset and liability accounts (net of acquisitions):			
Receivables	(59)	(150)	(116)
Inventories	61	31	(99)
Other current assets	24	(83)	(68)
Accounts payable and accrued liabilities	135	101	185
Noncurrent assets and liabilities, net	(56)	(97)	(129)
Taxes and interest payable	(247)	91	46
Other	(53)	(17)	(3)
Cash from operating activities - continuing operations	$ 1,241	$ 1,735	$ 1,718
Cash from/(used for) operating activities - discontinued operations	84	102	(190)
Cash from operating activities	$ 1,325	$ 1,837	$ 1,528
Investing activities			
Capital expenditures	$ (402)	$ (454)	$ (564)
Business acquisitions, net of cash balances acquired	(349)	(320)	(2,113)
Net proceeds from the sale of businesses	1,094	47	1,625
Proceeds from maturity of short-term investments	92	402	1,298
Purchase of short-term investments	—	(97)	(1,204)
Payments on cross currency swap contracts	(36)	(34)	(45)
Proceeds from cross currency swap contracts	37	37	37
(Payments on) / Proceeds from net investment hedges	(13)	19	49
Other	27	27	28
Cash from/(used for) investing activities - continuing operations	$ 450	$ (373)	$ (889)
Cash (used for)/from investing activities - discontinued operations	(14)	(22)	32
Cash from/(used for) investing activities	$ 436	$ (395)	$ (857)
Financing activities			
Net change in borrowings with maturities of three months or less	$ (15)	$ (32)	$ 89
Net (payments)/proceeds on commercial paper and short-term debt	(361)	(528)	932
Net proceeds from the issuance of long-term debt (net of discount and issuance costs)	988	1,242	1,163
Repayment of long-term debt	(379)	(340)	(1,803)
Premium paid for redemption of securities	(8)	—	(222)

Purchase of treasury stock	(1,050)	(751)	(750)
Issuance of treasury stock	31	53	57
Dividends paid on PPG common stock	(414)	(383)	(361)
Other	24	(15)	(34)
Cash used for financing activities - continuing operations	$ (1,184)	$ (754)	$ (929)
Cash used for financing activities - discontinued operations	—	—	(40)
Cash used for financing activities	$ (1,184)	$ (754)	$ (969)
Effect of currency exchange rate changes on cash and cash equivalents	(68)	(63)	(132)
Net increase/(decrease) in cash and cash equivalents	$ 509	$ 625	$ (430)
Cash and cash equivalents, beginning of year	$ 1,311	$ 686	$ 1,116
Cash and cash equivalents, end of year	$ 1,820	$ 1,311	$ 686
Supplemental disclosures of cash flow information:			
Interest paid, net of amount capitalized	$ 118	$ 115	$ 218
Taxes paid, net of refunds	$ 349	$ 383	$ 642

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

Notes to the Consolidated Financial Statements

1. Summary of Significant Accounting Policies

Principles of Consolidation

The accompanying consolidated financial statements include the accounts of PPG Industries, Inc. (“PPG” or the “Company”) and all subsidiaries, both U.S. and non-U.S., that it controls. PPG owns more than 50% of the voting stock of most of the subsidiaries that it controls. For those consolidated subsidiaries in which the Company’s ownership is less than 100% , the outside shareholders’ interests are shown as noncontrolling interests. Investments in companies in which PPG owns 20% to 50% of the voting stock and has the ability to exercise significant influence over operating and financial policies of the investee are accounted for using the equity method of accounting. As a result, PPG’s share of the earnings or losses of such equity affiliates is included in the accompanying consolidated statement of income and PPG’s share of these companies’ shareholders’ equity is included in “Investments” in the accompanying consolidated balance sheet. Transactions between PPG and its subsidiaries are eliminated in consolidation.

Use of Estimates in the Preparation of Financial Statements

The preparation of financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements, as well as the reported amounts of income and expenses during the reporting period. Such estimates also include the fair value of assets acquired and liabilities assumed resulting from the allocation of the purchase price related to business combinations consummated. Actual outcomes could differ from those estimates.

Revenue Recognition

The Company recognizes revenue when the earnings process is complete. Revenue is recognized by all operating segments when goods are shipped and title to inventory and risk of loss passes to the customer or when services have been rendered.

Shipping and Handling Costs

Amounts billed to customers for shipping and handling are reported in “Net sales” in the accompanying consolidated statement of income. Shipping and handling costs incurred by the Company for the delivery of goods to customers are included in “Cost of sales, exclusive of depreciation and amortization” in the accompanying consolidated statement of income.

Selling, General and Administrative Costs

Amounts presented as “Selling, general and administrative” in the accompanying consolidated statement of income are comprised of selling, customer service, distribution and advertising costs, as well as the costs of providing corporate-wide functional support in such areas as finance, law, human resources and planning. Distribution costs pertain to the movement and storage of finished goods inventory at company-owned and leased warehouses and other distribution facilities.

Advertising Costs

Advertising costs are expensed as incurred and totaled $322 million , $ 324 million and $ 297 million in 2016 , 2015 and 2014 , respectively.

Research and Development

Research and development costs, which consist primarily of employee related costs, are charged to expense as incurred.

($ in millions)	*2016*	*2015*	*2014*
Research and development – total	$ 487	$ 494	$ 499
Less depreciation on research facilities	21	18	16
Research and development, net	$ 466	$ 476	$ 483

Legal Costs

Legal costs, primarily include costs associated with acquisition and divestiture transactions, general litigation, environmental regulation compliance, patent and trademark protection and other general corporate purposes, are charged to expense as incurred.

Foreign Currency Translation

The functional currency of most significant non-U.S. operations is their local currency. Assets and liabilities of those operations are translated into U.S. dollars using year-end exchange rates; income and expenses are translated using the average exchange rates for the reporting period. Unrealized foreign currency translation adjustments are deferred in accumulated other comprehensive loss, a separate component of shareholders’ equity.

Cash Equivalents

Cash equivalents are highly liquid investments (valued at cost, which approximates fair value) acquired with an original maturity of three months or less.

Short-term Investments

Short-term investments are highly liquid, high credit quality investments (valued at cost plus accrued interest) that have stated maturities of greater than three months to one year. The purchases and sales of these investments are classified as investing activities in the consolidated statement of cash flows.

Marketable Equity Securities

The Company’s investment in marketable equity securities is recorded at fair market value and reported in “Other current assets” and “Investments” in the accompanying consolidated balance sheet with changes in fair market value recorded in income for those securities designated as trading securities and in other comprehensive income, net of tax, for those designated as available for sale securities.

Inventories

Inventories are stated at the lower of cost or market. Most U.S. inventories are stated at cost, using the last-in, first-out ("LIFO") method of accounting, which does not exceed market. All other inventories are stated at cost, using the first-in, first-out ("FIFO") method of accounting, which does not exceed market. PPG determines cost using either average or standard factory costs, which approximate actual costs, excluding certain fixed costs such as depreciation and property taxes. See Note 3, "Working Capital Detail" for further information concerning the Company's inventory.

Derivative Financial Instruments

The Company recognizes all derivative financial instruments (a "derivative") as either assets or liabilities at fair value on the balance sheet. The accounting for changes in the fair value of a derivative depends on the use of the instrument.

For a derivative that is considered "effective" as a hedge of an exposure to variability in expected future cash flows (cash flow hedge), the effective portion of the gain or loss on the derivative is recorded in other comprehensive income ("OCI") and the ineffective portion, if any, is reported in income from continuing operations. Amounts accumulated in OCI are reclassified into income from continuing operations in the same period or periods during which the hedged transactions are recorded in income from continuing operations.

For a derivative that is considered "effective" as a hedge of an exposure to changes in the fair value (fair value hedge) of an asset, a liability or a firm commitment, the change in the derivative's fair value is reported in income from continuing operations offsetting the gain or loss recognized on the item that is hedged.

For a derivative, debt or other financial instrument that is considered "effective" as a hedge of a net investment in a foreign operation, the gain or loss on the instrument is reported as a translation adjustment in accumulated other comprehensive income ("AOCI"). Gains and losses in AOCI related to hedges of the Company's net investments in foreign operations are reclassified out of AOCI and recognized in income from continuing operations upon a substantial liquidation, sale or partial sale of such investments or upon impairment of all or a portion of such investments. The cash flow impact of these instruments have been and will be classified as investing activities in the consolidated statement of cash flows.

Changes in the fair value of derivative instruments not designated as hedges for hedge accounting purposes are recognized in income from continuing operations in the period of change.

Property, Plant and Equipment

Property, plant and equipment is recorded at cost. Depreciation is computed on a straight-line method based on the estimated useful lives of related assets. Additional depreciation expense is recorded when facilities or equipment are subject to abnormal economic conditions or obsolescence.

The cost of significant improvements that add to productive capacity or extend the lives of properties are capitalized. Costs for repairs and maintenance are charged to expense as incurred. When a capitalized asset is retired or otherwise disposed of, the original cost and related accumulated depreciation balance are removed from the accounts and any related gain or loss is included in income from continuing operations. The amortization cost of capitalized leased assets is included in depreciation expense. Property and other long-lived assets are reviewed for impairment whenever events or circumstances indicate that their carrying amounts may not be recoverable. See Note 4, "Property, Plant and Equipment" for further details.

Goodwill and Identifiable Intangible Assets

Goodwill represents the excess of the cost over the fair value of acquired identifiable tangible and intangible assets less liabilities assumed from acquired businesses. Identifiable intangible assets acquired in business combinations are recorded based upon their fair value at the date of acquisition.

The Company tests goodwill of each reporting unit for impairment at least annually in connection with PPG's strategic planning process. The Company tests goodwill for impairment by either performing a qualitative evaluation or a two-step quantitative test. The qualitative evaluation is an assessment of factors, including reporting unit specific operating results as well as industry, market and general economic conditions, to determine whether it is more likely than not that the fair values of a reporting unit is less than its carrying amount, including goodwill. The Company may elect to bypass this qualitative assessment for some or all of its reporting units and perform a two-step quantitative test. The quantitative goodwill impairment test is performed during the fourth quarter by comparing the estimated fair value of the associated reporting unit as of September 30 to its carrying value. The Company's reporting units are its operating segments. (See Note 19, "Reportable Business Segment Information," for further information concerning the Company's operating segments.) Fair value is estimated using discounted cash flow methodologies.

The Company has determined that certain acquired trademarks have indefinite useful lives. The Company tests the carrying value of these trademarks for impairment at least annually, or as needed whenever events and circumstances indicate that their carrying amount may not be recoverable. The annual assessment takes place in the fourth quarter of each year either by completing a qualitative assessment or quantitatively by comparing the estimated fair value of each trademark as of September 30 to its carrying value. Fair value is estimated by using the relief from royalty method (a discounted cash flow methodology). The qualitative assessment includes consideration of factors, including revenue relative to the asset being assessed, the operating results of the related business as well as industry, market and general economic conditions, to determine whether it is more likely than not that the fair value of the asset is less than its carrying amount.

Identifiable intangible assets with finite lives are amortized on a straight-line basis over their estimated useful lives (1 to 30 years) and are reviewed for impairment whenever events or circumstances indicate that their carrying amount may not be recoverable.

Receivables and Allowances

All trade receivables are reported on the balance sheet at the outstanding principal adjusted for any allowance for credit losses

and any charge offs. The Company provides an allowance for doubtful accounts to reduce receivables to their estimated net realizable value when it is probable that a loss will be incurred. Those estimates are based on historical collection experience, current economic and market conditions, a review of the aging of accounts receivable and the assessments of current creditworthiness of customers.

Product Warranties

The Company accrues for product warranties at the time the associated products are sold based on historical claims experience. The reserve, pre-tax charges against income and cash outlays for product warranties were not significant to the consolidated financial statements of the Company for any year presented.

Asset Retirement Obligations

An asset retirement obligation represents a legal obligation associated with the retirement of a tangible long-lived asset that is incurred upon the acquisition, construction, development or normal operation of that long-lived asset. PPG recognizes asset retirement obligations in the period in which they are incurred, if a reasonable estimate of fair value can be made. The asset retirement obligation is subsequently adjusted for changes in fair value. The associated estimated asset retirement costs are capitalized as part of the carrying amount of the long-lived asset and depreciated over its useful life. PPG's asset retirement obligations are primarily associated with the retirement or closure of certain assets used in PPG's manufacturing process. The accrued asset retirement obligation recorded on PPG's balance sheet was $18 million and $13 million as of December 31, 2016 and 2015, respectively.

PPG's only conditional asset retirement obligation relates to the possible future abatement of asbestos contained in certain PPG production facilities. The asbestos in PPG's production facilities arises from the application of normal and customary building practices in the past when the facilities were constructed. This asbestos is encapsulated in place and, as a result, there is no current legal requirement to abate it. Inasmuch as there is no requirement to abate, the Company does not have any current plans or an intention to abate and therefore the timing, method and cost of future abatement, if any, are not known. The Company has not recorded an asset retirement obligation associated with asbestos abatement, given the uncertainty concerning the timing of future abatement, if any.

Reclassifications

Certain reclassifications of prior years' data have been made to conform to the current year presentation. These reclassifications had no impact on our previously reported net income, cash flows or shareholders' equity.

Accounting Standards Adopted in 2016

In April 2015, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") No. 2015-05, "Customer's Accounting for Fees Paid in a Cloud Computing Arrangement." This ASU requires the accounting for the cost of licenses to be recognized separately from the fees for computing services. The amendments in this ASU were effective for annual periods beginning after December 15, 2015. PPG adopted this guidance prospectively, commencing January 1, 2016. Adoption of this ASU did not have a material impact on PPG's consolidated financial position, results of operations or cash flows.

In September 2015, the FASB issued ASU No. 2015-16, "Simplifying the Accounting for Measurement-Period Adjustments." This ASU simplifies the treatment of adjustments to provisional amounts recognized in the period for items in a business combination for which the accounting is incomplete at the end of the reporting period. The amendments in this ASU were effective for fiscal years beginning after December 15, 2015 and for interim periods therein. PPG applied the provisions of this ASU commencing January 1, 2016. Adoption of this ASU did not have a material impact on PPG's consolidated financial position, results of operations or cash flows.

Accounting Standards to be Adopted in Future Years

In January 2017, the FASB issued ASU No. 2017-04, "Simplifying the Test for Goodwill Impairment." This ASU simplifies how an entity is required to test goodwill for impairment by eliminating Step 2 from the goodwill impairment test. Step 2 measures a goodwill impairment loss by comparing the implied fair value of a reporting unit's goodwill with the carrying amount of that goodwill. The amendments in this ASU are effective for public business entities for fiscal years beginning after December 15, 2019 and for interim periods therein. Early adoption is permitted. PPG does not believe this ASU will have a material impact on its consolidated financial position, results of operation or cash flows.

In November 2016, the FASB issued ASU No. 2016-18, "Restricted Cash." This ASU eliminates diversity in practice by requiring the statement of cash flows to reconcile total cash, including deposits with restrictions. The amendments in this ASU are effective for public business entities for fiscal years beginning after December 15, 2017 and for interim periods therein. PPG does not believe this ASU will have a material impact on its statement of cash flows.

In August 2016, the FASB issued ASU No. 2016-15, "Classification of Certain Cash Receipts and Cash Payments." This ASU addresses eight specific cash flow issues with the objective of eliminating the existing diversity in practice. The amendments in this ASU are effective for public business entities for fiscal years beginning after December 15, 2017 and for interim periods therein. PPG does not believe this ASU will have a material impact on its consolidated financial position, results of operation or cash flows.

In June 2016, the FASB issued ASU No. 2016-13, "Financial Instruments - Credit Losses." This ASU requires an organization to measure all expected credit losses for financial assets held at the reporting date based on historical experience, current conditions, and reasonable and supportable forecasts. Financial institutions and other organizations will now use forward-looking information to better inform their credit loss estimates. The amendments in this ASU are effective for fiscal years beginning after December 15, 2019 and for interim periods therein. PPG does not believe this ASU will have a material impact on its consolidated financial position, results of operation or cash flows.

In April 2016, the FASB issued ASU No. 2016-10, “Identifying Performance Obligations and Licensing.” This ASU addresses certain implementation issues that have surfaced since the issuance of ASU No. 2014-09 in May 2014. The ASU provides guidance in identifying performance obligations and determining the appropriate accounting for licensing arrangements. The amendments in this ASU are effective for fiscal years beginning after December 15, 2017 and for interim periods therein. PPG is in the process of assessing the impact the adoption of this ASU will have on its consolidated financial position, results of operations or cash flows.

In March 2016, the FASB issued ASU No. 2016-09, “Improvements to Employee Share-Based Payment Accounting.” This ASU simplifies certain aspects of the accounting for share-based payment transactions, including income tax requirements, forfeitures, and presentation on the balance sheet and the statement of cash flows. The amendments in this ASU are effective for annual periods beginning after December 15, 2016 and for the interim periods therein. Upon adoption, the Company expects the provisions of the ASU to create volatility in its effective tax rate on a go-forward basis as the excess tax benefit from the exercise of stock options will be recorded to tax expense rather than Additional paid-in-capital. PPG does not believe this ASU will have a material impact on its consolidated financial position, results of operations or cash flows.

In March 2016, the FASB issued ASU No. 2016-08, “Principal versus Agent Considerations (Reporting Revenue Gross versus Net).” This ASU clarifies the revenue recognition implementation guidance for preparers on certain aspects of principal versus agent consideration. The amendments in this ASU are effective for annual periods beginning after December 15, 2017 and for interim periods therein. PPG does not believe this ASU will have a material impact on its consolidated financial position, results of operation or cash flows.

In February 2016, the FASB issued ASU No. 2016-02, “Leases.” This ASU requires all lessees to recognize on the balance sheet right to use assets and lease liabilities for the rights and obligations created by lease arrangements with terms greater than 12 months. The amendments in this ASU are effective for fiscal years beginning after December 15, 2018 and for interim periods therein. PPG is in the process of assessing the impact the adoption of this ASU will have on its consolidated financial position, results of operations and cash flows. At a minimum, total assets and total liabilities will increase in the period the ASU is adopted. At December 31, 2016, PPG’s undiscounted future minimum payments outstanding for lease obligations were approximately $850 million .

In January 2016, the FASB issued ASU No. 2016-01, “Recognition and Measurement of Financial Assets and Liabilities.” This ASU simplifies the accounting and disclosures related to equity investments. The amendments in this ASU are effective for fiscal years beginning after December 15, 2017 and for interim periods therein. Adoption of this ASU will not have a material impact on PPG’s consolidated financial position, results of operations or cash flows.

In July 2015, the FASB issued ASU No. 2015-11, “Simplifying the Measurement of Inventory.” This ASU simplifies the measurement of inventory by requiring certain inventory to be measured at the lower of cost or net realizable value. The amendments in this ASU are effective for fiscal years beginning after December 15, 2016 and for interim periods therein. Adoption of this ASU will not have a material impact on PPG’s consolidated financial position, results of operations or cash flows.

In May 2014, the FASB issued ASU No. 2014-09, “Revenue from Contracts with Customers: Topic 606.” This ASU replaces nearly all existing U.S. GAAP guidance on revenue recognition. The standard prescribes a five-step model for recognizing revenue, the application of which will require significant judgment. The amendments in this ASU are effective for fiscal years beginning after December 15, 2017, and for interim periods therein. The provisions of this ASU may be applied retroactively or on a modified retrospective (cumulative effect) basis. PPG has not yet selected which transition method it will apply upon adoption. In addition, PPG is evaluating recently issued guidance on practical expedients as part of its transition decision. PPG believes the preponderance of the Company’s contracts with customers are standard ship and bill arrangements. Under the provisions of this ASU, PPG believes certain costs currently reported in Selling, general and administrative costs will be reclassified to Cost of sales, exclusive of depreciation and amortization, as they are tied to satisfaction of a performance obligation. In addition, PPG expects the cost of certain customer incentives will be recorded as a reduction of revenue rather than Cost of sales, exclusive of depreciation and amortization or Selling, general and administrative costs. Given the complexity of certain contractual arrangements, PPG is in the process of assessing the impact the adoption of this ASU will have on its consolidated financial position, results of operations and cash flows and has not concluded as to its significance.

2. Acquisitions and Divestitures

Acquisitions

MetoKote Corporation

In July 2016, PPG completed the acquisition of MetoKote Corporation ("MetoKote"), a U.S.-based coatings services business. MetoKote applies coatings to customers' manufactured parts and assembled products. It operates on-site coatings services within several customer manufacturing locations, as well as at regional service centers, located throughout the U.S., Canada, Mexico, the United Kingdom, Germany, Hungary and the Czech Republic. Customers ship parts to MetoKote service centers where they are treated to enhance paint adhesion and painted with electrocoat, powder or liquid coatings technologies. Coated parts are then shipped to the customer’s next stage of assembly. MetoKote coats an average of more than 1.5 million parts per day.

PPG is in the process of obtaining final third-party valuations of assets acquired in the MetoKote acquisition. As such, the allocation of the purchase price is subject to change. The following table summarizes the estimated fair value of assets acquired and liabilities assumed as reflected in the preliminary purchase price allocation for MetoKote.

($ in millions)		
Current assets	$	38
Property, plant, and equipment		73
Identifiable intangible assets with finite lives		86
Goodwill		166
Deferred income taxes [(a)]		(12)
Total assets	$	351
Current liabilities		(23)
Other long-term liabilities		(22)
Total liabilities	$	(45)
Total purchase price, net of cash acquired	$	306

[(a)] The net deferred income tax liability is included in assets due to the Company's tax jurisdictional netting.

The pro-forma impact on PPG's sales and results of operations, including the pro forma effect of events that are directly attributable to the acquisition, was not significant. While calculating this impact, no cost savings or operating synergies that may result from the acquisition were included. Since the acquisition, the results of this acquired business comprise the coatings services operating segment, included within the Industrial Coatings reportable segment.

Taiwan Chlorine Industries

In conjunction with the 2013 separation of its commodity chemicals business, PPG conveyed to Axiall Corporation ("Axiall") its 60% ownership interest in Taiwan Chlorine Industries (“TCI”), a joint venture with China Petrochemical Development Corporation (“CPDC”) located in Taiwan. Under PPG’s agreement with CPDC, if certain post-closing conditions were not met following the 3 year anniversary of the separation, CPDC had the option to sell its 40% ownership interest in TCI to Axiall for $100 million . In turn, Axiall had a right to designate PPG as its designee to purchase the 40% ownership interest of CPDC. In April 2016, Axiall announced that CPDC had decided to sell its ownership interest in TCI to Axiall. In June 2016, Axiall formally designated PPG to purchase the 40% ownership interest in TCI. In August 2016, Westlake Chemical Corporation acquired Axiall, which became a wholly-owned subsidiary of Westlake. PPG is currently negotiating the terms of its purchase of CPDC’s 40% ownership interest.

Consorcio Comex

In November 2014, PPG finalized the acquisition of Consorcio Comex, S.A. de C.V. (“Comex”), an architectural coatings company with headquarters in Mexico City, Mexico ($2.3 billion aggregate purchase price) for $1.95 billion , net of cash acquired of $69 million . PPG also repaid $280 million of third-party debt assumed in the acquisition. Comex manufactures coatings and related products in Mexico and sells them in Mexico and Central America principally through more than 4,200 stores that are independently owned and operated by more than 700 concessionaires. Comex also sells its products through regional retailers and wholesalers, and directly to customers. As of the acquisition date, Comex had approximately 3,900 employees, eight manufacturing facilities and six distribution centers. The acquisition further expands PPG’s global coatings business and adds a leading architectural coatings business in Mexico and Central America. Since the acquisition, the results of this acquired business have been principally included in the results of the architectural coatings - Americas and Asia Pacific business, within the Performance Coatings reportable segment. Comex’s net sales reported by PPG from this acquired business were approximately $900 million for the year ended December 31, 2015. Comex’s income from continuing operations related to this acquisition was a mid-teen percentage return on sales.

