UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K/A

Amendment No. 1

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2018

or

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission file number 001-12019

QUAKER CHEMICAL CORPORATION
(Exact name of Registrant as specified in its charter)

A Pennsylvania Corporation **(State or other jurisdiction of incorporation or organization)**	**No. 23-0993790** **(I.R.S. Employer Identification No.)**
One Quaker Park, 901 E. Hector Street, **Conshohocken, Pennsylvania** **(Address of principal executive offices)**	**19428-2380** **(Zip Code)**

Registrant's telephone number, including area code: (610) 832-4000

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

Title of each class	Trading Symbol(s)	Name of each Exchange on which registered
Common Stock, $1.00 par value	**KWR**	**New York Stock Exchange**

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

None

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

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

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

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

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

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

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

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

State the aggregate market value of the voting and non-voting common equity held by non-affiliates of the Registrant. (The aggregate market value is computed by reference to the last reported sale on the New York Stock Exchange on June 30, 2018): $2,037,718,906

Indicate the number of shares outstanding of each of the Registrant’s classes of common stock as of the latest practicable date: 13,337,601 shares of Common Stock, $1.00 Par Value, as of January 31, 2019.

DOCUMENTS INCORPORATED BY REFERENCE

None

EXPLANATORY NOTE

This Amendment No. 1 on Form 10-K/A (this "Amended Filing") amends our original Annual Report on Form 10-K for the year ended December 31, 2018 filed with the U.S. Securities and Exchange Commission (the "SEC") on February 28, 2019 (the "Original Filing"). However, this amendment does not change our consolidated financial statements as set forth in the Original Filing.

The purpose of this Amended Filing is to (i) revise the "Report of Independent Registered Certified Public Accounting Firm" of PricewaterhouseCoopers LLP appearing in the Index to Consolidated Financial Statements regarding the effectiveness of our internal control over financial reporting and (ii) revise the disclosure on our internal control over financial reporting in Part II, Item 9A to reflect management's conclusion that our disclosure controls and procedures were not effective at December 31, 2018 due to a material weakness in our internal control over financial reporting identified subsequent to the issuance of our Original Filing. This material weakness did not result in any change to our consolidated financial statements as set forth in the Original Filing. Part IV, Item 15