The purchase price related to the Comex acquisition was allocated based on information available at the acquisition date and was subject to customary post-closing adjustments. During the ten-month period ended October 31, 2015, PPG obtained a valuation of property, plant and equipment acquired in the Comex acquisition and made other changes during the measurement period which resulted in adjustments to property, plant and equipment, non-current deferred tax liabilities and goodwill. These measurement period adjustments increased goodwill by a net, aggregate amount of $3 million . These measurement period adjustments are not considered material individually or in the aggregate, therefore, prior periods have not been revised.

The following table summarizes the fair value of assets acquired and liabilities assumed as reflected in the purchase price allocation for Comex.

($ in millions)		
Current assets	$	340
Property, plant, and equipment		229
Trademarks with indefinite lives		1,022
Identifiable intangible assets with finite lives		281
Goodwill		1,089
Other non-current assets		54
Total assets		3,015
Current liabilities		(331)
Non-current deferred tax liabilities		(410)
Long-term debt		(280)
Accrued pensions		(20)
Other long-term liabilities		(24)
Total liabilities	$	(1,065)
Total purchase price, net of cash acquired	$	1,950

The identifiable intangible assets with finite lives in the table above, which consist primarily of customer relationships and acquired technology, are subject to amortization over a weighted average period of 24 years. See Note 6, “Goodwill and Other Identifiable Intangible Assets” for further details regarding PPG’s intangible assets.

The following information reflects the net sales of PPG for the year ended December 31, 2014 on a pro forma basis as if the transaction for the Comex acquisition had been completed on January 1, 2014.

Condensed Consolidated Pro Forma information (unaudited)

($ in millions)	*2014*
Net sales	$ 15,606

The pro forma impact on PPG's results of operations, including the pro forma effect of events that were directly attributable to the acquisition, was not significant to PPG's consolidated results of operations for 2014. While calculating this impact, no cost savings or operating synergies that may result from the acquisition were included.

Other Acquisitions

In 2016, 2015 and 2014, the Company completed several smaller business acquisitions. The total consideration paid for these acquisitions, net of cash acquired, debt assumed and other post closing adjustments, was $43 million , $371 million and $189 million , respectively.

On January 20, 2017, PPG announced that it has acquired certain assets of automotive refinish coatings company Futian Xinshi (Futian), an automotive refinish coatings company based in the Guangdong province of China. Futian distributes its products in China through a network of more than 200 distributors .

On January 5, 2017, PPG completed the acquisition of DEUTEK S.A., a leading Romanian paint and architectural coatings manufacturer, from the Emerging Europe Accession Fund. DEUTEK, established in 1993, manufactures and markets a large portfolio of well-known professional and consumer paint brands, including OSKAR ® and DANKE! ® . The company's products are sold in more than 120 do-it-yourself stores and 3,500 independent retail outlets in Romania.

Divestitures

During 2016, PPG finalized the sale of its flat glass business, European fiber glass business and its ownership interests in several joint ventures and business affiliates. The Company received total cash proceeds of approximately $1.1 billion from the following business divestitures.

Flat Glass Business

On October 1, 2016, PPG completed the sale of its flat glass manufacturing and glass coatings operations to Vitro S.A.B. de C.V. PPG received approximately $740 million in cash proceeds and recorded a pre-tax gain on the sale of $421 million . PPG reported the assets and liabilities of the flat glass business as "Assets held for sale" and "Liabilities held for sale" in the accompanying consolidated balance sheet as of December 31, 2015 and the results of operations of the flat glass business as discontinued operations on the condensed consolidated statements of income and cash flows for all periods presented.

Under the terms of the agreement, PPG divested its entire flat glass manufacturing and glass coatings operations, including production sites located in Fresno, California; Salem, Oregon; Carlisle, Pennsylvania; and Wichita Falls, Texas; four distribution/fabrication facilities located across Canada; and a research-and-development center located in Harmar, Pennsylvania, near Pittsburgh. PPG's flat glass business included approximately 1,200 employees. The business manufactures glass that is fabricated into products used primarily in commercial and residential construction.

The net sales and income from discontinued operations related to the flat glass business for the three years ended December 31, 2016, 2015 and 2014 were as follows:

($ in millions)	*December 31*		
	2016	*2015*	*2014*
Net sales	$ 427	$ 564	$ 569
Income from operations	$ 70	$ 99	$ 70
Net gain on the divestiture of the flat glass business	421	—	—
Income tax expense	178	32	22
Income from discontinued operations, net of tax	$ 313	$ 67	$ 48

The major classes of assets and liabilities of the flat glass business included in the PPG consolidated balance sheet at December 31, 2015 were as follows:

($ in millions)	*December 31, 2015*
Receivables	$ 79
Inventory	47
Property, plant, and equipment	196
Deferred income taxes [(a)]	(37)
Assets held for sale	$ 285
Short-term debt and current portion of long-term debt	1
Accounts payable and accrued liabilities	72
Long-term debt	16
Accrued pensions	16
Other postretirement benefits	6
Other long-term liabilities	1
Liabilities held for sale	$ 112

[(a)] The net deferred income tax liability is included in assets held for sale due to the Company's tax jurisdictional netting.

European Fiber Glass Business

On October 1, 2016, PPG completed the sale of its European fiber glass business to glass manufacturer Nippon Electric Glass Co. Ltd. ("NEG"). PPG recorded a pre-tax loss of $42 million , consisting predominately of a $46 million pension settlement charge which is recorded in "Selling, general and administrative" on the Consolidated Statement of Income. Manufacturing facilities in Hoogezand, Netherlands, and Wigan, England, and a research and development facility in Hoogezand were included in the transaction. The European fiber glass business manufactures reinforcement materials for thermoset and thermoplastic composite applications for the transportation, energy, infrastructure and consumer markets. The results of the European fiber glass business were not reclassified as discontinued operations, as the divestiture of the European fiber glass business did not have a major impact on PPG's ongoing results of operations and did not constitute an operating segment.

PFG Fiber Glass Joint Ventures

On November 18, 2016, PPG sold its 50% ownership interests in its two PFG fiber glass joint ventures to its joint venture partner Nan Ya Plastics Corporation ("Nan Ya"). Nan Ya

is affiliated with Taiwan-based Formosa Plastics Group. The PFG fiber glass joint ventures supply electronic yarn fibers used in integrated electronic circuit boards and fiber glass reinforcement products for automotive applications. PPG recorded a net pre-tax gain on the sale of $36 million which is reported in "Other income" on the Consolidated Statement of Income.

Pittsburgh Glass Works

In April 2016, PPG sold its minority ownership interest in Pittsburgh Glass Works LLC ("PGW") to LKQ Corporation concurrent with the majority partner's sale of its ownership interest. PPG recorded a pre-tax gain on the sale of $20 million . PPG accounted for its interest in PGW under the equity method of accounting. PPG's share of net earnings from PGW are reported in "Other income" in the Consolidated Statement of Income for all periods presented and have not been reclassified as discontinued operations, as the divestiture of PGW does not represent a strategic shift in PPG's operations and PGW did not have a major impact on PPG's ongoing results of operations.

In July 2014, PGW sold its insurance and services business and recognized a pre-tax gain. PPG's share of the pre-tax gain recognized by PGW was $94 million . This gain is reported in the caption "Other income" on the Consolidated Statement of Income. In addition, PPG received a cash distribution of $41 million from PGW to offset PPG's expected income tax liability associated with this transaction. The pre-tax gain and the cash distribution are both reported within the "Equity affiliate earnings, net of distributions received" caption on the Consolidated Statement of Cash Flows.

Mt. Zion Flat Glass Facility

In September 2014, PPG completed the sale of substantially all of the assets of its former Mt. Zion, Illinois, flat glass manufacturing facility to automotive glass manufacturer Fuyao Glass America Incorporated. As a result of this transaction, the Company recognized a pre-tax gain of $22 million which is reported in the caption "Discontinued Operations" on the Consolidated Statement of Income.

Plaka Business

In December 2016, PPG announced that it has reached a definitive agreement to sell the assets of its Mexico-based Plaka plasterboard and cement-board business to Knauf International GmbH. The transaction is expected to close in the first half of 2017, subject to regulatory approvals and other customary closing conditions. PPG has presented the assets of the Plaka business as "Assets held for sale" on the consolidated balance sheet as of December 31, 2016.

PPG acquired the Plaka business in 2014 as part of its acquisition of Comex. Plaka, with approximate sales of $30 million in 2015, manufactures plasterboard, cement board and drywall primarily for the Mexican construction market. The business employs about 200 people and operates a manufacturing facility in Querétaro, Mexico.

Transitions Optical Joint Venture and Sunlens Business

In March 2014, the Company completed the sale of its 51% ownership interest in its Transitions Optical joint venture and 100% of its optical sunlens business to Essilor International (Compagnie Generale D'Optique) SA ("Essilor"). PPG received cash at closing of $1.735 billion pre-tax (approximately $1.5 billion after-tax). The sale of these businesses, which were previously reported in the former Optical and Specialty Materials segment, resulted in a pre-tax gain of $1,468 million ($946 million after-tax) reported in discontinued operations. During the first quarter of 2014, the Company recognized $522 million of tax expense on the sale, of which $262 million is deferred U.S. income tax on the foreign earnings of the sale, as PPG does not consider these earnings to be reinvested for an indefinite period of time. The pre-tax gain on this sale reflects the excess of the sum of the cash proceeds received over the net book value of the net assets of PPG's former Transitions Optical and sunlens business. The Company also incurred $55 million of pre-tax expense, primarily for professional services related to the sale, post-closing adjustments, costs and other contingencies under the terms of the agreements. The net gain on the sale includes these related losses and expenses. During 2014, revisions to estimated tax liabilities associated with the transaction were recorded to discontinued operations.

The results of operations and cash flows of these businesses for the year ended December 31, 2014, and the net gain on the sale, are reported as results from discontinued operations for the year ended December 31, 2014. In prior periods presented, the results of operations and cash flows of these businesses were reclassified from continuing operations and presented as results from discontinued operations.

Essilor has also entered into 5 year agreements with PPG for the continued supply of photochromic materials and for research and development services, subject to renewal. PPG considered the significance of the revenues associated with the agreements compared to total operating revenues of the disposed businesses and determined that they were not significant.

Net sales and earnings from discontinued operations related to the Transitions Optical and sunlens transaction for the year ended December 31, 2014 are presented in the table below:

($ in millions)		*2014*
Net sales	$	247
Income from operations	$	104
Net gain from divestiture of PPG's interest in the Transitions Optical joint venture and sunlens business		1,468
Income tax expense		570
Income from discontinued operations, net of tax	$	1,002
Less: Net income attributable to non-controlling interests, discontinued operations		(33)
Net income from discontinued operations (attributable to PPG)	$	969

Notes to the Consolidated Financial Statements

3. Working Capital Detail

($ in millions)	2016	2015
Receivables		
Trade - net [1]	$ 2,324	$ 2,343
Equity affiliates	3	4
Other - net	365	362
Total	$ 2,692	$ 2,709
Inventories [2]		
Finished products	$ 969	$ 1,055
Work in process	165	161
Raw materials	375	402
Supplies	37	41
Total	$ 1,546	$ 1,659
Accounts payable and accrued liabilities		
Trade	$ 1,940	$ 1,886
Accrued payroll	447	466
Customer rebates	235	232
Other postretirement and pension benefits	124	131
Income taxes	93	106
Other	671	598
Total	$ 3,510	$ 3,419

(1) Allowance for Doubtful Accounts was $39 million and $46 million as of December 31, 2016 and 2015 , respectively.

(2) Inventories valued using the LIFO method of inventory valuation comprised 37% and 41% of total gross inventory values as of December 31, 2016 and 2015 , respectively. If the FIFO method of inventory valuation had been used, inventories would have been $120 million and $144 million higher as of December 31, 2016 and 2015 , respectively. During the years ended December 31, 2016 and 2015 , certain inventories accounted for on the LIFO method of accounting were reduced, which resulted in the liquidation of certain quantities carried at costs prevailing in prior years. The effect on income from continuing operations was expense of $2 million and income of $3 million for the years ended December 31, 2016 and 2015 , respectively.

4. Property, Plant and Equipment

($ in millions)	Useful Lives (years)	2016	2015
Land and land improvements	1-30	$ 464	$ 482
Buildings	20-40	1,420	1,453
Machinery and equipment	5-25	3,584	3,684
Other	3-20	783	797
Construction in progress		383	333
Total [1]		$ 6,634	$ 6,749
Less: accumulated depreciation		3,875	3,927
Net		$ 2,759	$ 2,822

(1) Interest capitalized in 2016 , 2015 and 2014 was $8 million , $9 million and $16 million , respectively.

5. Investments

($ in millions)	2016	2015
Investments in equity affiliates	$ 46	$ 221
Marketable equity securities - Trading (See Note 9)	78	77
Other	55	69
Total	$ 179	$ 367

The Company's investments in equity affiliates are comprised principally of 50% ownership interests in a number of joint ventures that manufacture and sell coatings.

Until November 2016, the Company's investments in and advances to equity affiliates included its ownership interests in two PFG fiber glass joint ventures. During November, these investments were sold. PPG's carrying value in these investments at the date of sale and December 31, 2015 totaled $125 million and $127 million , respectively. Refer to Note 2, "Acquisitions and Divestitures".

Until April 2016, the Company's investments in and advances to equity affiliates also included its minority ownership interest in PGW. In April 2016, PPG sold its minority ownership interest. Refer to Note 2, "Acquisitions and Divestitures" for additional information. PPG's carrying value in this investment at the date of sale and December 31, 2015 was $21 million and $18 million , respectively. In December 2015, PGW refinanced certain long term debt arrangements and recorded a debt extinguishment charge. PPG's share of the debt extinguishment charge was $11 million and was recorded in "Other income" on the Consolidated Statement of Income. In conjunction with the refinancing transaction, PGW distributed a portion of the debt proceeds to its owners, of which PPG's share was $72 million . The extinguishment charge and the cash distribution were both reported within the "Equity affiliate earnings, net of distributions received" caption on the Consolidated Statement of Cash Flows.

PPG's share of undistributed net earnings of equity affiliates was $7 million and $93 million as of December 31, 2016 and December 31, 2015 , respectively. Dividends received from equity affiliates were $7 million , $77 million and $5 million in 2016 , 2015 and 2014 , respectively.

6. Goodwill and Other Identifiable Intangible Assets

The change in the carrying amount of goodwill attributable to each reportable business segment for the years ended December 31, 2016 and 2015 was as follows:

($ in millions)	Performance Coatings	Industrial Coatings	Glass	Total
Balance, January 1, 2015	$ 3,267	$ 486	$ 48	$ 3,801
Acquisitions	109	104	—	213
Foreign currency translation	(303)	(38)	(4)	(345)
Balance, December 31, 2015	$ 3,073	$ 552	$ 44	$ 3,669
Acquisitions	6	168	—	174
Divestitures	—	—	(44)	(44)
Foreign currency translation	(209)	(18)	—	(227)
Balance, December 31, 2016	$ 2,870	$ 702	$ —	$ 3,572

The carrying amount of acquired trademarks with indefinite lives as of December 31, 2016 and 2015 totaled $1,107 million and $1,250 million , respectively. The decrease is primarily due to the strengthening of the U.S. dollar against most currencies. Refer to "Currency" section under Part II, Item 7. "Management's Discussion and Analysis of Financial Conditions and Results of Operations."

The Company's identifiable intangible assets with finite lives are being amortized over their estimated useful lives and are detailed below.

	December 31, 2016			December 31, 2015		
($ in millions)	Gross Carrying Amount	Accumulated Amortization	Net	Gross Carrying Amount	Accumulated Amortization	Net
Acquired technology	$ 587	$ (446)	$ 141	$ 572	$ (421)	$ 151
Customer-related intangibles	1,272	(618)	654	1,267	(574)	693
Tradenames	142	(71)	71	132	(61)	71
Other	38	(28)	10	39	(26)	13
Balance	$ 2,039	$ (1,163)	$ 876	$ 2,010	$ (1,082)	$ 928

Aggregate amortization expense was $121 million , $132 million and $126 million in 2016 , 2015 and 2014 , respectively. The estimated future amortization expense of identifiable intangible assets per year is as follows:

($ in millions)	2017	2018	2019	2020	2021
Estimated future amortization expense	$ 120	$ 115	$ 100	$ 90	$ 85

7. Business Restructuring

The Company records restructuring liabilities that represent charges incurred in connection with consolidations of certain operations, including operations from acquisitions, as well as headcount reduction programs. These charges consist primarily of severance costs and asset write-downs.

In December 2016, PPG's Board of Directors approved a business restructuring program which includes actions necessary to reduce its global cost structure. The program is focused on certain regions and end-use markets where business conditions are the weakest, as well as reductions in production capacity and various global functional and administrative costs. A pre-tax restructuring charge of $197 million was recorded in December 2016, of which approximately $140 million represents employee severance and other cash costs and nearly $60 million is related to the write-down of certain assets held for sale and other non-cash costs. In addition to the aforementioned pre-tax charge and cash costs, approximately $15 million of incremental restructuring-related cash costs are expected during 2017 for certain items that are required to be expensed on an as-incurred basis. The restructuring actions will result in the net reduction of approximately 1,700 positions, with substantially all actions to be completed in the first quarter of 2018. The actions have anticipated annual savings of approximately $125 million once fully implemented. The company expects to achieve $40 million to $50 million in savings in 2017 with the remainder of the projected annual savings to be substantially realized by year-end 2018.

The following table summarizes the 2016 restructuring charges and the reserve activity since inception and through the year ended December 31, 2016 :

($ in millions, except no. of employees)	Severance and Other Costs	Asset Write-offs	Total Reserve	Employees Impacted
Performance Coatings	$ 77	$ 45	$ 122	1,069
Industrial Coatings	52	14	66	804
Glass	2	—	2	153
Corporate	7	—	7	85
Total 2016 restructuring charge	$ 138	$ 59	$ 197	2,111
Activity to date	(6)	(59)	(65)	(40)
December 31, 2016	$ 132	$ —	$ 132	2,071

In April 2015, the Company approved a business restructuring plan which includes actions necessary to achieve cost synergies related to recent acquisitions. In addition, the program aimed to further align employee levels and production capacity in certain businesses and regions with current product demand, as well as reductions in various global administrative functions. A pre-tax restructuring charge of $140 million was recorded in April 2015, of which about 85% represents employee severance and other cash costs. The restructuring actions impacted approximately 1,800 employees and were substantially complete as of December 31, 2016.

The following table summarizes the 2015 restructuring charges and the reserve activity since inception and through the year ended December 31, 2016 :

($ in millions, except no. of employees)	*Severance and Other Costs*	*Asset Write-offs*	*Total Reserve*	*Employees Impacted*
Performance Coatings	$ 71	$ 6	$ 77	1,259
Industrial Coatings	42	13	55	534
Glass	4	—	4	33
Corporate	4	—	4	27
Total 2015 restructuring charge	$ 121	$ 19	$ 140	1,853
2015 Activity	(32)	(19)	(51)	(1,047)
Foreign currency impact	(2)	—	(2)	—
December 31, 2015	$ 87	$ —	$ 87	806
2016 Activity	(85)	—	(85)	(806)
Foreign currency impact	(2)	—	(2)	—
December 31, 2016	$ —	$ —	$ —	—

8. Borrowings and Lines of Credit

Long-term Debt Obligations

	As of December 31,	
($ in millions)	2016	2015
1.9 % notes, due 2016 (1)	$ —	$ 250
3-year variable rate bank loan, due 2017 (€500)	526	544
6.65% notes, due 2018	—	125
0.00% note, due 2019 (€300)	313	—
2.3% notes, due 2019	298	297
3.6% notes, due 2020	496	496
9% non-callable debentures, due 2021 (1)	133	133
0.875% notes, due 2022 (€600)	626	647
0.875% note, due 2025 (€600)	621	—
1.4% notes, due 2027 (€600)	620	641
2.5% note, due 2029 (€80)	83	86
7.70% notes, due 2038	174	174
5.5% notes, due 2040	247	246
3% note, due 2044 (€120)	118	122
Commercial paper	—	459
Impact of derivatives on debt (1)	3	4
Various other non-U.S. debt, weighted average 3.8% as of December 31, 2016 and 6.1% of December 31, 2015.	41	42
Capital lease obligations	18	14
Total	$ 4,317	$ 4,280
Less payments due within one year	530	254
Long-term debt	$ 3,787	$ 4,026

(1) PPG entered into several interest rate swaps which had the effect of converting fixed rate notes to variable rates, based on the three-month London Interbank Offered Rate (LIBOR). There were no interest rate swaps outstanding related to these instruments as of December 31, 2016 and 2015. The impact of the derivatives on debt represents the fair value adjustment of the debt while the interest rate swaps were outstanding, which is being amortized as a reduction to interest expense over the remaining term of the debt. The weighted average effective interest rate for these borrowings, including the effects of the swaps, was 8.4% and 3.1% for the years ended December 31, 2016 and 2015, respectively. Refer to Note 9, "Financial Instruments, Hedging Activities, and Fair Value Measurements" for additional information.

2016 Activities

In December 2016, PPG paid $133 million to redeem its $125 million 6.65% notes, due 2018, using cash on hand.

In December 2016, PPG prepaid the two $250 million Term Loan Credit Agreements which PPG entered into during May 2016. The Bank of Tokyo-Mitsubishi UFJ, Ltd. Term Loan originally terminated and all amounts outstanding were payable in March 2017. The BNP Paribas Term Loan originally terminated and all amounts outstanding were payable in May 2017.

In November 2016, PPG completed a public offering of €300 million 0.000% Notes due 2019 and €600 million 0.875% Notes due 2025. These notes were issued pursuant to PPG's existing shelf registration statement and pursuant to an indenture between the Company and The Bank of New York Mellon Trust Company, N.A., as trustee, as supplemented. The Indenture governing these notes contains covenants that limit the Company's ability to, among other things, incur certain liens securing indebtedness, engage in certain sale-leaseback transactions, and enter into certain consolidations, mergers, conveyances, transfers or leases of all or substantially all the Company's assets. The terms of these notes also require the Company to make an offer to repurchase Notes upon a Change of Control Triggering Event (as defined in the Indenture) at a price equal to 101% of their principal amount plus accrued and unpaid interest. The Company may issue additional debt from time to time pursuant to the Indenture.

The aggregate cash proceeds from the notes, net of discounts and fees, was $987 million . The notes are denominated in euro and have been designated as hedges of net investments in the Company's European operations. For more information, refer to Note 9 "Financial Instruments, Hedging Activities and Fair Value Measurements."

In January 2016, PPG's $250 million 1.9% notes matured, and PPG repaid these obligations with cash on hand.

2015 Activities

In December 2015, PPG entered into a five-year credit agreement (the "Credit Agreement") with several banks and financial institutions. The Credit Agreement replaced the Company's Five Year Credit Agreement dated as of September 12, 2012. The Credit Agreement provides for a $1.8 billion unsecured revolving credit facility. The Company has the ability to increase the size of the Credit Agreement by up to an additional $500 million , subject to the receipt of lender commitments and other conditions. The Credit Agreement will terminate on December 18, 2020. The Company has the right, subject to certain conditions set forth in the Credit Agreement, to designate certain subsidiaries of the Company as borrowers under the Credit Agreement. In connection with any such designation, the Company is required to guarantee the obligations of any such subsidiaries under the Credit Agreement. There were no amounts outstanding under the Credit Agreement during the years ended December 31, 2016 and 2015. The available borrowing rate on a one month, U.S. dollar denominated borrowing was 1.77% at December 31, 2016.

Borrowings under the Credit Agreement may be made in U.S. dollars or in euros. The Credit Agreement provides that

loans will bear interest at rates based, at the Company's option, on one of two specified base rates plus a margin based on certain formulas defined in the Credit Agreement. Additionally, the Credit Agreement contains a Commitment Fee, as defined in the Credit Agreement, on the amount of unused commitments under the Credit Agreement ranging from 0.080% to 0.225% per annum. The average Commitment Fee in 2016 was 0.09% , and PPG is committed to pay 0.09% in 2017.

The Credit Agreement also supports the Company's commercial paper borrowings. As a result, the commercial paper borrowings as of December 31, 2015 were classified as long-term debt based on PPG's intent and ability to refinance these borrowings on a long-term basis. There were no commercial paper borrowings outstanding as of December 31, 2016.

The Credit Agreement contains usual and customary restrictive covenants for facilities of its type, which include, with specified exceptions, limitations on the Company's ability to create liens or other encumbrances, to enter into sale and leaseback transactions and to enter into consolidations, mergers or transfers of all or substantially all of its assets. The Credit Agreement maintains the same restrictive covenant as the prior credit agreement whereby the Company must maintain a ratio of Total Indebtedness to Total Capitalization, as defined in the Credit Agreement, of 60% or less. As of December 31, 2016 , total indebtedness was 45% of the Company's total capitalization.

The Credit Agreement also contains customary events of default, including the failure to make timely payments when due under the Credit Agreement or other material indebtedness, the failure to satisfy covenants contained in the Credit Agreement, a change in control of the Company and specified events of bankruptcy and insolvency that would permit the lenders to accelerate the repayment of any loans.

In June 2015, PPG's €300 million 3.875% notes matured, upon which the Company paid $336 million to settle these obligations.

In March 2015, PPG completed a public offering of €600 million 0.875% notes due 2022 and €600 million 1.400% Notes due 2027, or €1.2 billion ($1.26 billion) in aggregate principal amount. These notes were issued pursuant to PPG's existing shelf registration statement and pursuant to an indenture between the Company and The Bank of New York Mellon Trust Company, N.A., as trustee, as supplemented. The Indenture governing these notes contains covenants that limit the Company's ability to, among other things, incur certain liens securing indebtedness, engage in certain sale-leaseback transactions, and enter into certain consolidations, mergers, conveyances, transfers or leases of all or substantially all the Company's assets. The terms of these notes also require the Company to make an offer to repurchase notes upon a Change of Control Triggering Event (as defined in the Indenture) at a price equal to 101% of their principal amount plus accrued and unpaid interest. The Company may issue additional debt from time to time pursuant to the Indenture.

The aggregate cash proceeds from the notes, net of discounts and fees, was $1.24 billion . The notes are denominated in euro and have been designated as hedges of net investments in the Company's European operations. For more information, refer to Note 9 "Financial Instruments, Hedging Activities and Fair Value Measurements."

2014 Activities

In November 2014, PPG completed a public offering of $300 million in aggregate principal amount of its 2.3% Notes due 2019. These notes were issued pursuant to its existing shelf registration statement and pursuant to an indenture between the Company and The Bank of New York Mellon Trust Company, N.A., as trustee, as supplemented. The Company may issue additional debt from time to time pursuant to the Indenture. The Indenture governing these notes contains covenants that limit the Company's ability to, among other things, incur certain liens securing indebtedness, engage in certain sale-leaseback transactions, and enter into certain consolidations, mergers, conveyances, transfers or leases of all or substantially all the Company's assets. The terms of these notes also require the Company to make an offer to repurchase notes upon a Change of Control Triggering Event (as defined in the Indenture) at a price equal to 101% of their principal amount plus accrued and unpaid interest.

Also in November 2014, the Company entered into three euro-denominated borrowings as follows.

3-year €500 million bank loan

Interest on this loan is variable and is based on changes to the EURIBOR interest rate. This loan contains covenants materially consistent with the five -year credit agreement. At December 31, 2016, the average interest rate on this borrowing was 0.31% .

15-year €80 million 2.5% fixed interest and 30-year €120 million 3.0% fixed interest notes

PPG privately placed a 15 -year €80 million 2.5% fixed interest note and a 30 -year €120 million 3.0% fixed interest note. These notes contain covenants materially consistent with the 2.3% Notes discussed above.

The cash proceeds related to these borrowings net of discounts and fees were as follows:

($ in millions)	*Proceeds*
3-year variable rate bank loan [1]	$ 620
2.30% notes, due 2019	297
15-year 2.5% fixed rate note [1]	99
30-year 3.0% fixed rate note [1]	142
Total cash proceeds	$ 1,158

(1) These debt arrangements are denominated in euro and have been designated as net investment hedges of the Company's european operations. For more information refer to Note 9 "Financial Instruments, Hedging Activities and Fair Value Measurements."

In December 2014, PPG completed a debt refinancing which included redeeming approximately $1.5 billion of public notes and a tender offer for any and all of its outstanding 9% debentures, due 2021 and the 7.70% notes, due 2038 (together, the "Offers"). The consideration for each $1,000 principal amount of the 2021 debentures was $1,334 and was $1,506 for the 2038 notes. After the expiration of the Offers, PPG accepted for purchase all of the securities that were validly tendered. An aggregate principal amount of $90 million was redeemed

through the tender offer which required $43 million of premiums to be paid to the debt holders.

The following table is a summary of the debt instruments redeemed and the tender offers completed:

($ in millions)	Amount Paid
Public notes redeemed:	
7 3/8% notes, due 2016	$ 146
6 7/8% notes, due 2017	75
6.65% notes, due 2018	575
7.4% notes, due 2019	199
2.70% notes, due 2022	400
Total of make-whole premiums paid to redeem notes	179
Tender Offer:	
9% debentures, due 2021	16
7.70% notes, due 2038	74
Total of premiums paid on tender offer	43
Total cash paid for debt redemption	$ 1,707

The Company recorded a charge of $317 million in 2014 for the debt redemption which consists of the aggregate make-whole cash premium of $179 million for the public notes redemption, the aggregate cash premium of $43 million for the debt redeemed through the tender offer, the net realization of the unamortized interest rate swaps and forward starting swap losses of $89 million , and a balance of unamortized fees and discounts of $6 million related to the debt redeemed. Refer to Note 9, “Financial Instruments, Hedging Activity and Fair Value Measurement,” for additional detail regarding the non-cash portion of the loss on the debt redemption.

The proceeds received from the 2.3% Notes and the three euro-denominated borrowing arrangements were used to fund approximately $1.2 billion of the approximately $1.7 billion used for the 2014 debt redemption. Cash on hand was used to fund the remaining portion of the redemption payments.

Restrictive Covenants and Cross-Default Provisions

As of December 31, 2016, PPG was in full compliance with the restrictive covenants under its various credit agreements, loan agreements and indentures.

Additionally, the Company’s Credit Agreement and its 3-year €500 million bank loan contain customary cross-default provisions. These provisions provide that a default on a debt service payment of $50 million or more for longer than the grace period provided under another agreement may result in an event of default under these agreements. The Company’s 9% non-callable debentures also contain a customary cross default provision triggered by the Company’s default on a debt service payment of $10 million or more. None of the Company’s primary debt obligations are secured or guaranteed by the Company’s affiliates.

Long-term Debt Maturities

Aggregate maturities of long-term debt during the next five years excluding commercial paper are:

($ in millions)	Maturity per year
2017	$ 530
2018	4
2019	614
2020	498
2021	132
Thereafter	$ 2,539

Other Debt Obligations

Short-term debt outstanding as of December 31, 2016 and 2015 , was as follows:

($ in millions)	2016	2015
Various, weighted average 5.8% as of December 31, 2016 and 13.2% as of December 31, 2015	$ 99	$ 29

Rental expense for operating leases was $275 million million, $265 million and $282 million in 2016 , 2015 and 2014 , respectively. The primary leased assets include paint stores, transportation equipment, warehouses and other distribution facilities, and office space, including the Company’s corporate headquarters located in Pittsburgh, Pa.

Minimum lease commitments for operating leases that have initial or remaining lease terms in excess of one year are as follows:

($ in millions)	As of December 31, 2016
2017	$ 200
2018	164
2019	131
2020	97
2021	62
Beyond 2021	$ 200

PPG’s non-U.S. operations have uncommitted lines of credit totaling $942 million of which $88 million was used as of December 31, 2016 . These uncommitted lines of credit are subject to cancellation at any time and are generally not subject to any commitment fees.

The Company had outstanding letters of credit and surety bonds of $160 million and $165 million as of December 31, 2016 and 2015 , respectively. The letters of credit secure the Company’s performance to third parties under certain self-insurance programs and other commitments made in the ordinary course of business.

As of December 31, 2016 and 2015 , guarantees outstanding were $12 million and $24 million , respectively. The guarantees relate primarily to debt of certain entities in which PPG has an ownership interest and selected customers of certain PPG businesses. A portion of such debt is secured by the assets of the related entities. The carrying value of these guarantees were $1 million at December 31, 2016 and 2015 and the fair values of these guarantees were $1 million at December 31, 2016 and 2015 . The fair value of each guarantee was estimated by comparing the net present value of two hypothetical cash flow

streams, one based on PPG's incremental borrowing rate and the other based on the borrower's incremental borrowing rate, as of the effective date of the guarantee. Both streams were discounted at a risk free rate of return. The Company does not believe any loss related to these letters of credit, surety bonds or guarantees is likely.

9. Financial Instruments, Hedging Activities and Fair Value Measurements

Financial instruments include cash and cash equivalents, short-term investments, cash held in escrow, marketable equity securities, accounts receivable, company-owned life insurance, accounts payable, short-term and long-term debt instruments, and derivatives. The fair values of these financial instruments approximated their carrying values at December 31, 2016 and 2015 , in the aggregate, except for long-term debt instruments.

Hedging Activities

The Company has exposure to market risk from changes in foreign currency exchange rates and interest rates and had exposure to PPG's stock price changes. As a result, financial instruments, including derivatives, have been used to hedge these underlying economic exposures. Certain of these instruments qualify as cash flow, fair value and net investment hedges upon meeting the requisite criteria, including effectiveness of offsetting hedged or underlying exposures. Changes in the fair value of derivatives that do not qualify for hedge accounting are recognized in income from continuing operations in the period incurred.

PPG's policies do not permit speculative use of derivative financial instruments. PPG enters into derivative financial instruments with high credit quality counterparties and diversifies its positions among such counterparties in order to reduce its exposure to credit losses. The Company did not realize a credit loss on derivatives during the three-year period ended December 31, 2016 .

All of PPG's outstanding derivative instruments are subject to accelerated settlement in the event of PPG's failure to meet its debt or payment obligations under the terms of the instruments' contractual provisions. In addition, should the Company be acquired and its payment obligations under the derivative instruments' contractual arrangements not be assumed by the acquirer, or should PPG enter into bankruptcy, receivership or reorganization proceedings, the instruments would also be subject to accelerated settlement.

In 2016 and 2015, there were no derivative instruments de-designated or discontinued as a hedging instrument. During 2014, there was one derivative instrument initially designated as a net investment hedge that was undesignated as a hedging instrument during the same year. The impact of this de-designation was not significant to the results of operations or financial position of the Company. There were no gains or losses deferred in AOCI that were reclassified to income from continuing operations during the three-year period ended December 31, 2016 related to hedges of anticipated transactions that were no longer expected to occur.

Fair Value Hedges

Until late 2016, PPG designated certain foreign currency forward contracts as hedges against the Company's exposure to future changes in fair value of certain firm sales commitments denominated in foreign currencies. As of December 31, 2015, the fair value of these contracts was insignificant.

The Company has used interest rate swaps from time to time to manage it's exposure to changing interest rates. When outstanding, the interest rate swaps were designated as fair value hedges of certain outstanding debt obligations of the Company and were recorded at fair value. There were no interest rate swaps outstanding as of December 31, 2016 and 2015 . However, in prior years, PPG settled interest rate swaps and received cash. The fair value adjustment of the debt at the time the interest rate swaps were settled is still being amortized as a reduction to interest expense over the remaining term of the related debt, the impact of which is insignificant. In 2014, as a result of the completed debt refinancing, a $4 million gain was recognized related to the portion of the fair value adjustment for the debt that was retired.

Prior to June 2016, PPG entered into renewable equity forward arrangements to hedge the impact to PPG's income from continuing operations for changes in the fair value of 2,777,778 shares of PPG stock that were contributed to the asbestos settlement trust as discussed in Note 13, "Commitments and Contingent Liabilities." These financial instruments were recorded at fair value as assets or liabilities and changes in the fair value of these financial instruments are reflected in the "Asbestos settlement – net" caption of the accompanying consolidated statement of income. The total principal amount paid for these shares was approximately $60 million . During the terms of these equity forward arrangements, PPG paid to the counterparty interest based on the principal amount and the counterparty paid to PPG an amount equal to the dividends paid on these shares which reduced the transaction price by approximately $10 million , net. The difference between the principal amount and any amounts related to unpaid interest or dividends and the market price for these shares, adjusted for credit risk, represented the fair value of these financial instruments as well as the amount that PPG received when the counterparty chose to settle these financial instruments. In conjunction with the funding of the asbestos settlement trust, the equity forward arrangements were settled. At settlement, in June 2016, the fair value of the equity forward arrangement was an asset of $258 million . As of December 31, 2015 , the fair value of these contracts was an asset of $223 million .

Cash Flow Hedges

PPG designates certain foreign currency forward contracts as cash flow hedges of the Company's exposure to variability in exchange rates on intercompany and third party transactions denominated in foreign currencies. As of December 31, 2016 and 2015 , the fair value of all foreign currency forward contracts designated as cash flow hedges was a net asset of $13 million and $44 million , respectively.

The Company entered into forward starting swaps in 2009 and 2010 to effectively lock-in a fixed interest rate for future debt refinancings with an anticipated term of ten years based on the ten year swap rate, to which was added a corporate spread. In the fourth quarter of 2014, in conjunction with a debt refinancing

transaction, a ten-year debt instrument was redeemed and a non-cash charge for the related remaining unamortized loss of $93 million was recognized. Refer to Note 8, "Borrowings and Lines of Credit" for more information on the Company's debt refinancing. There were no forward starting swaps outstanding as of December 31, 2016 and 2015 .

Net Investment Hedges

PPG uses cross currency swaps, foreign currency forward contracts and euro-denominated debt to hedge a significant portion of its net investment in its European operations. As of December 31, 2016 and 2015 , U.S. dollar to euro cross currency swap contracts with a total notional amount of $560 million were outstanding and are scheduled to expire in March 2018. On settlement of the remaining outstanding contracts, PPG will receive $560 million U.S. dollars and pay euros to the counterparties. During the term of these contracts, PPG will receive semiannual payments in March and September of each year based on a U.S. dollar, long-term interest rate fixed as of the contract inception date, and PPG will make annual payments in March of each year to the counterparties based on a euro, long-term interest rate fixed as of the contract inception date. As of December 31, 2016 and December 31, 2015 , the fair value of these contracts was an asset of $65 million and $41 million , respectively.

At December 31, 2016 and 2015, PPG had designated €2.8 billion and €1.9 billion , respectively, of euro-denominated borrowings as hedges of a portion of its net investment in the Company's European operations. The carrying value of these instruments at December 31, 2016 and 2015 was $2.9 billion and $2.0 billion , respectively.

In March 2015, PPG de-designated €300 million of euro-denominated borrowings originally issued in June 2005 and designated as a net investment hedge of a portion of PPG's net investment in the Company's European operations. There was no financial statement impact as a result of the de-designation. This borrowing matured and was repaid in June 2015.

During each year presented, PPG used foreign currency forward contracts to hedge a portion of its net investment in its European operations. Accordingly, changes in the fair value of these derivative instruments were recorded in AOCI. As of December 31, 2016 the fair value of these contracts were insignificant. As of December 31, 2015 and 2014, none of these contracts remained outstanding. In 2016, no cash proceeds were received from the settlement of these contracts. PPG received cash proceeds of $19 million and $49 million from the settlement of these contracts in 2015 and 2014, respectively.

Gains/Losses Deferred in AOCI

As of December 31, 2016 and 2015 , the Company had accumulated pre-tax unrealized translation gains in AOCI related to the euro-denominated borrowings, foreign currency forward contracts, and the cross currency swaps of $482 million and $349 million , respectively.

The following tables summarize the location and amount of gains (losses) related to derivative and debt financial instruments for the years ended December 31, 2016 , 2015 and 2014 . All dollar amounts are shown on a pre-tax basis.

	December 31, 2016		
		Gain/(Loss) Recognized	
Hedge Type ($ in millions)	*Gain/(Loss) Deferred in OCI*	*Amount*	*Caption in Consolidated Statement of Income*
Cash Flow			
Foreign currency forward contracts [(a)]	$ 1	$ (5)	Other charges and Cost of Sales
Total Cash Flow	$ 1	$ (5)	
Net Investment			
Cross currency swaps	$ 25		
Foreign denominated debt	122		
Foreign currency forward contracts	(14)		
Total Net Investment	$ 133		
Economic			
Foreign currency forward contracts		$ 14	Other charges

(a) The ineffective portion related to this item was $9 million of expense.

	December 31, 2015		
		Gain/(Loss) Recognized	
Hedge Type ($ in millions)	*Gain Deferred in OCI*	*Amount*	*Caption in Consolidated Statement of Income*
Fair Value			
Foreign currency forward contracts	Not applicable	$ (2)	Sales
Equity forward arrangements	Not applicable	(44)	Asbestos - net
Total Fair Value		$ (46)	
Cash Flow			
Foreign currency forward contracts [(a)]	$ 57	$ 50	Other charges and Cost of Sales
Total Cash Flow	$ 57	$ 50	
Net Investment			
Cross currency swaps	$ 77		
Foreign denominated debt	85		
Foreign currency forward contracts	19		
Total Net Investment	$ 181		
Economic			
Foreign currency forward contracts		$ 18	Other charges

(a) The ineffective portion related to this item was $7 million of expense.

	December 31, 2014			
		Gain (Loss) Recognized		
Hedge Type ($ in millions)	Gain Deferred in OCI	Amount	Caption in Consolidated Statement of Income
Fair Value			
Foreign currency forward contracts	Not applicable	$ 1	Sales
Equity forward arrangements	Not applicable	60	Asbestos - net
Total Fair Value		$ 61	
Cash Flow			
Forward starting swaps		$ (104)	Interest expense
Foreign currency forward contracts [a]	$ 51	47	Other charges
Total Cash Flow	$ 51	$ (57)	
Net Investment			
Cross currency swaps	$ 81		
Foreign denominated debt	75		
Foreign currency forward contracts	48		
Total Net Investment	$ 204		

(a) The ineffective portion related to this item was $7 million of expense.

Fair Value Measurements

The Company follows a fair value measurement hierarchy to measure its assets and liabilities. As of December 31, 2016 and 2015 , respectively, the assets and liabilities measured at fair value on a recurring basis were cash equivalents, equity securities and derivatives. In addition, the Company measures its pension plan assets at fair value (see Note 12, "Employee Benefit Plans" for further details). The Company's financial assets and liabilities are measured using inputs from the following three levels:

Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets and liabilities that the Company has the ability to access at the measurement date. Level 1 inputs are considered to be the most reliable evidence of fair value as they are based on unadjusted quoted market prices from various financial information service providers and securities exchanges.

Level 2 inputs are directly or indirectly observable prices that are not quoted on active exchanges, which include quoted prices for similar assets and liabilities in active markets, quoted prices for identical or similar assets or liabilities in markets that are not active, inputs other than quoted prices that are observable for the asset or liability and inputs that are derived principally from or corroborated by observable market data by correlation or other means. The fair values of the derivative instruments reflect the instruments' contractual terms, including the period to maturity, and uses observable market-based inputs, including forward curves.

Level 3 inputs are unobservable inputs employed for measuring the fair value of assets or liabilities. The Company does not have any recurring financial assets or liabilities that are recorded in its consolidated balance sheets as of December 31, 2016 and 2015 that are classified as Level 3 inputs.

Assets and liabilities reported at fair value on a recurring basis

	December 31, 2016		
($ in millions)	Level 1	Level 2	Level 3
Assets:			
Other current assets:			
Marketable equity securities	$ 4	—	—
Foreign currency forward contracts	—	$ 22	—
Investments:			
Marketable equity securities	$ 78	—	—
Other assets:			
Cross currency swaps	—	$ 65	—
Liabilities:			
Accounts payable and accrued liabilities:			
Foreign currency forward contracts	—	$ 9	—

	December 31, 2015		
($ in millions)	Level 1	Level 2	Level 3
Assets:			
Other current assets:			
Marketable equity securities	$ 4	—	—
Foreign currency forward contracts	—	$ 47	—
Equity forward arrangement	—	$ 223	—
Investments:			
Marketable equity securities	$ 77	—	—
Other assets:			
Cross currency swaps	—	$ 41	—
Liabilities:			
Accounts payable and accrued liabilities:			
Foreign currency forward contracts	—	$ 4	—

Long-Term Debt

($ in millions)	December 31, 2016 [a]	December 31, 2015 [b]
Long-term debt - carrying value	$ 4,299	$ 4,265
Long-term debt - fair value	$ 4,502	$ 4,367

(a) Excluding capital lease obligations of $18 million and short term borrowings of $99 million as of December 31, 2016.

(b) Excluding capital lease obligations of $14 million and short term borrowings of $29 million as of December 31, 2015.

The fair values of the debt instruments were based on discounted cash flows and interest rates then currently available to the Company for instruments of the same remaining maturities and were measured using level 2 inputs.

Assets and liabilities reported at fair value on a nonrecurring basis

In conjunction with the 2016 and 2015 restructuring actions, certain nonmonetary assets were written down to their fair value. Refer to Note 7, "Business Restructuring" for further details associated with these actions."

There were no significant adjustments to the fair value of nonmonetary assets or liabilities during the year ended December 31, 2014 .

Call and put option on noncontrolling interest

In 2015, PPG acquired a majority interest in a coatings business whose financial results are included in PPG's consolidated financial statements. PPG has recorded the noncontrolling interest in this consolidated affiliate as a liability instead of equity in its consolidated balance sheets due to call and put option provisions associated with the noncontrolling interest, which have similar terms. This liability was $38 million and $37 million at December 31, 2016 and 2015, respectively.

10. Earnings Per Common Share

Historical share and per share data (except for shares on the balance sheet) give retroactive effect to the 2 -for-1 stock split discussed in Note 14, "Shareholders' Equity."

	December 31		
($ in millions, except per share amounts)	*2016*	*2015*	*2014*
Earnings per common share (attributable to PPG)			
Income from continuing operations, net of tax	$ 564	$ 1,338	$ 1,085
Income from discontinued operations, net of tax	$ 313	$ 68	$ 1,017
Net income (attributable to PPG)	$ 877	$ 1,406	$ 2,102
Weighted average common shares outstanding	265.6	271.4	276.6
Effect of dilutive securities:			
Stock options	0.8	1.0	1.4
Other stock compensation plans	1.0	1.2	1.6
Potentially dilutive common shares	1.8	2.2	3.0
Adjusted weighted average common shares outstanding	267.4	273.6	279.6
Earnings per common share (attributable to PPG):			
Income from continuing operations, net of tax	$ 2.12	$ 4.93	$ 3.92
Income from discontinued operations, net of tax	$ 1.18	$ 0.25	$ 3.68
Net income (attributable to PPG)	$ 3.30	$ 5.18	$ 7.60
Earnings per common share - assuming dilution (attributable to PPG)			
Income from continuing operations, net of tax	$ 2.11	$ 4.89	$ 3.88
Income from discontinued operations, net of tax	$ 1.17	$ 0.25	$ 3.64
Net income (attributable to PPG)	$ 3.28	$ 5.14	$ 7.52

There were 0.6 million outstanding stock options excluded in both 2016 and 2015, from the computation of earnings per diluted common share due to their anti-dilutive effect. There were no shares excluded in 2014 from the computation of earnings per diluted common share due to their anti-dilutive effect.

11. Income Taxes

The provision for income taxes by taxing jurisdiction and by significant components consisted of the following:

($ in millions)	*2016*	*2015*	*2014*
Current income tax expense			
U.S. federal	$ (232)	$ 130	$ 105
U.S. state and local	(19)	20	25
Foreign	337	275	194
Total current income tax	$ 86	$ 425	$ 324
Deferred income tax expense			
U.S. federal	$ 153	$ 28	$ (76)
U.S. state and local	10	6	(1)
Foreign	(8)	(35)	(10)
Total deferred income tax	155	(1)	(87)
Total	$ 241	$ 424	$ 237

A reconciliation of the statutory U.S. corporate federal income tax rate to the Company's effective tax rate follows:

	2016	*2015*	*2014*
U.S. federal income tax rate	35.0 %	35.0 %	35.0 %
Changes in rate due to:			
U.S. state and local taxes	(2.2)	1.0	1.0
U.S. tax cost (benefit) on foreign dividends	0.4	(1.0)	(4.0)
U.S. tax incentives	(5.4)	(2.1)	(2.3)
U.S. deferred tax on foreign income	(3.0)	(4.0)	—
U.S./foreign tax differential	(14.8)	(7.0)	(13.0)
Asbestos charge	18.2	—	—
Other	0.9	1.9	0.9
Effective income tax rate	29.1 %	23.8 %	17.6 %

The total tax expense for 2016 includes a deferred tax benefit of $364 million related to the $1,015 million of pre-tax pension settlement charges discussed in Note 12, "Pensions and Other Postretirement Benefits." During 2016, the Company recorded a $151 million net tax charge associated with the funding of the Pittsburgh Corning ("PC") asbestos settlement trust (the "Trust") described in Note 13, "Commitments and Contingent Liabilities." Further, in conjunction with the funding of the Trust, PPG provided taxes on the earnings of certain foreign subsidiaries and recorded one-time book tax benefits for its contribution of the Company's ownership interest in PC's European subsidiary to the Trust and for a change in the measurement of certain deferred tax liabilities.

In 2016, U.S. tax incentives include a benefit for dividends paid on PPG stock held in the Company Employee Stock Ownership Plan, a benefit for research and development activities and a benefit for income related to domestic production activities. The increase in the U.S. tax incentive benefit from 2015 to 2016 is primarily due to a larger deduction for domestic production activities.

In 2016 and 2015, U.S. deferred tax on foreign earnings includes the remeasurement of a U.S. deferred tax liability to repatriate foreign earning on which PPG has not asserted permanent reinvestment in the foreign jurisdiction.

(Loss) Income before income taxes of the Company's U.S. operations for 2016, 2015 and 2014 was $(163) million , $740 million and $320 million , respectively. Income before income taxes of the Company's foreign operations for 2016 , 2015 and 2014 was $990 million , $1,043 million and $1,026 million , respectively.

Deferred income taxes

Deferred income taxes are provided for the effect of temporary differences that arise because there are certain items treated differently for financial accounting than for income tax reporting purposes. The deferred tax assets and liabilities are determined by applying the enacted tax rate in the year in which the temporary difference is expected to reverse. Net deferred income tax assets and liabilities as of December 31 were, as follows:

($ in millions)	*2016*	*2015*
Deferred income tax assets related to		
Employee benefits	$ 604	$ 730
Contingent and accrued liabilities	263	604
Operating loss and other carry-forwards	197	361
Inventories	17	20
Property	49	47
Other	100	98
Valuation allowance	(119)	(139)
Total	$ 1,111	$ 1,721
Deferred income tax liabilities related to		
Property	$ 382	$ 580
Intangibles	647	439
Employee benefits	4	67
Derivatives	6	4
Undistributed foreign earnings	189	158
Other	146	222
Total	$ 1,374	$ 1,470
Deferred income tax (liabilities) assets – net	$ (263)	$ 251

As of December 31, 2016 and 2015, subsidiaries of the Company had available net operating loss carryforwards and available income tax credit carryforwards as follows:

($ in millions)	*2016*	*2015*	*Expiration*
Available net operating loss carryforwards:			
Indefinite expiration	$ 376	$ 390	NA
Definite expiration	118	165	2017 - 2029
Total	$ 494	$ 555	NA
Net operating loss carryforwards, tax effected	$ 140	$ 156	NA
Income tax credit carryforwards	$ 57	$ 205	2017 - 2026

A valuation allowance of $119 million and $139 million has been established for carry-forwards at December 31, 2016 and 2015, when the ability to utilize them is not likely.

The Company had $5.3 billion and $5.0 billion of undistributed earnings of non-U.S. subsidiaries as of December 31, 2016 and 2015, respectively. These amounts relate to approximately 250 subsidiaries in approximately 75 taxable jurisdictions. Over the past several years, PPG has established deferred tax liabilities on certain undistributed earnings, namely in connection with divestitures and the funding of the Trust. At December 31, 2016 and 2015, the expected future tax cost to repatriate these foreign earnings which are not permanently reinvested totaled $189 million and $158 million , respectively. No significant deferred U.S. income taxes have been provided on the remaining $3.5 billion and $4.2 billion of PPG's undistributed earnings as they are considered to be reinvested for an indefinite period of time or will be repatriated when it is tax effective to do so. The Company estimates repatriation of undistributed earnings of non-U.S. subsidiaries as of December 31, 2016 and 2015 would have resulted in a U.S. tax cost of approximately $ 350 million and $ 375 million , respectively.

Unrecognized tax benefits

The Company files federal, state and local income tax returns in numerous domestic and foreign jurisdictions. In most tax jurisdictions, returns are subject to examination by the relevant tax authorities for a number of years after the returns have been filed. The Company is no longer subject to examinations by tax authorities in any major tax jurisdiction for years before 2006. Additionally, the Internal Revenue Service has completed its examination of the Company's U.S. federal income tax returns filed for years through 2011. The examinations of the Company's U.S. federal income tax returns for 2012 through 2013 are currently underway.

A reconciliation of the total amounts of unrecognized tax benefits (excluding interest and penalties) as of December 31 follows:

($ in millions)	*2016*	*2015*	*2014*
January 1	$ 82	$ 71	$ 85
Current year tax positions - additions	25	14	12
Prior year tax positions - additions	8	5	3
Pre-acquisition unrecognized tax benefits	—	4	—
Prior year tax positions - reductions	(11)	(3)	(15)
Statute of limitations expirations	(8)	(1)	(2)
Settlements	—	(3)	(6)
Foreign currency translation	(2)	(5)	(6)
December 31	$ 94	$ 82	$ 71

The Company expects that any reasonably possible change in the amount of unrecognized tax benefits in the next 12 months would not be significant.

The total amount of unrecognized tax benefits that, if recognized, would affect the effective tax rate was $89 million as of December 31, 2016.

Interest and penalties

	December 31,		
($ in millions)	2016	2015	2014
Accrued interest and penalties related to unrecognized tax benefits	$ 9	$ 8	$ 7
Loss/(income) recognized in income tax expense related to interest and penalties	$ 1	$ 2	$ (2)

The Company recognizes accrued interest and penalties related to unrecognized tax benefits in income tax expense.

12. Employee Benefit Plans

Defined Benefit Plans

PPG has defined benefit pension plans that cover certain employees worldwide. The principal defined benefit pension plans are those in the U.S., Canada, the Netherlands and the U.K. These plans in the aggregate represent approximately 93% of the projected benefit obligation at December 31, 2016 , of which the U.S. defined benefit pension plans represent the majority.

U.S. defined benefit plans

As of January 1, 2006, the Company closed the salaried defined benefit plans to new entrants. The defined benefit plan of certain hourly employees was closed to new entrants in 2006 or thereafter. Eligible employees participate in a defined contribution retirement plan. Further in 2011, the Company approved amendments related to certain U.S. defined benefit plans so that depending upon the affected employee's combined age and years of service to PPG, certain employees stopped accruing benefits either during 2011 or at some point in the future. The affected employees will participate in the Company's defined contribution retirement plans from the date their benefits under their respective defined benefit plans are frozen. The Company has amended other defined benefit plans in other countries in a similar way and plans to continue reviewing and potentially changing other PPG defined benefit plans in the future.

U.S. pension annuity contracts

In June 2016, the Company entered into a Definitive Purchase Agreement by and among the Company, Massachusetts Mutual Life Insurance Company ("MassMutual") and State Street Bank & Trust Company ("State Street"), as independent fiduciary to the Company's United States defined benefit pension plans (the "Plans"), and a Definitive Purchase Agreement by and among the Company, Metropolitan Life Insurance Company ("MetLife") and State Street. In August 2016, pursuant to the two Definitive Purchase Agreements, the Plans purchased group annuity contracts that irrevocably transferred to the two insurance companies certain pension benefit obligations for approximately 13,200 of the Company's retirees in the United States who started receiving their monthly retirement benefit payments on or before April 1, 2016. The value of the benefit obligation of each affected former salaried employee's retirement benefit obligation is irrevocably guaranteed by, and split equally between, MassMutual and MetLife. Pursuant to these Definitive Purchase Agreements, MassMutual serves as the lead administrator. The value of each affected former hourly employee's retirement benefit obligation is irrevocably guaranteed by MetLife, and MetLife will serve as the administrator. The amount of each affected retiree's annuity payment is equal to the amount of such individual's pension benefit. The purchase of group annuity contracts was funded directly by the assets of the Plans. By irrevocably transferring the obligations and assets to MassMutual and MetLife, the Company reduced its overall pension projected benefit obligation by approximately $1.6 billion and recognized a non-cash pension settlement charge of approximately $535 million after-tax ($857 million pre-tax).

Following the transfer of the aforementioned U.S. retiree obligations and assets to third party insurers, PPG contributed $146 million and $29 million to its U.S. plans in 2016 and January 2017, respectively. These contributions will be funded by cash on hand.

U.S. plan merger and remeasurement

During 2016, as a result of the purchase of group annuity contracts, PPG merged two of its qualified defined benefit pension plans that contained retired plan participants into one surviving plan. In conjunction with the merger and purchase of group annuity contracts, PPG remeasured its qualified pension plan benefit obligations using prevailing discount rates as of July 31, 2016 which averaged 3.6% as compared to a 4.5% discount rate as of December 31, 2015. The remeasurement increased the Company's cumulative pension benefit obligation of its remaining plans by $306 million and increased the Company's full year 2016 qualified defined benefit pension expense by approximately $10 million .

Canadian pension annuity contracts

In August 2016, the Company purchased group annuity contracts that transferred pension benefit obligations for certain of the Company's retirees and terminated vested participants in Canada who started receiving their monthly retirement benefit payments on or before April 1, 2016 to Sun Life Assurance Company of Canada ("Sun Life") and The Canada Life Assurance Company ("Canada Life"). The amount of each affected retiree's annuity payment is equal to the amount of such individual's pension benefit. The purchase of group annuity contracts was funded directly by the assets of the Canadian plans. By transferring the obligations and assets to Sun Life and Canada Life, the Company reduced its overall pension projected benefit obligation by approximately $200 million and recognized a non-cash pension settlement charge of $47 million after-tax ($64 million pre-tax). The Company made voluntary contributions aggregating $7 million to the Canadian plans in 2016 related to the pension annuity contracts. These contributions were funded by cash on hand.

Sale of the flat glass business

On October 1, 2016, PPG completed the sale of its flat glass business as discussed in Note 2, "Acquisitions and Divestitures." PPG transferred certain defined benefit pension liabilities, resulting in a settlement charge of $11 million which is included in the net gain on the sale of the flat glass business. This transaction lowered the projected benefit obligation of PPG's defined benefit pension plan by approximately $100 million . PPG transferred pension assets of $55 million in 2016 in connection with the sale and expects to transfer an additional $5 million to $10 million in 2018.

Prior to the sale, results of operations for the flat glass business included pension expense of $4 million , $5 million , and $4 million in 2016, 2015, and 2014, respectively and other postretirement benefit expense of $1 million in 2016, 2015, and 2014, respectively. These amounts are included in "Income from discontinued operations, net of tax" in 2016, 2015 and 2014, respectively. During 2015, PPG's contributions to its U.S. pension plans included amounts attributable to flat glass participants totaling $16 million . The contribution attributable

to the flat glass participants has been included in cash flows from operations - discontinued operations.

Sale of the European fiber glass business

On October 1, 2016, PPG completed the sale of its European fiber glass business as discussed in Note 2, "Acquisitions and Divestitures." PPG transferred the defined benefit pension liabilities resulting in a net settlement charge of $46 million . This transaction lowered the projected benefit obligation of PPG's defined benefit pension plans by approximately $340 million . PPG transferred pension assets of approximately $250 million in connection with the sale.

Plan Termination

During June 2014, PPG terminated one of the defined benefit pension plans containing only participants who are no longer accruing benefits, which lowered the projected benefit obligation and plan assets of PPG's defined benefit pension plans by $41 million . Additionally, PPG recorded an immaterial settlement loss related to the termination of the plan.

Postretirement medical

PPG sponsors welfare benefit plans that provide postretirement medical and life insurance benefits for certain U.S. and Canadian employees and their dependents of which the U.S. welfare benefit plans represent approximately 88% of the projected benefit obligation at December 31, 2016. Salaried and certain hourly employees in the U.S. hired on or after October 1, 2004, or rehired on or after October 1, 2012 are not eligible for post retirement medical benefits.

The U.S. welfare benefit plans include an Employee Group Waiver Plan ("EGWP") for certain Medicare-eligible retirees and their dependents which includes a fully-insured Medicare Part D prescription drug plan. As such, PPG is not eligible to receive the federal subsidy provided under the Medicare Act of 2003 for these retirees and their dependents.

These plans in the U.S. and Canada require retiree contributions based on retiree-selected coverage levels for certain retirees and their dependents and provide for sharing of future benefit cost increases between PPG and participants based on management discretion. The Company has the right to modify, amend or terminate certain of these benefit plans in the future.

In August 2016, the Company communicated plan design changes to certain Medicare-eligible retiree plan participants. Effective January 1, 2017, the Company-sponsored Medicare-eligible plans will be replaced by a Medicare private exchange. By offering retiree health coverage through a private Medicare exchange, PPG is able to provide Medicare-eligible participants with more choice of plans and plan designs, greater flexibility, and different price points for coverage. After January 1, 2017, PPG's contribution to coverage for Medicare-eligible retirees will be in the form of a tax-free account known as a Health Reimbursement Arrangement (HRA). The HRA can be used to pay for health care and prescription drug plan premiums and certain out-of-pocket medical costs; unused funds can be carried over to future years.

The announcement of these plan design changes triggered a remeasurement of PPG's retiree medical benefit obligation using prevailing interest rates. The announced plan design change resulted in a $306 million reduction in the Company's postretirement benefit obligation. PPG accounted for the plan design change prospectively, and the plan change will be amortized to periodic postretirement benefit cost over a 5.6 year period.

The following table sets forth the changes in projected benefit obligations ("PBO") (as calculated as of December 31), plan assets, the funded status and the amounts recognized in the accompanying consolidated balance sheet for the Company's defined benefit pension and other postretirement benefit plans:

	Pensions		*Other Postretirement Benefits*	
($ in millions)	*2016*	*2015*	*2016*	*2015*
Projected benefit obligation, January 1	$ 5,349	$ 5,775	$ 1,084	$ 1,196
Service cost	48	57	15	16
Interest cost	142	196	31	45
Plan amendments	—	—	(306)	—
Actuarial losses (gains) - net	538	(137)	13	(101)
Benefits paid	(233)	(271)	(53)	(52)
Plan transfers	(4)	—	—	—
Foreign currency translation adjustments	(141)	(236)	2	(19)
Settlements and curtailments	(2,354)	(8)	—	—
Flat glass business changes, net	(96)	—	6	(2)
Other	3	(27)	—	1
Projected benefit obligation, December 31	$ 3,252	$ 5,349	$ 792	$ 1,084
Market value of plan assets, January 1	$ 4,627	$ 4,839		
Actual return on plan assets	470	(19)		
Company contributions	204	273		
Participant contributions	1	2		
Benefits paid	(205)	(249)		
Plan transfers	(3)	—		
Plan settlements	(2,338)	(17)		
Plan expenses and other-net	—	(4)		
Foreign currency translation adjustments	(134)	(214)		
Flat glass business changes, net	(61)	16		
Market value of plan assets, December 31	$ 2,561	$ 4,627		
Funded Status	$ (691)	$ (722)	$ (792)	$ (1,084)
Amounts recognized in the Consolidated Balance Sheet:				
Other assets (long-term)	110	57	—	—
Accounts payable and accrued liabilities	(61)	(67)	(61)	(63)
Accrued pensions	(740)	(695)	—	—
Other postretirement benefits	—	—	(731)	(1,015)
Liabilities held for sale	—	(17)	—	(6)
Net liability recognized	$ (691)	$ (722)	$ (792)	$ (1,084)

The PBO is the actuarial present value of benefits attributable to employee service rendered to date, including the effects of estimated future pay increases. The accumulated benefit obligation ("ABO") is the actuarial present value of benefits attributable to employee service rendered to date, but does not include the effects of estimated future pay increases.

The ABO for all defined benefit pension plans as of December 31, 2016 and 2015 was $3,171 million and $5,220 million , respectively.

The following table details the pension plans where the benefit liability exceeds the fair value of the plan assets:

	Pensions	
($ in millions)	*2016*	*2015*
Plans with PBO in Excess of Plan Assets:		
Projected benefit obligation	$ 2,406	$ 4,717
Fair value of plan assets	$ 1,609	$ 3,937
Plans with ABO in Excess of Plan Assets:		
Accumulated benefit obligation	$ 2,302	$ 4,351
Fair value of plan assets	$ 1,575	$ 3,676

Net actuarial losses / prior service cost/(credit) deferred in accumulated other comprehensive loss

	Pensions		Other Postretirement Benefits	
($ in millions)	*2016*	*2015*	*2016*	*2015*
Accumulated net actuarial losses	$ 918	$ 1,872	$ 226	$ 228
Accumulated prior service cost (credit)	1	(18)	(298)	(24)
Total	$ 919	$ 1,854	$ (72)	$ 204

The accumulated net actuarial losses for pensions and other postretirement benefits relate primarily to historical declines in the discount rate as well as updated mortality assumptions. The accumulated net actuarial losses exceed 10% of the higher of the market value of plan assets or the PBO at the beginning of the year, therefore, amortization of such excess has been included in net periodic benefit costs for pension and other postretirement benefits in each of the last three years. The amortization period is the average remaining service period of active employees expected to receive benefits unless a plan is mostly inactive in which case the amortization period is the average remaining life expectancy of the plan participants. Accumulated prior service cost (credit) is amortized over the future service periods of those employees who are active at the dates of the plan amendments and who are expected to receive benefits.

The decrease in accumulated other comprehensive loss (pre-tax) in 2016 relating to defined benefit pension and other postretirement benefits is primarily attributable to pension settlement charges and other postretirement plan design changes, as follows:

($ in millions)	*Pensions*	*Other Postretirement Benefits*
Net actuarial loss arising during the year	$ 260	$ 17
New prior service cost (credit)	16	(305)
Amortization of actuarial loss	(110)	(19)
Amortization of prior service cost	1	31
Foreign currency translation adjustments	(23)	—
Impact of settlements and curtailments	(1,063)	—
Impact of flat glass transaction	(16)	—
Net change	$ (935)	$ (276)

The 2016 net actuarial loss related to the Company's pension and other postretirement benefit plans of $277 million was primarily due to a decrease in the weighted average discount rate used to determine the benefit obligation at December 31, 2016. This decrease was partially offset by an actual gain on asset performance in excess of the expected return on plan assets for the year.

The estimated amount of accumulated net actuarial loss for the defined benefit pension plans that will be amortized from accumulated other comprehensive income into net periodic benefit cost in 2017 is $77 million . The estimated amounts of accumulated net actuarial loss and prior service (credit) for the other postretirement benefit plans that will be amortized from accumulated other comprehensive (loss) income into net periodic benefit cost in 2017 are $22 million and $(59) million , respectively.

Net periodic benefit cost

Net periodic benefit cost for the three years ended December 31, 2016 , included the following:

	Pensions			Other Postretirement Benefits		
($ in millions)	2016	2015	2014	2016	2015	2014
Service cost	$ 48	$ 57	$ 52	$ 15	$ 16	$ 15
Interest cost	142	196	230	31	45	47
Expected return on plan assets	(213)	(287)	(297)	—	—	—
Amortization of prior service credit	(1)	(2)	(2)	(31)	(9)	(10)
Amortization of actuarial losses	110	119	77	19	32	11
Settlements, curtailments, and special termination benefits	1,015	8	8	—	—	—
Net periodic benefit cost	$ 1,101	$ 91	$ 68	$ 34	$ 84	$ 63

Net periodic benefit cost is included in Cost of sales, exclusive of depreciation and amortization, Selling, general and administrative and Research and development in the accompanying consolidated statements of income.

Key assumptions

The following weighted average assumptions were used to determine the benefit obligation for the Company's defined benefit pension and other postretirement plans as of December 31, 2016 and 2015 :

	2016	*2015*
Discount rate [1]	3.7%	4.1%
Rate of compensation increase	1.6%	2.0%

(1) The discount rate for U.S. defined benefit pension and other postretirement plans was 4.3% and 4.5% as of December 31, 2016 and 2015, respectively.

The following weighted average assumptions were used to determine the net periodic benefit cost for the Company's defined benefit pension and other postretirement benefit plans for the three years in the period ended December 31, 2016 :

	2016	2015	2014
Discount rate	3.6%	3.8%	4.6%
Expected return on assets	6.1%	6.1%	6.5%
Rate of compensation increase	1.6%	2.0%	3.0%

These assumptions for each plan are reviewed on an annual basis. In determining the expected return on plan asset assumption, the Company evaluates the mix of investments that comprise each plan's assets and external forecasts of future long-term investment returns. The Company compares the expected return on plan assets assumption to actual historic returns to ensure reasonability. For 2016, the return on plan assets assumption for PPG's U.S. defined benefit pension plans was 7.15% . A change in the rate of return of 100 basis points, with other assumptions held constant, would impact 2017 net periodic pension expense by $11 million . The global expected return on plan assets assumption to be used in determining 2017 net periodic pension expense will be 5.40% (7.50% for the U.S. plans only).

The discount rate used in accounting for pensions and other postretirement benefits is determined by reference to a current yield curve and by considering the timing and amount of projected future benefit payments. In 2016, the Company changed the method it uses to estimate the service and interest cost components of net periodic benefit cost for pension and other postretirement benefit costs for substantially all of its U.S. and foreign plans. Historically, the service and interest cost components were estimated using a single weighted-average discount rate derived from the yield curve used to measure the projected benefit obligation at the beginning of the period. The Company has elected to use a full yield curve approach ("Split-rate" method) in the estimation of these components of benefit cost by applying specific spot rates along the yield curve used in the determination of the benefit obligation to the relevant projected cash flows. The Company made this change to improve the correlation between projected benefit cash flows and the corresponding yield curve spot rates and to provide a more precise measurement of service and interest costs. This change does not affect the measurement of the Company's total benefit obligations. The Company accounted for this change as a change in estimate and, accordingly, began recognizing its effect in fiscal year 2016. A change in the discount rate of 100 basis points, with all other assumptions held constant, would impact 2017 net periodic benefit expense for our defined benefit pension and other postretirement benefit plans by $28 million and $24 million , respectively.

In 2014, the Company updated the mortality tables used to calculate its U.S. defined benefit pension and other postretirement benefit liabilities. In October 2014, the Society of Actuaries' Retirement Plans Experience Committee released new mortality tables known as RP 2014. The new tables released reflect a long period of significant improvement in mortality. The Company considered these new tables and performed a review of its own mortality history, as well as the industry in which the Company operates to assess future improvements in mortality rates based on its U.S. population. The Company chose to value its U.S. defined benefit pension and other postretirement benefit liabilities using a slightly modified assumption of future mortality which better approximates our plan participant population and reflects significant improvement in life expectancy over the previously used mortality table, known as RP 2000.

The weighted-average healthcare cost trend rate (inflation) used for 2016 was 6.1% declining to a projected 4.4% in the year 2024 . For 2017 , the assumed weighted-average healthcare cost trend rate used will be 6.3% declining to a projected 4.5% between 2016 and 2039 for medical and prescription drug costs, respectively. These assumptions are reviewed on an annual basis. In selecting rates for current and long-term health care cost assumptions, the Company takes into consideration a number of factors including the Company's actual health care cost increases, the design of the Company's benefit programs, the demographics of the Company's active and retiree populations and external expectations of future medical cost inflation rates. If these 2017 health care cost trend rates were increased or decreased by one percentage point per year, such increase or decrease would have the following effects:

	One-Percentage Point	
($ in millions)	Increase	Decrease
Increase (decrease) in the aggregate of service and interest cost components of annual expense	$ 8	$ (5)
Increase (decrease) in the benefit obligation	$ 25	$ (17)

Contributions to defined benefit plans

($ in millions)	December 31,		
	2016	2015	2014
U.S. defined benefit pension contributions [a]	$ 146	$ 234	$ 2
Non-U.S. defined benefit pension plans	$ 58	$ 39	$ 39

[a] During 2015, U.S. contributions totaling $16 million associated with the flat glass business were recast as cash flows from operations - discontinued operations and are excluded from the table above.

Following the transfer of certain U.S. retiree obligations and assets to third party insurers, PPG contributed $146 million and $29 million to its U.S. plans in 2016 and January 2017, respectively. Some contributions to PPG's non-U.S. defined benefit pension plans in 2016 were required by local funding requirements. PPG expects to make mandatory contributions to its non-U.S. plans in the range of $20 million to $30 million in 2017 . PPG may make voluntary contributions to its defined benefit pension plans in 2017 and beyond.

Benefit payments

The estimated benefits expected to be paid under the Company's defined benefit pension and other postretirement benefit plans (in millions) are:

($ in millions)	*Pensions*	*Other Postretirement Benefits*
2017	$ 169	$ 61
2018	$ 124	$ 61
2019	$ 118	$ 60
2020	$ 125	$ 60
2021	$ 127	$ 59
2022 to 2025	$ 704	$ 267

Beginning in 2012, the Company initiated a lump sum payout program that gave certain terminated vested participants in certain U.S. defined benefit pension plans the option to take a one-time lump sum cash payment in lieu of receiving a future monthly annuity. During 2016, PPG paid $13 million in lump sum benefits to terminated vested participants who elected to participate in the program.

Plan assets

Each PPG sponsored defined benefit pension plan is managed in accordance with the requirements of local laws and regulations governing defined benefit pension plans for the exclusive purpose of providing pension benefits to participants and their beneficiaries. Investment committees comprised of PPG managers have fiduciary responsibility to oversee the management of pension plan assets by third party asset managers. Pension plan assets are held in trust by financial institutions and managed on a day-to-day basis by the asset managers. The asset managers receive a mandate from each investment committee that is aligned with the asset allocation targets established by each investment committee to achieve the plan's investment strategies. The performance of the asset managers is monitored and evaluated by the investment committees throughout the year.

Pension plan assets are invested to generate investment earnings over an extended time horizon to help fund the cost of benefits promised under the plans while mitigating investment risk. The asset allocation targets established for each pension plan are intended to diversify the investments among a variety of asset categories and among a variety of individual securities within each asset category to mitigate investment risk and provide each plan with sufficient liquidity to fund the payment of pension benefits to retirees.

The following summarizes the weighted average target pension plan asset allocation as of December 31, 2016 and 2015 for all PPG defined benefit plans:

Asset Category	*2016*	*2015*
Equity securities	30-65%	30-65%
Debt securities	30-65%	30-65%
Real estate	0-10%	0-10%
Other	0-20%	0-10%

The fair values of the Company's pension plan assets at December 31, 2016 , by asset category, are as follows:

($ in millions)	*Level 1 (1)*	*Level 2 (1)*	*Level 3 (1)*	*Total*
Asset Category				
Equity securities:				
U.S.				
Large cap	$ —	$ 240	$ —	$ 240
Small cap	—	21	—	21
PPG common stock	53	—	—	53
Non-U.S.				
Developed and emerging markets (2)	80	397	—	477
Debt securities:				
Cash and cash equivalents	—	224	—	224
Corporate (3)				
U.S. (4)	—	21	86	107
Developed and emerging markets (2)	—	42	—	42
Diversified (5)	—	622	—	622
Government				
U.S. (4)	—	4	—	4
Developed markets	—	170	—	170
Other (6)	—	—	15	15
Real estate, hedge funds, and other	—	172	414	586
Total	$ 133	$ 1,913	$ 515	$ 2,561

(1) These levels refer to the accounting guidance on fair value measurement described in Note 9, "Financial Instruments, Hedging Activities and Fair Value Measurements."

(2) These amounts represent holdings in investment grade debt or equity securities of issuers in both developed markets and emerging economies.

(3) This category represents investment grade debt securities from a diverse set of industry issuers.

(4) These investments are primarily long duration fixed income securities.

(5) This category represents commingled funds invested in diverse portfolios of debt securities.

(6) This category includes mortgage-backed and asset backed debt securities, municipal bonds and other debt securities including derivatives.

The fair values of the Company's pension plan assets at December 31, 2015 , by asset category, are as follows:

($ in millions)	Level 1 (1)	Level 2 (1)	Level 3 (1)	Total
Asset Category				
Equity securities:				
U.S.				
Large cap	$ —	$ 336	$ —	$ 336
Small cap	—	104	—	104
PPG common stock	87	—	—	87
Non-U.S.				
Developed and emerging markets (2)	91	690	—	781
Debt securities:				
Cash and cash equivalents	—	51	—	51
Corporate (3)				
U.S. (4)	—	1,016	125	1,141
Developed and emerging markets (2)	—	146	—	146
Diversified (5)	—	581	—	581
Government				
U.S. (4)	173	65	—	238
Developed markets	—	383	—	383
Other (6)	—	159	21	180
Real estate, hedge funds, and other	—	110	489	599
Total	$ 351	$ 3,641	$ 635	$ 4,627

(1) *These levels refer to the accounting guidance on fair value measurement described in Note 9, "Financial Instruments, Hedging Activities and Fair Value Measurements."*

(2) *These amounts represent holdings in investment grade debt or equity securities of issuers in both developed markets and emerging economies.*

(3) *This category represents investment grade debt securities from a diverse set of industry issuers.*

(4) *These investments are primarily long duration fixed income securities.*

(5) *This category represents commingled funds invested in diverse portfolios of debt securities.*

(6) *This category includes mortgage-backed and asset backed debt securities, municipal bonds and other debt securities including derivatives.*

The change in the fair value of the Company's Level 3 pension assets for the years ended December 31, 2016 and 2015 was as follows:

($ in millions)	Real Estate	Other Debt Securities	Hedge Funds & Other Assets	Total
Balance, January 1, 2015	$ 210	$ 23	$ 379	$ 612
Realized gain	15	1	—	16
Unrealized gain/(loss) for positions still held	12	—	(4)	8
Transfers in/(out)	(24)	(1)	38	13
Foreign currency loss	(4)	(2)	(8)	(14)
Balance, December 31, 2015	$ 209	$ 21	$ 405	$ 635
Realized gain	28	1	—	29
Unrealized loss for positions still held	(15)	—	(1)	(16)
Transfers (out)/in	(88)	(5)	16	(77)
Foreign currency loss	(5)	(1)	(50)	(56)
Balance, December 31, 2016	$ 129	$ 16	$ 370	$ 515

Real Estate properties are externally appraised at least annually by reputable, independent appraisal firms. Property valuations are also reviewed on a regular basis and are adjusted if there has been a significant change in circumstances related to the property since the last valuation.

Other debt securities consist of insurance contracts, which are externally valued by insurance companies based on the present value of the expected future cash flows. Hedge funds consist of a wide range of investments which target a relatively stable investment return. The underlying funds are valued at different frequencies, some monthly and some quarterly, based on the value of the underlying investments. Other assets consist primarily of small investments in private equity funds and senior secured debt obligations of non-investment grade borrowers.

Retained liabilities and legacy settlement charges

PPG has retained certain liabilities for pension and post-employment benefits earned for service up to the date of sale of its former automotive glass and service business, totaling $342 million and $867 million at December 31, 2016 and 2015 , respectively, for employees who were active as of the divestiture date and for individuals who were retirees of the business as of the divestiture date. PPG recognized expense of $20 million , $17 million and $19 million related to these obligations in 2016 , 2015 , and 2014 , respectively.

PPG has retained certain liabilities for defined benefit pension and post-retirement benefits earned for service up to the date of sale of its former automotive glass and service business for employees who were active as of the divestiture date and for individuals who were retirees of the business as of the divestiture date. There have been multiple PPG facilities closures in Canada related to the former automotive glass and services business as well as other PPG businesses. These various plant closures have resulted in partial and full windups, and related settlement charges, of pension plans for various hourly and salary employees employed by these locations. The charges are recorded for the individual plans when a particular windup is approved by the Canadian pension authorities, the Company has made all contributions to the individual plan and has discharged

the liability through either lump sum payments to participants or purchasing annuities.

During August and September 2016, PPG completed the wind-up of two legacy Canadian plans and recorded after-tax wind-up charges totaling $34 million ($47 million pre-tax). Cash contributions made in conjunction with these windups were approximately $1 million . The Company recorded a settlement charge of $7 million in 2015 related to legacy plant closures. We expect limited additional settlement charges related to these legacy plant closures; although the Company retains the right to continue to review and potentially change other PPG defined benefit plans in the future.

Other Plans

Defined contribution plans

The Company has defined contribution plans for certain employees in the U.S., China, United Kingdom, Australia, Italy, and other countries. In 2016, 2015 and 2014, the Company recognized expense for its defined contribution retirement plans of $70 million , $60 million and $55 million , respectively. The Company's annual cash contributions to its defined contribution retirement plans approximated the expense recognized in each year. As of December 31, 2016 and 2015 , the Company's liability for contributions to be made to its defined contribution retirement plans was $11 million and $12 million , respectively.

Employee savings plan

PPG's Employee Savings Plan ("Savings Plan") covers substantially all employees in the U.S., Puerto Rico and Canada. The Company makes matching contributions to the Savings Plan, at management's discretion, based upon participants' savings, subject to certain limitations. For most participants not covered by a collective bargaining agreement, Company-matching contributions are established each year at the discretion of the Company and are applied to participant savings up to a maximum of 6% of eligible participant compensation. For those participants whose employment is covered by a collective bargaining agreement, the level of Company-matching contribution, if any, is determined by the relevant collective bargaining agreement. The Company-matching contribution remained at 100% for 2016.

In 2016, the Company terminated its U.S. defined contribution plan and subsequently merged the plan into the Savings Plan. Under the combined plan, eligible employees will continue to receive a contribution equal to between 2% and 5% of annual compensation, based on age and years of service.

Compensation expense and cash contributions related to the Company match of participant contributions to the Savings Plan for 2016 , 2015 , and 2014 totaled $48 million , $44 million and $42 million , respectively. A portion of the Savings Plan qualifies under the Internal Revenue Code as an Employee Stock Ownership Plan. As a result, the dividends on PPG shares held by that portion of the Savings Plan totaling $14 million , $13 million and $14 million for 2016 , 2015 , and 2014 , respectively, were tax deductible to the Company for U.S. Federal tax purposes.

Deferred compensation plan

The Company has a deferred compensation plan for certain key managers which allows them to defer a portion of their compensation in a phantom PPG stock account or other phantom investment accounts. The amount deferred earns a return based on the investment options selected by the participant. The amount owed to participants is an unfunded and unsecured general obligation of the Company. Upon retirement, death, disability, termination of employment, scheduled payment or unforeseen emergency, the compensation deferred and related accumulated earnings are distributed in accordance with the participant's election in cash or in PPG stock, based on the accounts selected by the participant.

The plan provides participants with investment alternatives and the ability to transfer amounts between the phantom non-PPG stock investment accounts. To mitigate the impact on compensation expense of changes in the market value of the liability, the Company has purchased a portfolio of marketable securities that mirror the phantom non-PPG stock investment accounts selected by the participants, except the money market accounts. These investments are carried by PPG at fair market value, and the changes in market value of these securities are also included in income from continuing operations. Trading occurs in this portfolio to align the securities held with the participant's phantom non-PPG stock investment accounts, except the money market accounts.

The cost of the deferred compensation plan, comprised of dividend equivalents accrued on the phantom PPG stock account, investment income and the change in market value of the liability, was expense of $7 million , $5 million and $10 million in 2016 , 2015 and 2014 , respectively. These amounts are included in "Selling, general and administrative" in the accompanying consolidated statement of income. The change in market value of the investment portfolio was income of $5 million , $3 million , and $8 million in 2016 , 2015 and 2014 , respectively, of which approximately $3 million annually was realized gains, and is also included in "Selling, general and administrative."

The Company's obligations under this plan, which are included in "Accounts payable and accrued liabilities" and "Other liabilities" in the accompanying consolidated balance sheet, totaled $124 million as of December 31, 2016 and 2015 , and the investments in marketable securities, which are included in "Investments" and "Other current assets" in the accompanying consolidated balance sheet, were $82 million and $81 million as of December 31, 2016 and 2015 , respectively.

13. Commitments and Contingent Liabilities

PPG is involved in a number of lawsuits and claims, both actual and potential, including some that it has asserted against others, in which substantial monetary damages are sought. These lawsuits and claims may relate to contract, patent, environmental, product liability, antitrust, employment and other matters arising out of the conduct of PPG's current and past business activities. To the extent that these lawsuits and claims involve personal injury and property damage, PPG believes it has adequate insurance; however, certain of PPG's insurers are contesting coverage with respect to some of these claims, and other insurers, as they had prior to the asbestos settlement described below, may contest coverage with respect to some of the asbestos claims if the settlement is not implemented. PPG's lawsuits and claims against others include claims against insurers and other third parties with respect to actual and contingent losses related to environmental, asbestos and other matters.

The results of any current or future litigation and claims are inherently unpredictable. However, management believes that, in the aggregate, the outcome of all lawsuits and claims involving PPG will not have a material effect on PPG's consolidated financial position or liquidity; however, such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized.

Foreign Tax Matter

In June 2014, PPG received a notice from a Foreign Tax Authority ("FTA") inviting the Company to pay interest totaling approximately $70 million for failure to withhold taxes on a 2009 intercompany dividend. Prior to the payment of the dividend, PPG obtained a ruling from the FTA which indicated that the dividend was tax-exempt and eligible for a simplified no-withholding procedure provided that certain administrative criteria were met. The FTA asserted that PPG did not meet all of the administrative criteria for the simplified procedure, and consequently taxes should have been withheld by the dividend payer, which would have made the dividend recipient eligible for a refund. The Company disagreed with the FTA's assertion. In March 2015, PPG received a formal assessment from the FTA. During September 2016, legislation was passed in the foreign taxing jurisdiction which would preclude the assessment of interest for failure to meet the administrative criteria. The new legislation was subject to a 100-day period during which the public could have sought a referendum on the legislation. The 100 day period lapsed in January 2017 without a referendum, thus closing this matter.

Asbestos matters

Prior to 2000, the Company had been named as a defendant in numerous claims alleging bodily injury from (i) exposure to asbestos-containing products allegedly manufactured, sold or distributed by the Company, its subsidiaries, or for which they are otherwise alleged to be liable; (ii) exposure to asbestos allegedly present at a facility owned or leased by the Company; or (iii) exposure to asbestos-containing products of Pittsburgh Corning Corporation ("PC") for which the Company was alleged to be liable under a variety of legal theories (the Company and Corning Incorporated were each 50% shareholders in PC).

Pittsburgh Corning Corporation asbestos bankruptcy

In 2000, PC filed for Chapter 11 in the U.S. Bankruptcy Court for the Western District of Pennsylvania in an effort to permanently and comprehensively resolve all of its pending and future asbestos-related liability claims. At the time of the bankruptcy filing, the Company had been named as one of many defendants in approximately 114,000 open claims. The Bankruptcy Court subsequently entered a series of orders preliminarily enjoining the prosecution of asbestos litigation against PPG until after the effective date of a confirmed PC plan of reorganization. During the pendency of this preliminary injunction staying asbestos litigation against PPG, PPG and certain of its historical liability insurers negotiated a settlement with representatives of present and future asbestos claimants. That settlement was incorporated into a PC plan of reorganization that was confirmed by the Bankruptcy Court on May 24, 2013 and ultimately became effective on April 27, 2016. With the effectiveness of the plan, the preliminary injunction staying the prosecution of asbestos litigation against PPG expired by its own terms on May 27, 2016. In accordance with the settlement, the Bankruptcy Court issued a permanent channeling injunction under Section 524(g) of the Bankruptcy Code that prohibits present and future claimants from asserting claims against PPG that arise, in whole or in part, out of exposure to asbestos or asbestos-containing products manufactured, sold and/or distributed by PC or asbestos on or emanating from any PC premises. The channeling injunction, by its terms, also prohibits codefendants in cases that are subject to the channeling injunction from asserting claims against PPG for contribution, indemnification or other recovery. The channeling injunction also precludes the prosecution of claims against PPG arising from alleged exposure to asbestos or asbestos-containing products to the extent that a claimant is alleging or seeking to impose liability, directly or indirectly, for the conduct of, claims against, or demands on PC by reason of PPG's: (i) ownership of a financial interest in PC; (ii) involvement in the management of PC, or service as an officer, director or employee of PC or a related party; (iii) provision of insurance to PC or a related party; or (iv) involvement in a financial transaction affecting the financial condition of PC or a related party. The foregoing PC related claims are referred to as "PC Relationship Claims."

The channeling injunction channels the Company's liability for PC Relationship Claims to a trust funded in part by PPG and its participating insurers for the benefit of current and future PC asbestos claimants (the "Trust"). The Trust is the sole recourse for holders of PC Relationship Claims. PPG and its affiliates have no further liability or responsibility for, and will be

permanently protected from, pending and future PC Relationship Claims. The channeling injunction does not extend to present and future claims against PPG that arise out of alleged exposure to asbestos or asbestos-containing products historically manufactured, sold and/or distributed by PPG or its subsidiaries or for which they are alleged to be liable that are not PC Relationship Claims, and does not extend to claims against PPG alleging personal injury allegedly caused by asbestos on premises presently or formerly owned, leased or occupied by PPG. These claims are referred to as non-PC Relationship Claims.

In accordance with the PC plan of reorganization, PPG's equity interest in PC was canceled. PPG satisfied its funding obligations to the Trust on June 9, 2016, when it conveyed to the Trust the stock it owned in Pittsburgh Corning Europe and 2,777,778 shares of PPG's common stock and made a cash payment to the Trust in the amount of $764 million . PPG's historical insurance carriers participating in the PC plan of reorganization are required to make cash payments to the Trust of approximately $1.7 billion , subject to a right of prepayment at a 5.5% discount rate.

On October 13, 2016, the Bankruptcy Court issued an order entering a final decree and closing the Chapter 11 case. That order provided that the Bankruptcy Court retained jurisdiction to enforce any order issued in the case and any agreements approved by the court, enforce the terms and conditions or the modified third amended Plan, and consider any requests to reopen the case.

The following table outlines the impact on PPG's financial statements for the three years ended December 31, 2016 including the change in fair value of the PPG stock contributed to the Trust, the equity forward instrument and the increase in the net present value of the payments made to the trust.

	Consolidated Balance Sheet			
	Asbestos Settlement Liability		*Equity Forward (Asset) Liability*	*Pre-tax Charge*
($ in millions)	*Current*	*Long-term*		
Balance as of January 1, 2014	$ 763	$ 245	$ (207)	$ 11
Change in fair value:				
PPG stock	58	—	—	58
Equity forward instrument	—	—	(60)	(60)
Accretion of asbestos liability	—	14	—	14
Balance as of and Activity for the year ended December 31, 2014	$ 821	$ 259	$ (267)	$ 12
Change in fair value:				
PPG stock	(46)	—	—	(46)
Equity forward instrument	—	—	44	44
Accretion of asbestos liability	14	—	—	14
Reclassification	7	(7)	—	—
Balance as of and Activity for the year ended December 31, 2015	$ 796	$ 252	$ (223)	$ 12
Change in fair value:				
PPG stock	34	—	—	34
Equity forward instrument	—		(35)	(35)
Accretion of asbestos liability	—	6	—	6
Settlement of equity forward instrument with counterparty [(a)]	—	—	(49)	—
Contribution of PCE shares and relinquishment of PC investment	(15)	—	—	—
Contribution of 2,777,778 shares of PPG stock to the PC Trust	(308)		308	
Contribution of cash to the PC Trust [(a)]	(506)	(258)	—	
Reclassification	(1)	—	(1)	—
Balance as of and Activity for the year ended December 31, 2016	$ —	$ —	$ —	$ 5

[(a)] Cash outflows related to the asbestos settlement funding totaled $813 million in 2016.

The fair value of the equity forward instrument was included as an "Other current asset" as of December 31, 2015 in the accompanying consolidated balance sheet. Payments under the fixed payment schedule required annual payments that were due each June. The current portion of the asbestos settlement liability included in the accompanying consolidated balance sheet as of December 31, 2015, consisted of all such payments required through June 2016, the fair value of PPG's common stock and the value of PPG's investment in Pittsburgh Corning Europe. The net present value of the remaining payments was included in the long-term asbestos settlement liability in the accompanying consolidated balance sheet as of December 31, 2015.

Non-PC relationship asbestos claims

At the time PC filed for bankruptcy, PPG had been named as one of many defendants in one or more of the categories of asbestos-related claims identified above. Over the course of the 16 years during which the PC bankruptcy proceedings, and corresponding preliminary injunction staying the prosecution of asbestos-related claims against PPG, were pending, certain plaintiffs alleging premises claims filed motions seeking to lift the stay with respect to more than 1,000 individually-identified premises. The Bankruptcy Court granted motions to lift the stay in respect to certain of these premises claims and directed PPG to engage in a process to address any additional premises claims that were the subject of pending or anticipated lift-stay motions. As a result of the overall process as directed by the Bankruptcy Court involving more than 1,000 premises claims between 2006 and May 27, 2016, hundreds of these claims were withdrawn or dismissed without payment and approximately 650 premises claims were dismissed upon agreements by PPG and its insurers to resolve such claims in exchange for monetary payments.

With respect to the remaining claims not identified above and still reportable within the inventory of 114,000 asbestos-related claims at the time PC filed for bankruptcy, the Company considers such claims to fall within one or more of the following categories: (1) claims that have been closed or dismissed as a result of processes undertaken during the bankruptcy; (2) claims that may have been previously filed on the dockets of state and federal courts in various jurisdictions, but are inactive as to the Company; and (3) claims that are subject, in whole or in part, to the channeling injunction and thus will be resolved, in whole or in part, in accordance with the Trust procedures established under the PC bankruptcy reorganization plan. As a result of the foregoing, the Company does not consider these three categories of claims to be open or active litigation against it, although the Company cannot now determine whether, or the extent to which, any of these claims may in the future be reinstituted, reinstated, or revived such that they may become open and active asbestos-related claims against it.

Current open and active claims post-Pittsburgh Corning bankruptcy

The Company is aware of approximately 750 open and active asbestos-related claims pending against the Company and certain of its subsidiaries. These claims consist primarily of non-PC Relationship Claims and claims against a subsidiary of PPG. The Company is defending the remaining open and active claims vigorously.

Since April 1, 2013, a subsidiary of PPG has been implicated in claims alleging death or injury caused by asbestos-containing products manufactured, distributed or sold by a North American architectural coatings business or its predecessors which was acquired by PPG. All such claims have been either served upon or tendered to the seller for defense and indemnity pursuant to obligations undertaken by the seller in connection with the Company's purchase of the North American architectural coatings business. The seller has accepted the defense of these claims subject to the terms of various agreements between the Company and the seller. The seller's defense and indemnity obligations in connection with newly filed claims will cease with respect to claims filed after April 1, 2018.

PPG has established reserves totaling approximately $180 million for asbestos-related claims that would not be channeled to the Trust which, based on presently available information, we believe will be sufficient to encompass all of PPG's current and potential future asbestos liabilities. These reserves include a $162 million reserve established in 2009 in connection with an amendment to the PC plan of reorganization. These reserves, which are included within "Other liabilities" on the accompanying consolidated balance sheets, represent PPG's best estimate of its liability for these claims. PPG does not have sufficient current claim information or settlement history on which to base a better estimate of this liability in light of the fact that the Bankruptcy Court's injunction staying most asbestos claims against the Company was in effect from April 2000 through May 2016. PPG will monitor the activity associated with its remaining asbestos claims and evaluate, on a periodic basis, its estimated liability for such claims, its insurance assets then available, and all underlying assumptions to determine whether any adjustment to the reserves for these claims is required.

The amount reserved for asbestos-related claims by its nature is subject to many uncertainties that may change over time, including (i) the ultimate number of claims filed; (ii) the amounts required to resolve both currently known and future unknown claims; (iii) the amount of insurance, if any, available to cover such claims; (iv) the unpredictable aspects of the litigation process, including a changing trial docket and the jurisdictions in which trials are scheduled; (v) the outcome of any trials, including potential judgments or jury verdicts; (vi) the lack of specific information in many cases concerning exposure for which PPG is allegedly responsible, and the claimants' alleged diseases resulting from such exposure; and (vii) potential changes in applicable federal and/or state tort liability law. All of these factors may have a material effect upon future asbestos-related liability estimates. As a potential offset to any future asbestos financial exposure, under the PC plan of reorganization PPG retained, for its own account, the right to pursue insurance coverage from certain of its historical insurers that did not participate in the PC plan of reorganization. While the ultimate outcome of PPG's asbestos litigation cannot be predicted with certainty, PPG believes that any financial exposure resulting from its asbestos-related claims will not have a material adverse effect on PPG's consolidated financial position, liquidity or results of operations.

Environmental matters

It is PPG's policy to accrue expenses for environmental contingencies when it is probable that a liability has been incurred and the amount of loss can be reasonably estimated. Reserves for environmental contingencies are exclusive of claims against third parties and are generally not discounted. In management's opinion, the Company operates in an environmentally sound manner and the outcome of the Company's environmental contingencies will not have a material effect on PPG's financial position or liquidity; however, any such outcome may be material to the results of operations of any particular period in which costs, if any, are recognized.

Management anticipates that the resolution of the Company's environmental contingencies will occur over an extended period of time.

As of December 31, 2016 and 2015 , PPG had reserves for environmental contingencies associated with PPG's former chromium manufacturing plant in Jersey City, N.J. ("New Jersey Chrome") and for other environmental contingencies, including National Priority List sites and legacy glass and chemical manufacturing sites. These reserves are reported as "Accounts payable and accrued liabilities" and "Other liabilities" in the accompanying consolidated balance sheet.

Environmental Reserves

($ in millions)	2016	2015
New Jersey Chrome	$ 163	$ 133
Legacy glass and chemical	70	48
Other	52	52
Total	$ 285	$ 233
Current Portion	*$ 76*	*$ 51*

Pre-tax charges against income for environmental remediation costs are included in "Other charges" in the accompanying consolidated statement of income. The pre-tax charges and cash outlays related to such environmental remediation in 2016 , 2015 and 2014 , were as follows:

Pre-tax charges against income for environmental remediation

($ in millions)	2016	2015	2014
New Jersey Chrome	$ 60	$ —	$ 136
Other	34	9	8
Total	$ 94	$ 9	$ 144
Cash outlays for environmental spending	*$ 47*	*$ 109*	*$ 165*

The Company continues to analyze, assess and remediate the environmental issues associated with New Jersey Chrome as further discussed below. During the past three years, charges for estimated environmental remediation costs were significantly higher than PPG's historical range. Excluding the charges related to New Jersey Chrome, pre-tax charges against income for environmental remediation have ranged between $8 million and $34 million per year for the past 10 years.

Management expects cash outlays for environmental remediation costs to range from $50 million to $70 million in 2017 and $25 million to $50 million annually from 2018 through 2021.

It is possible that technological, regulatory and enforcement developments, the results of environmental studies and other factors could alter the Company's expectations with respect to future charges against income and future cash outlays. Specifically, the level of expected future remediation costs and cash outlays is highly dependent upon activity related to New Jersey Chrome as discussed below.

Remediation: New Jersey Chrome

Since 1990, PPG has remediated 47 of 61 residential and nonresidential sites under the 1990 Administrative Consent Order ("ACO") with the New Jersey Department of Environmental Protection ("NJDEP"). The most significant of the 14 remaining sites is the former Garfield Avenue chromium manufacturing location in Jersey City, New Jersey. The principal contaminant of concern is hexavalent chromium. A settlement agreement among PPG, NJDEP and Jersey City (which had asserted claims against PPG for lost tax revenue) was reached in the form of a Judicial Consent Order (the "JCO") that was entered by the court on June 26, 2009. PPG's remedial obligations under the ACO were incorporated into the JCO. A new process was established for the review of PPG submitted technical reports for investigation and remedy selection for the 14 ACO sites and an additional six sites, which PPG accepted sole responsibility under the terms of a September 2011 agreement with NJDEP pursuant to the JCO. The JCO also provided for the appointment of a court-approved Site Administrator who was responsible for establishing a master schedule for the remediation of the 20 PPG sites which existed at that time. One site was subsequently removed from the JCO process during 2014 and will be remediated separately at a future date. A total of 19 sites remain subject to the JCO process.

The most significant assumptions underlying the estimate of remediation costs for all New Jersey Chrome sites are those related to the extent and concentration of chromium impacts in the soil, as these determine the quantity of soil that must be treated in place, the quantity that will have to be excavated and transported for offsite disposal, and the nature of disposal required. During the fourth quarter 2016 and the third quarter 2014, PPG completed updated assessments of costs incurred to date versus current progress and the potential cost impacts of the most recent information, including the extent of impacted soils, percentage of hazardous versus non-hazardous soils, daily soil excavation rates, and engineering, administrative and other associated costs. Based on these assessments, reserve adjustments of $60 million and $136 million were recorded during 2016 and 2014, respectively. Principal factors affecting costs included refinements in the estimate of the mix of hazardous to non-hazardous soils to be excavated, an overall increase in soil volumes to be excavated, enhanced water management requirements, decreased daily soil excavation rates due to site conditions, initial estimates for remedial actions related to groundwater, and increased oversight and management costs. The reserve adjustments for the estimated costs to remediate all New Jersey Chrome sites are exclusive of any third party indemnification, as the recovery of any such amounts is uncertain.

In conjunction with the JCO, PPG has completed all remedial activities at six sites and has received "No Further Action" or equivalent determinations from the NJDEP on these sites. PPG has also completed soil remedial activities at seven sites as of December 31, 2016. Soil remedial and field activities for the remaining six sites will also extend beyond the end of 2017. PPG is working with NJDEP and Jersey City regarding PPG's approach to obtain land use limitations, which require property owner consent for certain properties.

On November 6, 2015, the court approved a Consent Order among the parties to the JCO that modified the master schedule and established a timeline for the remediation of areas that are not currently accessible. Under the revised master schedule, soil remedial and field activities at most JCO sites, adjacent properties and roadways are scheduled to be complete by 2020,

with the final JCO site to be remediated by 2022. The NJDEP can seek stipulated civil penalties if PPG fails to complete soil and source remediation of JCO sites or perform certain other tasks under the master schedule.

In addition to the JCO sites, there are also 10 sewer sites for which responsibility is shared jointly between PPG and Honeywell International Inc. and two sites located within a former Exxon Mobil Corporation oil refinery.

Groundwater remediation at the former Garfield Avenue chromium-manufacturing site and five adjacent sites is expected to occur over several years after NJDEP's approval of the work plan. Ongoing groundwater monitoring will be utilized to develop a final groundwater remedial action work plan which is currently expected to be submitted to NJDEP no later than 2020. Groundwater at the remaining 13 JCO sites or other sites for which PPG has some responsibility is not expected to be a significant issue.

PPG's financial reserve for remediation of all New Jersey Chrome sites is $163 million at December 31, 2016 . The major cost components of this liability continue to be related to transportation and disposal of impacted soil as well as construction services. These components each account for approximately 28% and 29% of the accrued amount, respectively.

There are multiple, future events yet to occur, including further remedy selection and design, remedy implementation and execution and applicable governmental agency or community organization approvals. Considerable uncertainty exists regarding the timing of these future events for the New Jersey Chrome sites. Final resolution of these events is expected to occur over the next several years. As these events occur and to the extent that the cost estimates of the environmental remediation remedies change, the existing reserve for this environmental remediation matter will be adjusted.

Remediation: other sites

Among other sites at which PPG is managing environmental liabilities, remedial actions are occurring at a legacy chemical manufacturing site in Barberton, Ohio, where PPG has completed a Facility Investigation and Corrective Measure Study under USEPA's Resource Conservation and Recovery Act ("RCRA") Corrective Action Program. PPG has also been addressing the impacts from a legacy plate glass manufacturing site in Kokomo, Indiana under the Voluntary Remediation Program of the Indiana Department of Environmental Management. PPG is currently performing additional investigation activities at this location.

With respect to certain waste sites, the financial condition of other potentially responsible parties also contributes to the uncertainty of estimating PPG's final costs. Although contributors of waste to sites involving other potentially responsible parties may face governmental agency assertions of joint and several liability, in general, final allocations of costs are made based on the relative contributions of wastes to such sites. PPG is generally not a major contributor to such sites.

Separation and merger of the commodity chemicals business

As a result of the commodity chemicals business separation transaction, PPG has retained responsibility for potential environmental liabilities that may result from future Natural Resource Damage claims and any potential tort claims at the Calcasieu River Estuary associated with activities and historical operations of the Lake Charles, La. facility. PPG will additionally retain responsibility for all liabilities relating to, arising out of or resulting from sediment contamination in the Ohio River resulting from historical activities and operations at the Natrium, W.Va. facility, exclusive of remedial activities, if any, required to be performed on-site at the Natrium facility. PPG's obligations with respect to Ohio River sediment will terminate on December 30, 2017 unless within five years from December 30, 2012 PPG is required to further assess or to remediate sediment contamination caused by PPG's operation of the Natrium facility prior to the separation of the commodity chemicals business from PPG in which event PPG's obligations with respect to sediment in the Ohio River will continue for five years beyond the time that PPG is required to further assess or remediate sediment in the Ohio River.

Remediation: reasonably possible matters

In addition to the amounts currently reserved for environmental remediation, the Company may be subject to loss contingencies related to environmental matters estimated to be as much as $100 million to $200 million . Such unreserved losses are reasonably possible but are not currently considered to be probable of occurrence. These reasonably possible unreserved losses relate to environmental matters at a number of sites, none of which are individually significant. The loss contingencies related to these sites include significant unresolved issues such as the nature and extent of contamination at these sites and the methods that may have to be employed to remediate them.

The impact of evolving programs, such as natural resource damage claims, industrial site re-use initiatives and domestic and international remediation programs, also adds to the present uncertainties with regard to the ultimate resolution of this unreserved exposure to future loss. The Company's assessment of the potential impact of these environmental contingencies is subject to considerable uncertainty due to the complex, ongoing and evolving process of investigation and remediation, if necessary, of such environmental contingencies, and the potential for technological and regulatory developments.

Notes to the Consolidated Financial Statements

14. Shareholders' Equity

A class of 10 million shares of preferred stock, without par value, is authorized but unissued. Common stock has a par value of $1.66 2/3 per share; 1.2 billion shares are authorized.

On April 16, 2015, the PPG Board of Directors approved a 2 -for-1 split of the Company's common stock for all shareholders. The record date for the split was the close of business on May 11, 2015 and the additional shares were distributed on June 12, 2015. Each shareholder as of the date of record received one additional share of common stock for each share held. Historical per share and share data (except for shares on the balance sheet) in this Form 10-K give retroactive effect to the stock split.

The following table summarizes the shares outstanding for the three years ended December 31, 2016 :

	Common Stock	*Treasury Stock*	*Shares Outstanding*
Balance, January 1, 2014	581,146,136	(303,853,372)	277,292,764
Purchases	—	(7,626,382)	(7,626,382)
Issuances	—	2,298,184	2,298,184
Balance, December 31, 2014	581,146,136	(309,181,570)	271,964,566
Purchases	—	(6,992,772)	(6,992,772)
Issuances	—	1,904,215	1,904,215
Balance, December 31, 2015	581,146,136	(314,270,127)	266,876,009
Purchases	—	(10,725,869)	(10,725,869)
Issuances	—	1,180,020	1,180,020
Balance, December 31, 2016	581,146,136	(323,815,976)	257,330,160

Per share cash dividends paid were $1.56 in 2016 , $1.41 in 2015 and $1.31 in 2014 .

15. Accumulated Other Comprehensive Loss

($ in millions)	*Unrealized Foreign Currency Translation Adjustments*	*Pension and Other Post-retirement Benefit Adjustments, net of tax (c)*	*Unrealized Gain (Loss) on Derivatives, net of tax (d)*	*Accumulated Other Comprehensive (Loss) Income*
Balance, January 1, 2014	$ (38)	$ (1,157)	$ (65)	$ (1,260)
Current year deferrals to AOCI (a)	(442)	—	—	(442)
Current year deferrals to AOCI, tax effected (b)	(148)	(377)	34	(491)
Reclassifications from AOCI to net income	—	42	35	77
Period change	$ (590)	$ (335)	$ 69	$ (856)
Balance, December 31, 2014	$ (628)	$ (1,492)	$ 4	$ (2,116)
Current year deferrals to AOCI (a)	(630)	—	—	(630)
Current year deferrals to AOCI, tax effected (b)	(74)	9	41	(24)
Reclassifications from AOCI to net income	—	104	(36)	68
Period change	$ (704)	$ 113	$ 5	$ (586)
Balance, December 31, 2015	$ (1,332)	$ (1,379)	$ 9	$ (2,702)
Current year deferrals to AOCI (a)	(299)	—	—	(299)
Current year deferrals to AOCI, tax effected (b)	(167)	29	3	(135)
Reclassifications from AOCI to net income	—	779	1	780
Period change	$ (466)	$ 808	$ 4	$ 346
Balance, December 31, 2016	$ (1,798)	$ (571)	$ 13	$ (2,356)

(a) - Unrealized foreign currency translation adjustments related to translation of foreign denominated balance sheets are not presented net of tax given that no deferred U.S. income taxes have been provided on undistributed earnings of non-U.S. subsidiaries because they are deemed to be reinvested for an indefinite period of time.

(b) - The tax cost related to unrealized foreign currency translation adjustments on tax inter-branch transactions and net investment hedges for the years ended December 31, 2016 , 2015 and 2014 was $(34) million , $(84) million and $(33) million , respectively. In 2015 and 2014, the balance includes a remeasurement of the tax cost on the foreign proceeds from the sale of the Company's interest in Transitions Optical which have not been permanently reinvested. Refer to Note 2, "Acquisitions and Divestitures" for additional information.

(c) - The tax (cost) benefit related to the adjustment for pension and other postretirement benefits for the years ended December 31, 2016 , 2015 and 2014 was $(403) million , $(51) million and $162 million , respectively. Reclassifications from AOCI are included in the computation of net periodic benefit costs (See Note 12, "Employee Benefit Plans"). The cumulative tax benefit related to the adjustment for pension and other postretirement benefits at December 31, 2016 and 2015 was $276 million and $679 million , respectively.

(d) - The tax cost (benefit) related to the change in the unrealized gain on derivatives for the years ended December 31, 2016 , 2015 and 2014 was $2 million , $(2) million and $(40) million , respectively. Reclassifications from AOCI are included in the gain or loss recognized on cash flow hedges (See Note 9 "Financial Instruments, Hedging Activities and Fair Value Measurements").

16. Other Income

($ in millions)	2016	2015	2014
Gain on disposals of ownership interests in business affiliates	$ 82	$ —	$ —
Royalty income	15	20	29
Share of net earnings of equity affiliates (See Note 5)	12	11	101
Gain on sale of assets	6	4	6
Other	61	90	79
Total	$ 176	$ 125	$ 215

17. Stock-Based Compensation

The Company's stock-based compensation includes stock options, restricted stock units ("RSUs") and grants of contingent shares that are earned based on achieving targeted levels of total shareholder return. All current grants of stock options, RSUs and contingent shares are made under the PPG Industries, Inc. Amended and Restated Omnibus Incentive Plan ("PPG Amended Omnibus Plan"), which was amended and restated effective April 21, 2016. Shares available for future grants under the PPG Amended Omnibus Plan were 8.0 million as of December 31, 2016 .

($ in millions)	2016	2015	2014
Total stock-based compensation	$ 39	$ 54	$ 71
Income tax benefit recognized	$ 14	$ 18	$ 24

Stock Options

PPG has outstanding stock option awards that have been granted under the PPG Amended Omnibus Plan. Under the PPG Amended Omnibus Plan, certain employees of the Company have been granted options to purchase shares of common stock at prices equal to the fair market value of the shares on the date the options were granted. The options are generally exercisable 36 months after being granted and have a maximum term of 10 years. Upon exercise of a stock option, shares of Company stock are issued from treasury stock.

The fair value of stock options issued to employees is measured on the date of grant and is recognized as expense over the requisite service period. PPG estimates the fair value of stock options using the Black-Scholes option pricing model. The risk-free interest rate is determined by using the U.S. Treasury yield curve at the date of the grant and using a maturity equal to the expected life of the option. The expected life of options is calculated using the average of the vesting term and the maximum term, as prescribed by accounting guidance on the use of the simplified method for determining the expected term of an employee share option. The expected dividend yield and volatility are based on historical stock prices and dividend amounts over past time periods equal in length to the expected life of the options.

The following weighted average assumptions were used to calculate the fair values of stock option grants in each year:

	2016	2015	2014
Weighted average exercise price	$ 95.29	$118.02	$93.61
Risk free interest rate	1.6%	1.9%	2.1%
Expected life of option in years	6.5	6.5	6.5
Expected dividend yield	2.1%	2.7%	3.0%
Expected volatility	22.8%	29.2%	30.1%

The weighted average fair value of options granted was $17.94 per share, $26.94 per share and $21.55 per share for the years ended December 31, 2016 , 2015 , and 2014 , respectively.

A summary of stock options outstanding and exercisable and activity for the year ended December 31, 2016 is presented below:

	Number of Shares	Weighted Average Exercise Price	Weighted Average Remaining Contractual Life (in years)	Intrinsic Value (in millions)
Outstanding, January 1, 2016	3,729,728	$ 67.68	6.5	$ 127
Granted	792,079	$ 95.29		
Exercised	(611,091)	$ 50.08		
Forfeited/Expired	(29,150)	$ 100.22		
Outstanding, December 31, 2016	3,881,566	$ 75.84	6.5	$ 86
Vested or expected to vest, December 31, 2016	3,657,738	$ 66.90	6.4	$ 86
Exercisable, December 31, 2016	1,859,345	$ 48.43	4.6	$ 86

At December 31, 2016 , unrecognized compensation cost related to outstanding stock options that have not yet vested totaled $7 million . This cost is expected to be recognized as expense over a weighted average period of 1.5 years.

The following table presents stock option activity for the years ended December 31, 2016 , 2015 and 2014 :

($ in millions)	*2016*	*2015*	*2014*
Total intrinsic value of stock options exercised	$ 34	$ 92	$ 92
Cash received from stock option exercises	$ 32	$ 53	$ 57
Income tax benefit from the exercise of stock options	$ 12	$ 31	$ 33
Total fair value of stock options vested	$ 16	$ 13	$ 10

Restricted Stock Units ("RSUs")

Long-term incentive value is delivered to selected key management employees by granting RSUs, which have either time or performance-based vesting features. The fair value of an RSU is equal to the market value of a share of PPG stock on the date of grant. Time-based RSUs vest over the three -year period following the date of grant, unless forfeited, and will be paid out in the form of stock, cash or a combination of both at the Company's discretion at the end of the three year vesting period. Performance-based RSUs vest based on achieving specific annual performance targets for earnings per share growth and cash flow return on capital over the three calendar year-end periods following the date of grant. Unless forfeited, the performance-based RSUs will be paid out in the form of stock, cash or a combination of both at the Company's discretion at the end of the three -year performance period if PPG meets the performance targets. The amount paid for performance-based awards may range from 0% to 180% of the original grant, based upon the frequency with which the annual earnings per share growth and cash flow return on capital performance targets are met over the three calendar year periods comprising the vesting period. For the purposes of expense recognition, PPG has assumed that performance-based RSUs granted in 2014 will vest at the 150% level and those granted in 2015 and 2016 will vest at the 100% level. As of December 31, 2016 , five of the six possible performance targets had been met for the 2014 grant, three of the four possible performance targets had been met for the 2015 grant, and one of two possible performance targets had been met for the 2016 grant.

The following table summarizes RSU activity for the year ended December 31, 2016 :

	Number of Shares	Weighted Average Fair Value	Intrinsic Value (in millions)
Outstanding, January 1, 2016	1,094,161	$ 119.26	$ 108
Granted	265,105	$ 91.84	
Additional shares vested	94,036	$ 89.67	
Released from restrictions	(682,850)	$ 70.49	
Forfeited	(48,528)	$ 86.52	
Outstanding, December 31, 2016	721,924	$ 95.65	$ 69
Vested or expected to vest, December 31, 2016	687,385	$ 95.71	$ 66

There was $14 million of total unrecognized compensation cost related to unvested RSUs outstanding as of December 31, 2016 . This cost is expected to be recognized as expense over a weighted average period of 1.6 years.

Contingent Share Grants

The Company also provides grants of contingent shares to selected key executives that may be earned based on PPG total shareholder return ("TSR") over the three -year period following the date of grant. Contingent share grants (referred to as "TSR awards") are made annually and are paid out at the end of each three -year period based on the Company's performance. Performance is measured by determining the percentile rank of the total shareholder return of PPG common stock in relation to the total shareholder return of the S&P 500 for the three -year period following the date of grant. This comparison group represents the entire S&P 500 Index as it existed at the beginning of the performance period, excluding any companies that have been removed from the index because they ceased to be publicly traded. The payment of awards following the three -year award period will be based on performance achieved in accordance with the scale set forth in the plan agreement and may range from 0% to 220% of the initial grant. A payout of 100% is earned if the target performance is achieved. Contingent share awards for the 2014-2016, 2015-2017, and 2016-2018 periods earn dividend equivalents for the award period, which will be paid to participants or credited to the participants' deferred compensation plan accounts with the award payout at the end of the period based on the actual number of contingent shares that are earned. Any payments made at the end of the award period may be in the form of stock, cash or a combination of both. The TSR awards qualify as liability awards, and compensation expense is recognized over the three -year award period based on the fair value of the awards (giving consideration to the Company's percentile rank of total shareholder return) remeasured in each reporting period until settlement of the awards.

As of December 31, 2016 , there was $0.5 million of total unrecognized compensation cost related to outstanding TSR awards based on the current estimate of fair value. This cost is expected to be recognized as expense over a weighted average period of 1.0 year.

18. Quarterly Financial Information (unaudited)

Historical share and per share data (except for shares on the balance sheet) give retroactive effect to the 2 -for-1 stock split discussed in Note 14, "Shareholders' Equity."

	2016 Quarter Ended				
($ in millions, except per share amounts)	*Mar. 31*	*Jun. 30*	*Sept. 30*	*Dec. 31*	*Full Year (1)*
Net sales	$ 3,544	$ 3,921	$ 3,789	$ 3,497	$ 14,751
Cost of sales (2)	1,920	2,094	2,081	1,968	8,063
Net income (loss) attributable to PPG					
Continuing operations	337	351	(201)	77	564
Discontinued operations	10	19	17	267	313
Net income (loss)	347	370	(184)	344	877
Earnings (loss) per common share					
Continuing operations	$ 1.26	$ 1.31	$ (0.75)	$ 0.29	$ 2.12
Discontinued operations	$ 0.04	$ 0.07	$ 0.06	$ 1.02	$ 1.18
Earnings (loss) per common share	$ 1.30	$ 1.38	$ (0.69)	$ 1.31	$ 3.30
Earnings (loss) per common share - assuming dilution					
Continuing operations	$ 1.25	$ 1.30	$ (0.75)	$ 0.29	$ 2.11
Discontinued operations	$ 0.04	$ 0.07	$ 0.06	$ 1.01	$ 1.17
Earnings (loss) per common share – assuming dilution	$ 1.29	$ 1.37	$ (0.69)	$ 1.30	$ 3.28

	2015 Quarter Ended				
($ in millions except per share amounts)	*Mar. 31*	*Jun. 30*	*Sept. 30*	*Dec. 31*	*Full Year (1)*
Net sales	$ 3,531	$ 3,958	$ 3,725	$ 3,552	$ 14,766
Cost of sales (2)	1,973	2,187	2,049	1,997	8,206
Net income attributable to PPG					
Continuing operations	309	319	415	295	1,338
Discontinued operations	13	18	18	19	68
Net income	322	337	433	314	1,406
Earnings per common share					
Continuing operations	$ 1.13	$ 1.17	$ 1.53	$ 1.10	$ 4.93
Discontinued operations	$ 0.05	$ 0.07	$ 0.07	$ 0.07	$ 0.25
Earnings per common share	$ 1.18	$ 1.24	$ 1.60	$ 1.17	$ 5.18
Earnings per common share - assuming dilution					
Continuing operations	$ 1.12	$ 1.16	$ 1.52	$ 1.09	$ 4.89
Discontinued operations	$ 0.05	$ 0.07	$ 0.07	$ 0.07	$ 0.25
Earnings per common share – assuming dilution	$ 1.17	$ 1.23	$ 1.59	$ 1.16	$ 5.14

(1) Full year earnings-per-share was calculated using the full year weighted average shares outstanding. As such, the sum of the quarters may not equal the total earnings-per-share for the year.

(2) Exclusive of depreciation and amortization.

19. Reportable Business Segment Information

Segment Organization and Products

PPG is a multinational manufacturer with 11 operating segments (which the Company refers to as "strategic business units") that are organized based on the Company's major products lines. These operating segments are also the Company's reporting units for purposes of testing goodwill for impairment (see Note 1, "Summary of Significant Accounting Policies").

The Company's reportable business segments include the following three segments: Performance Coatings, Industrial Coatings and Glass. The operating segments have been aggregated based on economic similarities, the nature of their products, production processes, end-use markets and methods of distribution.

The Performance Coatings reportable segment is comprised of the refinish, aerospace, architectural coatings – Americas and Asia Pacific, architectural coatings - EMEA, and protective and marine coatings operating segments. This reportable segment primarily supplies a variety of protective and decorative coatings, sealants and finishes along with paint strippers, stains and related chemicals, as well as transparencies and transparent armor.

The Industrial Coatings reportable segment is comprised of the automotive original equipment manufacturer ("OEM") coatings, industrial coatings, packaging coatings, coatings services and the specialty coatings and materials operating segments. This reportable segment primarily supplies a variety of protective and decorative coatings and finishes along with adhesives, sealants, metal pretreatment products, optical monomers and coatings, precipitated silicas and other specialty materials.

The Glass reportable segment is comprised of the fiber glass operating segment. This reportable segment primarily supplies continuous-strand fiber glass products.

Production facilities and markets for Performance Coatings, and Industrial Coatings are global, while Glass is only North America. PPG's reportable segments continue to pursue opportunities to further develop their global markets, including efforts in Asia, Eastern Europe and Latin America. Each of the reportable segments in which PPG is engaged is highly competitive. The diversification of our product lines and the worldwide markets served tend to minimize the impact on PPG's total sales and income from continuing operations of changes in demand in a particular market or in a particular geographic area.

The accounting policies of the operating segments are the same as those described in the summary of significant accounting policies (See Note 1, "Summary of Significant Accounting Policies"). The Company allocates resources to operating segments and evaluates the performance of operating segments based upon segment income, which is income before interest expense – net, income taxes, and noncontrolling interests and excludes certain charges which are considered to be unusual or non-recurring. The Company also evaluates performance of operating segments based on working capital reduction, margin growth, and sales volume growth. Legacy items include current costs related to former operations of the Company, including certain environmental remediation, pension and other postretirement benefit costs, and certain charges for legal and other matters which are considered to be unusual or non-recurring. These legacy costs are excluded from the segment income that is used to evaluate the performance of the operating segments.

Corporate unallocated costs include the costs of corporate staff functions not directly associated with the operating segments, the cost of corporate legal cases, net of related insurance recoveries and the cost of certain insurance and stock-based compensation programs. Net periodic pension expense is allocated to the operating segments and the portion of net periodic pension expense related to the corporate staff functions is included in the Corporate unallocated costs.

Product movement between Performance Coatings and Industrial Coatings is limited, is accounted for as an inventory transfer, and is recorded at cost plus a mark-up, the impact of which is not significant to the segment income of the coatings reportable segments.

($ in millions) **Reportable Business Segments**	*Performance Coatings*	*Industrial Coatings*	*Glass*	*Corporate / Eliminations / Non-Segment Items* [1]	*Consolidated Totals*
2016					
Net sales to external customers	$ 8,580	$ 5,690	$ 481	$ —	$ 14,751
Intersegment net sales	—	1	—	(1)	—
Total net sales	$ 8,580	$ 5,691	$ 481	$ (1)	$ 14,751
Segment income	$ 1,314	$ 1,042	$ 53	$ —	$ 2,409
Legacy items [2]					(115)
Business restructuring charge					(197)
Transaction-related costs [5]					(9)
Pension settlement charges					(968)
Asset write-downs					(27)
Loss on divestiture of European fiber glass business					(42)
Gains on disposals of ownership interests in business affiliates					82
Interest expense, net of interest income					(99)
Corporate unallocated [1]					(207)
Income before income taxes					$ 827
Depreciation and amortization	$ 272	$ 143	$ 22	$ 25	$ 462
Share of net earnings (loss) of equity affiliates	$ 5	$ 1	$ 3	$ 3	$ 12
Segment assets [3]	$ 9,168	$ 3,972	$ 220	$ 2,409	$ 15,769
Investment in equity affiliates	$ 30	$ 13	$ —	$ 3	$ 46
Expenditures for property (including business acquisitions)	$ 187	$ 510	$ 22	$ 32	$ 751

($ in millions) **Reportable Business Segments**	*Performance Coatings*	*Industrial Coatings*	*Glass*	*Corporate / Eliminations / Non-Segment Items* [1]	*Consolidated Totals*
2015					
Net sales to external customers	$ 8,765	$ 5,476	$ 525	$ —	$ 14,766
Intersegment net sales	—	1	—	(1)	—
Total net sales	$ 8,765	$ 5,477	$ 525	$ (1)	$ 14,766
Segment income	$ 1,302	$ 985	$ 38	$ —	$ 2,325
Legacy items [2]					(51)
Business restructuring charge					(140)
Transaction-related costs [5]					(44)
Interest expense, net of interest income					(86)
Corporate unallocated [1]					(221)
Income before income taxes					$ 1,783
Depreciation and amortization	$ 296	$ 124	$ 25	$ 26	$ 471
Share of net earnings/(loss) of equity affiliates	$ 7	$ —	$ 7	$ (3)	$ 11
Segment assets [3]	$ 9,917	$ 3,643	$ 557	$ 2,959	$ 17,076
Investment in equity affiliates	$ 45	$ 13	$ 127	$ 36	$ 221
Expenditures for property (including business acquisitions)	$ 298	$ 414	$ 24	$ 38	$ 774

Notes to the Consolidated Financial Statements

($ in millions) **Reportable Business Segments**	*Performance Coatings*	*Industrial Coatings*	*Glass*	*Corporate / Eliminations / Non-Segment Items* [1]	*Consolidated Totals*
2014					
Net sales to external customers	$ 8,698	$ 5,552	$ 541	$ —	$ 14,791
Intersegment net sales	—	1	—	(1)	—
Total net sales	$ 8,698	$ 5,553	$ 541	$ (1)	$ 14,791
Segment income	$ 1,205	$ 951	$ 35	$ —	$ 2,191
Legacy items [2]					(27)
Debt refinancing charge					(317)
Transaction-related costs [5]					(62)
Interest expense, net of interest income					(137)
Corporate unallocated [1]					(256)
Income before income taxes					$ 1,392
Depreciation and amortization	$ 284	$ 115	$ 27	$ 24	$ 450
Share of net earnings of equity affiliates	$ —	$ —	$ (3)	$ 104	$ 101
Segment assets [3]	$ 10,709	$ 3,621	$ 531	$ 2,674	$ 17,535
Investment in equity affiliates	$ 41	$ 15	$ 127	$ 112	$ 295
Expenditures for property (including business acquisitions)	$ 2,374	$ 251	$ 33	$ 19	$ 2,677

($ in millions)

Geographic Information	*2016*	*2015*	*2014*
Net sales [4]			
United States and Canada	$ 6,595	$ 6,589	$ 6,624
Europe, Middle East and Africa (“EMEA”)	4,304	4,270	4,802
Asia Pacific	2,431	2,434	2,517
Latin America	1,421	1,473	848
Total	$ 14,751	$ 14,766	$ 14,791
Segment income			
United States and Canada	$ 1,202	$ 1,218	$ 1,200
EMEA	588	528	576
Asia Pacific	387	366	319
Latin America	232	213	96
Total	$ 2,409	$ 2,325	$ 2,191
Property—net			
United States and Canada	$ 1,335	$ 1,315	$ 1,248
EMEA	726	805	831
Asia Pacific	447	431	414
Latin America	251	271	402
Total	$ 2,759	$ 2,822	$ 2,895

(1) *Corporate intersegment net sales represent intersegment net sales eliminations. Corporate unallocated costs include the costs of corporate staff functions not directly associated with the operating segments, certain legal and insurance costs and stock-based compensation expense.*

(2) *Legacy items include current costs related to former operations of the Company, including certain environmental remediation, pension and other postretirement benefit costs, legal costs and certain charges which are considered to be non-recurring. Until April 2016, legacy items also include equity earnings from PPG’s minority investment in Pittsburgh Glass Works, LLC. The Legacy items for 2016 and 2014 include environmental remediation pre-tax charges of $82 million and $138 million , respectively. These charges relate to continued environmental remediation activities at legacy chemicals sites, primarily at PPG’s former Jersey City, N.J. chromium manufacturing plant and associated sites (See Note 13). In 2014, Legacy items includes the gains from an equity affiliates sale of a business line (Refer to Note 2, “Acquisitions and Divestitures”).*

(3) *Segment assets are the total assets used in the operation of each segment. Corporate assets are principally cash and cash equivalents, cash held in escrow, short term investments, deferred tax assets and, until April 2016, PPG’s equity investment in it’s former automotive glass and services business. Non-segment items also includes the assets of businesses which have been reclassified as discontinued operations in the Consolidated Statement of Income. (Refer to Note 2, “Acquisitions and Divestitures”).*

(4) *Net sales to external customers are attributed to geographic regions based upon the location of the operating unit shipping the product.*

(5) *Transaction-related costs include advisory, legal, accounting, valuation, and other professional or consulting fees incurred to effect significant acquisitions, as well as similar fees and other costs to effect divestitures not classified as discontinued operations. These costs also include the flow-through cost of sales for the step up to fair value of inventory acquired in acquisitions. These costs also include certain nonrecurring severance costs and charges associated with the Company’s business portfolio transformation.*

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

None.

Item 9A. Controls and Procedures

(a) Evaluation of disclosure controls and procedures.

Based on their evaluation as of the end of the period covered by this Form 10-K, the Company's principal executive officer and principal financial officer have concluded that the Company's disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934 (the "Exchange Act")) are effective to ensure that information required to be disclosed by the Company in reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in Securities and Exchange Commission rules and forms and to ensure that information required to be disclosed by the Company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the Company's management, including its principal executive and principal financial officers, as appropriate, to allow timely decisions regarding required disclosure.

(b) Changes in internal control over financial reporting.

There were no changes in the Company's internal control over financial reporting that occurred during the Company's most recent fiscal quarter that have materially affected, or are reasonably likely to materially affect, the Company's internal control over financial reporting.

(c) *Management report on internal control over financial reporting.*

See Management Report on page 35 for management's annual report on internal control over financial reporting. See Report of Independent Registered Public Accounting Firm on page 34 for PricewaterhouseCoopers LLP's audit report on the Company's internal control over financial reporting.

Item 9B. Other Information

None.

Part III

Item 10. Directors, Executive Officers and Corporate Governance

The information about the Company's directors required by Item 10 and not otherwise set forth below is contained under the caption "Proposal 1: Election of Directors" in PPG's definitive Proxy Statement for the 2017 Annual Meeting of Shareholders (the "Proxy Statement") which the Company anticipates filing with the Securities and Exchange Commission, pursuant to Regulation 14A, not later than 120 days after the end of the Company's fiscal year, and is incorporated herein by reference.

The executive officers of the Company are elected by the Board of Directors. The information required by this item concerning the Company's executive officers is incorporated by reference herein from Part I of this report under the caption "Executive Officers of the Company."

Information regarding the Company's Audit Committee is included in the Proxy Statement under the caption "Corporate Governance – Audit Committee" and is incorporated herein by reference.

Information regarding the Company's codes of ethics is included in the Proxy Statement under the caption "Corporate Governance – Codes of Ethics" and is incorporated herein by reference.

Information about compliance with Section 16(a) of the Exchange Act is included in the Proxy Statement under the caption "Beneficial Ownership – Section 16(a) Beneficial Ownership Reporting Compliance" and is incorporated herein by reference.

Item 11. Executive Compensation

The information required by Item 11 is contained in the Proxy Statement under the captions "Compensation of Directors," "Compensation Discussion and Analysis," "Compensation of Executive Officers," "Potential Payments upon Termination or Change in Control," "Corporate Governance – Compensation Committee Interlocks and Insider Participation," and "Corporate Governance – Officers-Directors Compensation Committee Report to Shareholders" and is incorporated herein by reference.

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

The information required by Item 12 is contained in the Proxy Statement under the captions "Beneficial Ownership" and "Equity Compensation Plan Information" and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence

The information required by Item 13 is contained in the Proxy Statement under the captions "Corporate Governance – Director Independence," "Corporate Governance – Review and Approval or Ratification of Transactions with Related Persons" and "Corporate Governance – Certain Relationships and Related Transactions" and is incorporated herein by reference.

Item 14. Principal Accounting Fees and Services

The information required by Item 14 is contained in the Proxy Statement under the caption "Independent Registered Public Accounting Firm" and is incorporated herein by reference.

Part IV

Item 15. Exhibits, Financial Statement Schedules

(a)(1) Consolidated Financial Statements and Reports of Independent Registered Public Accounting Firm (see Part II, Item 8 of this Form 10-K).

The following information is filed as part of this Form 10-K:

	Page
Report of Independent Registered Public Accounting Firm	34
Management Report	35
Consolidated Statement of Income for the Years Ended December 31, 2016, 2015 and 2014	36
Consolidated Statement of Comprehensive Income for the Years Ended December 31, 2016, 2015 and 2014	36
Consolidated Balance Sheet as of December 31, 2016 and 2015	37
Consolidated Statement of Shareholders' Equity for the Years Ended December 31, 2016, 2015 and 2014	38
Consolidated Statement of Cash Flows for the Years Ended December 31, 2016, 2015 and 2014	39
Notes to the Consolidated Financial Statements	40

(a)(2) Consolidated Financial Statement Schedule for the years ended December 31, 2016, 2015 and 2014.

The following Consolidated Financial Statement Schedule should be read in conjunction with the previously referenced financial statements:

Schedule II – Valuation and Qualifying Accounts

Allowance for Doubtful Accounts for the Years Ended December 31, 2016, 2015, and 2014

($ in millions)	*Balance at Beginning of Year*	*Charged to Costs and Expenses*	*Other Additions(1)*	*Deductions(2)*	*Balance at End of Year*
2016	$ 46	$ 22	$ —	$ (29)	$ 39
2015	$ 81	$ 10	$ —	$ (45)	$ 46
2014	$ 68	$ 16	$ 31	$ (34)	$ 81

(1) Represents allowance for doubtful accounts of acquired businesses.

(2) Notes and accounts receivable written off as uncollectible, net of recoveries, amounts attributable to divestitures and changes attributable to foreign currency translation.

All other schedules are omitted because they are not applicable.

(a)(3) Exhibits. The following exhibits are filed as a part of, or incorporated by reference into, this Form 10-K.

2 Transaction Agreement by and among PPG Industries, Inc., PPG Industries Securities, LLC, PPG Luxembourg Finance S.àR.L., Group 26 Diversified Holdings Ireland, and Essilor International (Compagnie Generale D'Optique) S.A. was filed as Exhibit 2.1 to the Registrant's Quarterly Report on Form 10-Q for the period ended September 30, 2013.

2.1 Stock Purchase Agreement, dated June 30, 2014, by and among Avisep, S.A. de C.V., Bevisep, S.A. de C.V., PPG Industries, Inc. and Consorcio Comex, S.A. de C.V., was filed as Exhibit 2 to the Registrant's Quarterly Report on Form 10-Q for the period ended June 30, 2014.

2.2 Definitive Purchase Agreement, dated as of June 24, 2016, by and among Massachusetts Mutual Life Insurance Company, PPG Industries, Inc. and State Street Bank and Trust Company, as Independent Fiduciary of the PPG Industries, Inc. Pension Plans, was filed as Exhibit 2.1 to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016.

2.3 Definitive Purchase Agreement, dated as of June 24, 2016, by and among Metropolitan Life Insurance Company, PPG Industries, Inc. and State Street Bank and Trust Company, as Independent Fiduciary of the PPG Industries, Inc. Pension Plans, was filed as Exhibit 2.2 to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016.

3 Statement with Respect to Shares Eliminating the Series A Junior Participating Preferred Stock, was filed as Exhibit 3.1 to the Registrant's Quarterly Report on Form 10-Q for the period ended September 30, 2014.

3.1 Restated Articles of Incorporation of PPG Industries, Inc., was filed as Exhibit 3.2 to the Registrant's Quarterly Report on Form 10-Q for the period ended September 30, 2014.

3.2 Articles of Amendment to the Restated Articles of Incorporation of PPG Industries, Inc. effective June 12, 2015, was filed as Exhibit 3.1 to the Registrant's Current Report on Form 8-K filed on June 18, 2015.

3.3 Amended and Restated Bylaws of PPG Industries, Inc., as amended on December 10, 2015, was filed as Exhibit 3.1 to the Registrant's Current Report on Form 8-K filed on December 15, 2015.

4 Indenture, dated as of Aug. 1, 1982, was filed as Exhibit 4.1 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.

4.1 First Supplemental Indenture, dated as of April 1, 1986, was filed as Exhibit 4.2 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.

4.2 Second Supplemental Indenture, dated as of October 1, 1989, was filed as Exhibit 4.3 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.

4.3 Third Supplemental Indenture, dated as of November 1, 1995, was filed as Exhibit 4.4 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.

4.4 Indenture, dated as of June 24, 2005, was filed as Exhibit 4.1 to the Registrant's Current Report on Form 8-K dated June 20, 2005.

4.5 Indenture, dated as of March 18, 2008, was filed as Exhibit 4.1 to the Registrant's Current Report on Form 8-K filed on March 18, 2008.

4.6 Supplemental Indenture, dated as of March 18, 2008, was filed as Exhibit 4.2 to the Registrant's Current Report on Form 8-K filed on March 18, 2008.

4.7 Second Supplemental Indenture, dated as of November 12, 2010, was filed as Exhibit 4.3 to the Registrant's Current Report on Form 8-K filed on November 12, 2010.

4.8 Third Supplemental Indenture, dated as of August 3, 2012, was filed as Exhibit 4.4 to the Registrant's Current Report on Form 8-K filed on August 3, 2012.

4.9 Fourth Supplemental Indenture, dated as of November 12, 2014, between PPG Industries, Inc. and The Bank of New York Mellon Trust Company, was filed as Exhibit 4.2 to the Registrant's Current Report on Form 8-K filed on November 12, 2014.

4.10 Fifth Supplemental Indenture, dated as of March 13, 2015, between PPG Industries, Inc. and The Bank of New York Mellon Trust Company, N.A., as trustee, was filed as Exhibit 4.3 to the Registrant's Current Report on Form 8-K filed on March 13, 2015.

4.11 Sixth Supplemental Indenture, dated as of November 3, 2016, between PPG Industries, Inc. and The Bank of New York Mellon Trust Company, N.A., as trustee, was filed as Exhibit 4.3 to the Registrant's Current Report on Form 8-K filed on November 3, 2016.

* 10 PPG Industries, Inc. Nonqualified Retirement Plan, as amended and restated September 24, 2008, was filed as Exhibit 10 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2011.

* 10.1 Form of Change in Control Employment Agreement entered into with executives prior to January 1, 2008, as amended, was filed as Exhibit 10.2 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2007.

* 10.2 Form of Change in Control Employment Agreement entered into with executives on or after January 1, 2008 through December 31, 2009, was filed as Exhibit 10.24 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2007.

* 10.3 Form of Change in Control Employment Agreement entered into with executives on or after January 1, 2010, was filed as Exhibit 10.3 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2009.

* 10.4 Form of Change in Control Employment Agreement entered into with executives on or after June 30, 2012 was filed as Exhibit 10.4 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2012.

* 10.5 Form of Change in Control Employment Agreement entered into with executives on or after January 1, 2014, was filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q for the period ended March 31, 2014.

* 10.6 PPG Industries, Inc. Deferred Compensation Plan for Directors related to compensation deferred prior to January 1, 2005, was filed as Exhibit 10.3 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 1997.

* 10.7 PPG Industries, Inc. Deferred Compensation Plan for Directors related to compensation deferred on or after January 1, 2005, as amended February 15, 2006, was filed as Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q for the period ended March 31, 2006.

* 10.8 PPG Industries, Inc. Deferred Compensation Plan related to compensation deferred prior to January 1, 2005, as amended effective July 14, 2004, was filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q for the period ended June 30, 2004.

* 10.9 PPG Industries, Inc. Deferred Compensation Plan related to compensation deferred on or after January 1, 2005, as amended and restated September 24, 2008, was filed as Exhibit 10.6 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2008.

* 10.10 PPG Industries, Inc. Deferred Compensation Plan related to compensation deferred on or prior to January 1, 2005, as amended and restated effective January 1, 2011, was filed as Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q for the period ended June 30, 2012.

* 10.11 PPG Industries, Inc. Deferred Compensation Plan related to compensation deferred on or after to January 1, 2005, as amended and restated effective January 1, 2011, was filed as Exhibit 10.5 to the Registrant's Quarterly Report on Form 10-Q for the period ended June 30, 2012.

* 10.12 PPG Industries, Inc. Executive Officers' Long Term Incentive Plan was filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K dated February 16, 2005.

* 10.13 PPG Industries, Inc. Incentive Compensation Plan for Key Employees, as amended April 20, 2006, was filed as Exhibit 10.8 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2008.

* 10.14 PPG Industries, Inc. Management Award Plan, as amended April 20, 2006, was filed as Exhibit 10.9 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2008.

* 10.15 PPG Industries, Inc. Omnibus Incentive Plan was filed as Exhibit 10.18 to the Registrant's Quarterly Report on Form 10-Q for the period ended March 31, 2006.

* 10.16 PPG Industries, Inc. Amended and Restated Omnibus Incentive Plan, was filed as Annex A to the Registrant's Definitive Proxy Statement for its 2011 Annual Meeting of Shareholders filed on March 10, 2011.

* 10.17 PPG Industries, Inc. Amended and Restated Omnibus Incentive Plan, was filed as Annex B to the Registrant's Definitive Proxy Statement for its 2016 Annual Meeting of Shareholders filed on March 10, 2016.

* 10.18 Form of Time-Vested Restricted Stock Unit Award Agreement for Directors, was filed as Exhibit 10 to the Registrant's Quarterly Report on Form 10-Q for the period ended June 30, 2014.

* 10.19 Form of Non-Qualified Stock Option Award Agreement, was filed as Exhibit 10.14 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2008.

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	10.29	Five-Year Credit Agreement dated as of December 18, 2015 among PPG Industries, Inc.; the several banks and financial institutions party thereto; JPMorgan Chase Bank, N.A., as administrative agent; The Bank of Tokyo-Mitsubishi UFJ, Ltd., BNP Paribas, Citibank, N.A. and PNC Bank, National Association, as co-syndication agents; and J.P. Morgan Securities LLC, The Bank of Tokyo-Mitsubishi UFJ, Ltd., BNP Paribas Securities Corp., Citigroup Global Markets Inc., and PNC Capital Markets LLC, as co-lead arrangers and co-bookrunners, was filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed on December 22, 2015.
*	10.30	Employment arrangement with Jean-Marie Greindl, was filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q for the quarter ended March 31, 2016.
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* Management contracts, compensatory plans or arrangements required to be filed as an exhibit hereto pursuant to Item 601 of Regulation S-K.

** Attached as Exhibit 101 to this report are the following documents formatted in XBRL (Extensible Business Reporting Language) as of and for the year ended December 31, 2016: (i) the Consolidated Statement of Income, (ii) the Consolidated Balance Sheet, (iii) the Consolidated Statement of Shareholders' Equity, (iv) the Consolidated Statement of Comprehensive Income (Loss), (v) the Consolidated Statement of Cash Flows, (vi) Notes to Consolidated Financial Statements and (vii) Financial Schedule of Valuation and Qualifying Accounts.

Item 16. Form 10-K Summary

None.

Signatures

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized on February 16, 2017 .

PPG INDUSTRIES, INC.
(Registrant)

By /s/ Frank S. Sklarsky
Frank S. Sklarsky, *Executive Vice President and Chief Financial Officer*

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed by the following persons on behalf of the Registrant and in the capacities indicated on February 16, 2017 .

Signature	Capacity
/s/ Michael H. McGarry Michael H. McGarry	Director, Chairman and Chief Executive Officer
/s/ Frank S. Sklarsky Frank S. Sklarsky	Executive Vice President and Chief Financial Officer (Principal Financial and Accounting Officer)
S. F. Angel	Director
J. G. Berges	Director
J. V. Faraci	Director
H. Grant	Director
V. F. Haynes	Director
M. L. Healey	Director
M. J. Hooper	Director
M. W. Lamach	Director
M. H. Richenhagen	Director

By /s/ Frank S. Sklarsky
Frank S. Sklarsky, *Attorney-in-Fact*

PPG Industries Inc. and Consolidated Subsidiaries

Index to Exhibits

	2	Transaction Agreement by and among PPG Industries, Inc., PPG Industries Securities, LLC, PPG Luxembourg Finance S.àR.L., Group 26 Diversified Holdings Ireland, and Essilor International (Compagnie Generale D'Optique) S.A. was filed as Exhibit 2.1 to the Registrant's Quarterly Report on Form 10-Q for the period ended September 30, 2013.
	2.1	Stock Purchase Agreement, dated June 30, 2014, by and among Avisep, S.A. de C.V., Bevisep, S.A. de C.V., PPG Industries, Inc. and Consorcio Comex, S.A. de C.V., was filed as Exhibit 2 to the Registrant's Quarterly Report on Form 10-Q for the period ended June 30, 2014.
	2.2	Definitive Purchase Agreement, dated as of June 24, 2016, by and among Massachusetts Mutual Life Insurance Company, PPG Industries, Inc. and State Street Bank and Trust Company, as Independent Fiduciary of the PPG Industries, Inc. Pension Plans, was filed as Exhibit 2.1 to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016.
	2.3	Definitive Purchase Agreement, dated as of June 24, 2016, by and among Metropolitan Life Insurance Company, PPG Industries, Inc. and State Street Bank and Trust Company, as Independent Fiduciary of the PPG Industries, Inc. Pension Plans, was filed as Exhibit 2.2 to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016.
	3	Statement with Respect to Shares Eliminating the Series A Junior Participating Preferred Stock, was filed as Exhibit 3.1 to the Registrant's Quarterly Report on Form 10-Q for the period ended September 30, 2014.
	3.1	Restated Articles of Incorporation of PPG Industries, Inc., was filed as Exhibit 3.2 to the Registrant's Quarterly Report on Form 10-Q for the period ended September 30, 2014.
	3.2	Articles of Amendment to the Restated Articles of Incorporation of PPG Industries, Inc. effective June 12, 2015, was filed as Exhibit 3.1 to the Registrant's Current Report on Form 8-K filed on June 18, 2015.
	3.3	Amended and Restated Bylaws of PPG Industries, Inc., as amended on December 10, 2015, was filed as Exhibit 3.1 to the Registrant's Current Report on Form 8-K filed on December 15, 2015.
	4	Indenture, dated as of Aug. 1, 1982, was filed as Exhibit 4.1 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.
	4.1	First Supplemental Indenture, dated as of April 1, 1986, was filed as Exhibit 4.2 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.
	4.2	Second Supplemental Indenture, dated as of October 1, 1989, was filed as Exhibit 4.3 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.
	4.3	Third Supplemental Indenture, dated as of November 1, 1995, was filed as Exhibit 4.4 to the Registrant's Registration Statement on Form S-3 (No. 333-44397) dated January 16, 1998.
	4.4	Indenture, dated as of June 24, 2005, was filed as Exhibit 4.1 to the Registrant's Current Report on Form 8-K dated June 20, 2005.
	4.5	Indenture, dated as of March 18, 2008, was filed as Exhibit 4.1 to the Registrant's Current Report on Form 8-K filed on March 18, 2008.
	4.6	Supplemental Indenture, dated as of March 18, 2008, was filed as Exhibit 4.2 to the Registrant's Current Report on Form 8-K filed on March 18, 2008.
	4.7	Second Supplemental Indenture, dated as of November 12, 2010, was filed as Exhibit 4.3 to the Registrant's Current Report on Form 8-K filed on November 12, 2010.
	4.8	Third Supplemental Indenture, dated as of August 3, 2012, was filed as Exhibit 4.4 to the Registrant's Current Report on Form 8-K filed on August 3, 2012.
	4.9	Fourth Supplemental Indenture, dated as of November 12, 2014, between PPG Industries, Inc. and The Bank of New York Mellon Trust Company, was filed as Exhibit 4.2 to the Registrant's Current Report on Form 8-K filed on November 12, 2014.
	4.10	Fifth Supplemental Indenture, dated as of March 13, 2015, between PPG Industries, Inc. and The Bank of New York Mellon Trust Company, N.A., as trustee, was filed as Exhibit 4.3 to the Registrant's Current Report on Form 8-K filed on March 13, 2015.
	4.11	Sixth Supplemental Indenture, dated as of November 3, 2016, between PPG Industries, Inc. and The Bank of New York Mellon Trust Company, N.A., as trustee, was filed as Exhibit 4.3 to the Registrant's Current Report on Form 8-K filed on November 3, 2016.
*	10	PPG Industries, Inc. Nonqualified Retirement Plan, as amended and restated September 24, 2008, was filed as Exhibit 10 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2011.
*	10.1	Form of Change in Control Employment Agreement entered into with executives prior to January 1, 2008, as amended, was filed as Exhibit 10.2 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2007.

*	10.2	Form of Change in Control Employment Agreement entered into with executives on or after January 1, 2008 through December 31, 2009, was filed as Exhibit 10.24 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2007.
*	10.3	Form of Change in Control Employment Agreement entered into with executives on or after January 1, 2010, was filed as Exhibit 10.3 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2009.
*	10.4	Form of Change in Control Employment Agreement entered into with executives on or after June 30, 2012 was filed as Exhibit 10.4 to the Registrant's Annual Report on Form 10-K for the period ended December 31, 2012.
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Exhibit 12

PPG INDUSTRIES, INC. AND CONSOLIDATED SUBSIDIARIES
Computation of Ratio of Earnings to Fixed Charges
(Dollars in millions)

	Year ended December 31				
	2016	**2015**	**2014**	**2013**	**2012**
Earnings:					
Earnings before income taxes and net earnings in equity affiliates	$ 811	$ 1,766	$ 1,239	$ 1,207	$ 800
Plus:					
Fixed charges exclusive of capitalized interest	215	211	278	282	279
Amortization of capitalized interest	6	6	5	5	5
Adjustments for equity affiliates	7	77	5	9	12
Total	**$ 1,039**	**$ 2,060**	**$ 1,527**	**$ 1,503**	**$ 1,096**
Fixed Charges:					
Interest expense including amortization of debt discount/premium and debt expense	$ 125	$ 124	$ 186	$ 195	$ 209
Rentals - portion representative of interest	90	87	92	87	70
Fixed charges exclusive of capitalized interest	215	211	278	282	279
Capitalized interest	8	9	16	10	8
Total	**$ 223**	**$ 220**	**$ 294**	**$ 292**	**$ 287**
Ratio of earnings to fixed charges	**4.7**	**9.4**	**5.2**	**5.1**	**3.8**

Note: The financial information of all prior periods has been reclassified to reflect discontinued operations.

Exhibit 13.1

PPG INDUSTRIES, INC. AND CONSOLIDATED SUBSIDIARIES
Market Information, Dividends and Holders of Common Stock
For the Year Ended December 31, 2016

Market Information

Stock Exchange Listings

PPG common stock is traded on the New York Stock Exchange (symbol:PPG).

Quarterly Stock Market Price

	2016		2015 †	
Quarter Ended	**High**	**Low**	**High**	**Low**
March 31	$ 112.10	$ 88.37	$ 118.95	$ 109.91
June 30	117.00	98.08	117.48	110.33
September 30	110.14	99.78	118.27	84.40
December 31	104.08	89.64	106.87	82.93

Dividends

	2016		2015 †	
Month of Payment	**Amount (Millions)**	**Per Share**	**Amount (Millions)**	**Per Share**
March	$ 96	$ 0.36	$ 91	$ 0.33
June	107	0.40	98	0.36
September	106	0.40	97	0.36
December	105	0.40	97	0.36
Total	$ 414	$ 1.56	$ 383	$ 1.41

† On April 16, 2015, the PPG Board of Directors approved a 2-for-1 split of the company's common stock. PPG common stock began trading on a split-adjusted basis on June 15, 2015. All historical per share and share data give retroactive effect to the 2-for-1 stock split.

PPG has paid uninterrupted annual dividends since 1899. The latest quarterly dividend of 40 cents per share was approved by the board of directors on January 19, 2017, payable March 10, 2017 to shareholders of record February 17, 2017.

Holders of Common Stock

The number of holders of record of PPG common stock as of January 31, 2017 was 14,048 as shown on the records of the Company’s transfer agent.

Exhibit 13.2

PPG INDUSTRIES, INC. AND CONSOLIDATED SUBSIDIARIES
Selected Financial Data
(Millions, except per share amounts)

	Year Ended December 31				
	2016	**2015**	**2014**	**2013**	**2012**
Net Sales	$ 14,751	$ 14,766	$ 14,791	$ 13,736	$ 12,169
Amounts Attributable to PPG					
Continuing Operations	$ 564	$ 1,338	$ 1,085	$ 932	$ 649
Discontinued Operations	313	68	1,017	2,299	292
Net income (attributable to PPG)	$ 877	$ 1,406	$ 2,102	$ 3,231	$ 941
Earnings per common share:					
Continuing Operations	$ 2.12	$ 4.93	$ 3.92	$ 3.25	$ 2.12
Discontinued Operations	1.18	0.25	3.68	8.01	0.95
Net Income	$ 3.30	$ 5.18	$ 7.60	$ 11.26	$ 3.07
Earnings per common share - assuming dilution:					
Continuing Operations	$ 2.11	$ 4.89	$ 3.88	$ 3.22	$ 2.09
Discontinued Operations	1.17	0.25	3.64	7.92	0.94
Net Income	$ 3.28	$ 5.14	$ 7.52	$ 11.14	$ 3.03
Dividends per share	1.56	1.41	1.31	1.21	1.17
Total assets	15,769	17,076	17,535	15,804	15,811
Long-term debt	3,787	4,026	3,516	3,339	3,332

Note: The financial information of all prior periods has been reclassified to reflect discontinued operations and retroactive adoption of certain Accounting Standard Updates.

PPG Industries, Inc.
And Consolidated Subsidiaries

Subsidiaries of the Registrant
December 31, 2016

Significant subsidiaries included in the 2016 consolidated financial statements of the Company are:

	Jurisdiction of Incorporation or Organization	Percentage of Voting Power
United States:		
Cuming Microwave Corporation	Massachusetts	100
I.V.C. Industrial Coatings, Inc.	Indiana	100
MetoKote Corporation	Delaware	100
MetoKote Mexico Holdings, Inc.	Ohio	100
MK Holding Corporation	Delaware	100
Pinetree Stockholding Corporation	Delaware	100
PPG Architectural Finishes, Inc.	Delaware	100
PPG Holdings Argentina USA LLC	Delaware	100
PPG Holdings Latin America USA LLC	Delaware	100
PPG Industries Fiber Glass Products, Inc.	Delaware	100
PPG Industries International, Inc.	Delaware	100
PPG Industries Ohio, Inc.	Delaware	100
PPG Industries Securities, LLC	Delaware	100
PPG Kansai Automotive Finishes U.S., LLC	Delaware	60
PRC-DeSoto International, Inc.	California	100
Sierracin Corporation	Delaware	100
Sierracin/Sylmar Corporation	California	100
The Glidden Supply Company LLC	Delaware	100
Vanex, Inc.	Delaware	100
Other Americas:		
A P Resinas, S.A. de C.V.	Mexico	100
Alermac Inversiones, S.A. de C.V.	Mexico	100
Centro de Investigación en Polímeros, S.A. de C.V.	Mexico	100
Comercial Mexicana de Pinturas, S.A. de C.V.	Mexico	100
Comex Industrial Coatings, S.A. de C.V.	Mexico	100
Consorcio Comex, S.A. de C.V.	Mexico	100
Consorcio Latinoamericano, S.A.	Mexico	100
Distribuidora Kroma, S.A. de C.V.	Mexico	100
Empresa AGA, S.A. de C.V.	Mexico	100
Fábrica de Pinturas Universales, S.A. de C.V.	Mexico	100
Grupo Comex, S.A. de C.V.	Mexico	100
Kemzus, S.A. de C.V.	Mexico	100
MetoKote Canada Limited	Canada	100
MetoKote de Mexico, S. de R.L. de C.V.	Mexico	100
PPG ALESCO Automotive Finishes Mexico, S. de R.L. de C.V.	Mexico	60
PPG Architectural Coatings (Puerto Rico) Inc.	Puerto Rico	100
PPG Architectural Coatings Canada Inc.	Canada	100
PPG Canada Inc.	Canada	100
PPG Industrial do Brasil - Tintas E. Vernizes - Ltda.	Brazil	100
PPG Industries Argentina S.R.L.	Argentina	100

PPG Industries Chile S.A.	Chile	100
PPG Industries Colombia Ltda.	Colombia	100
PPG Industries de Mexico, S.A. de C.V.	Mexico	100
PPG Kansai Automotive Finishes Canada, LP	Canada	60
PPG Mexico, S.A. de C.V.	Mexico	100
Viasa, S.A. de C.V.	Mexico	100
EMEA:		
Brown Brothers Distribution Limited	United Kingdom	100
Dyrup A/S	Denmark	100
Dyrup SAS	France	100
EPIC Insurance Co. Ltd.	Bermuda	100
Group 26 Diversified Holdings Ireland Unlimited Company	Ireland	100
Johnstone's Paints Limited	United Kingdom	100
Kalon Investment Company Limited	United Kingdom	100
Kalon South Africa Proprietary Limited	South Africa	100
Malcolm Enamellers ACP Limited	United Kingdom	100
MetoKote Deutschland GmbH	Germany	100
MetoKote UK Limited	United Kingdom	100
Peintures de Paris SAS	France	99.94
PPG AC - France SA	France	99.94
PPG Architectural Coatings UK Limited	United Kingdom	100
PPG Cameroun SA	Cameroon	51.5
PPG CEE Premazi (d.o.o.)	Slovenia	100
PPG Coatings B.V.	The Netherlands	100
PPG Coatings BVBA/SPRL	Belgium	100
PPG Coatings Danmark AS	Denmark	100
PPG Coatings Deutschland GmbH	Germany	100
PPG Coatings Europe B.V.	The Netherlands	100
PPG Coatings Nederland BV	The Netherlands	100
PPG Coatings S.A.	France	99.9
PPG Coatings South Africa (Pty) Ltd.	South Africa	100
PPG Deco Czech a.s.	Czech Republic	100
PPG Deco Polska sp. z.o.o.	Poland	100
PPG Deco Slovakia, s.r.o.	Slovakia	100
PPG Deutschland Business Support GmbH	Germany	100
PPG Deutschland Sales & Services GmbH	Germany	100
PPG Distribution S.A.S.	France	99.94
PPG Europe B.V.	The Netherlands	100
PPG Finance B.V.	The Netherlands	100
PPG France Business Support S.A.S.	France	100
PPG France Manufacturing S.A.S.	France	100
PPG Guadeloupe SAS	Guadeloupe	100
PPG Holdco SAS	France	100
PPG Holdings (U.K.) Limited	United Kingdom	100
PPG Ibérica, S.A.	Spain	100
PPG Ibérica Sales & Services, S.L.	Spain	100
PPG Industrial Coatings B.V.	The Netherlands	100
PPG Industries (UK) Ltd	United Kingdom	100
PPG Industries Chemicals B.V.	The Netherlands	100

PPG Industries Europe Sàrl	Switzerland	100
PPG Industries France S.A.S.	France	100
PPG Industries Italia S.r.l.	Italy	100
PPG Industries Kimya a Sanayi VE Ticaret AS	Turkey	100
PPG Industries Lackfabrik GmbH	Germany	100
PPG Industries Lipetsk LLC	Russia	100
PPG Industries LLC	Russia	100
PPG Industries Middle East FZE	U.A.E	100
PPG Industries Netherlands B.V.	The Netherlands	100
PPG Industries Poland Sp. Z.o.o.	Poland	100
PPG Italia Sales & Services S.r.l.	Italy	100
PPG Luxembourg Finance S.àR.L.	Luxembourg	100
PPG Luxembourg Holdings S.àR.L.	Luxembourg	100
PPG Polifarb Cieszyn S.A.	Poland	100
PPG Retail France SAS	France	99.94
PPG Réunion SAS	La Reunion	51
PPG Service Sud S.r.l.	Italy	100
PPG Switzerland GmbH	Switzerland	100
PPG Trilak Kft.	Hungary	100
PPG Univer S.P.A.	Italy	100
Prominent Paints Proprietary Limited	South Africa	100
Revocoat France SAS	France	100
Revocoat Holding SAS	France	100
Revocoat Iberica SLU	Spain	100
Schoch Holding AG	Switzerland	100
Sealants Europe SAS	France	66
Sigma Marine & Protective Coatings Holding B.V.	The Netherlands	100
SigmaKalon (BC) UK Limited	United Kingdom	100
SigmaKalon UK Holding Limited	United Kingdom	100
Tintas DYRUP, S.A.	Portugal	100
Asia:		
Foshan Bairun Chemicals Co., Ltd.	China	100
PPG Aerospace Materials (Suzhou) Co. Ltd.	China	100
PPG Asian Paints Private Ltd.	India	50
PPG Coatings (Hong Kong) Co., Limited	Hong Kong	100
PPG Coatings (Kunshan) Co., Ltd.	China	100
PPG Coatings (Malaysia) Sdn. Bhd.	Malaysia	100
PPG Coatings (Shanghai) Co., Ltd.	China	100
PPG Coatings (Suzhou) Company Ltd.	China	100
PPG Coatings (Thailand) Co., Ltd.	Thailand	100
PPG Coatings (Tianjin) Co., Ltd.	China	100
PPG Coatings (Wuhu) Company, Ltd.	China	100
PPG Coatings (Zhangjiagang) Co., Ltd.	China	100
PPG COATINGS SINGAPORE PTE. LTD.	Singapore	100
PPG Industries (Korea) Ltd.	South Korea	100
PPG Industries (Singapore) Pte., Ltd.	Singapore	100
PPG Industries Australia PTY Limited A.C.N. 055 500 939	Australia	100
PPG Industries New Zealand Limited	New Zealand	100
PPG Japan Ltd.	Japan	100

PPG Management (Shanghai) Co., Ltd.	China	100
PPG Packaging Coatings (Suzhou) Co., Ltd.	China	100
PPG Paints Trading (Shanghai) Co., Ltd.	China	100
PPG Performance Coatings (Hong Kong) Limited	Hong Kong	100
PPG Performance Coatings (Malaysia) Sdn. Bhd.	Malaysia	100
PPG SSC Co., Ltd.	South Korea	80.01
PRC-Desoto Australia Pty Ltd.	Australia	100
Protec Pty Ltd. A.C.N. 007 857 392	Australia	100
PT. PPG Coatings Indonesia	Indonesia	100
Spraylat Coatings (Shanghai) Limited	China	100

Exhibit 23

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statement on Form S-3 No. 333-190216 and Registration Statements on Form S-8 Nos. 33-64077, 333-140559, 333-140561, 333-140562, 333-173656, 333-173657, 333-173658, 333-176852, 333-192988, and 333-212813 of PPG Industries, Inc. of our report dated February 16, 2017 relating to the financial statements, financial statement schedule and the effectiveness of internal control over financial reporting, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP

Pittsburgh, Pennsylvania
February 16, 2017

Exhibit 24

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Stephen F. Angel, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2017.

/s/ STEPHEN F. ANGEL

Stephen F. Angel

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, James G. Berges, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ JAMES G. BERGES

James G. Berges

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, John V. Faraci, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ JOHN V. FARACI

John V. Faraci

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Hugh Grant, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ HUGH GRANT

Hugh Grant

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Victoria F. Haynes, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ VICTORIA F. HAYNES

Victoria F. Haynes

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Melanie L. Healey, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ MELANIE L. HEALEY

Melanie L. Healey

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Michele J. Hooper, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ MICHELE J. HOOPER

Michele J. Hooper

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Michael W. Lamach, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ MICHAEL W. LAMACH

Michael W. Lamach

PPG INDUSTRIES, INC.

POWER OF ATTORNEY

(10-K)

I, Martin H. Richenhagen, a Director of PPG Industries, Inc. (the "Corporation"), a Pennsylvania corporation, hereby constitute and appoint Michael H. McGarry, Glenn E. Bost II and Frank S. Sklarsky, or any of them, my true and lawful attorneys or attorneys-in-fact, with full power of substitution and revocation, to sign, in my name and on my behalf as a Director of the Corporation, the Corporation's Form 10-K for the fiscal year ended December 31, 2016 , to be filed with the Securities and Exchange Commission, Washington, DC.

WITNESS my hand this 16th day of February, 2016.

/s/ MARTIN H. RICHENHAGEN

Martin H. Richenhagen

Exhibit 31.1

PRINCIPAL EXECUTIVE OFFICER CERTIFICATION

I, Michael H. McGarry, certify that:

1. I have reviewed this annual report on Form 10-K of PPG Industries, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
    (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
    (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
    (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
    (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
    (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
    (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

/s/ Michael H. McGarry

Michael H. McGarry

Chairman and Chief Executive Officer

February 16, 2017

Exhibit 31.2

PRINCIPAL FINANCIAL OFFICER CERTIFICATION

I, Frank S. Sklarsky, certify that:

1. I have reviewed this annual report on Form 10-K of PPG Industries, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
    (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
    (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
    (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
    (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
    (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
    (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

/s/ Frank S. Sklarsky

Frank S. Sklarsky

Executive Vice President and Chief Financial Officer

(Principal Financial and Accounting Officer)

February 16, 2017

Exhibit 32.1

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the annual report on Form 10-K of PPG Industries, Inc. for the period ended December 31, 2016 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Michael H. McGarry, Chairman and Chief Executive Officer of PPG Industries, Inc., certify to the best of my knowledge, pursuant to 18 U.S.C. §1350, as adopted pursuant to §906 of the Sarbanes-Oxley Act of 2002, that:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of PPG Industries, Inc.

/s/ Michael H. McGarry

Michael H. McGarry

Chairman and Chief Executive Officer

February 16, 2017

Exhibit 32.2

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the annual report on Form 10-K of PPG Industries, Inc. for the period ended December 31, 2016 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Frank S. Sklarsky, Executive Vice President and Chief Financial Officer of PPG Industries, Inc., certify to the best of my knowledge, pursuant to 18 U.S.C. §1350, as adopted pursuant to §906 of the Sarbanes-Oxley Act of 2002, that:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of PPG Industries, Inc.

/s/ Frank S. Sklarsky

Frank S. Sklarsky

Executive Vice President and Chief Financial Officer

(Principal Financial and Accounting Officer)

February 16, 2017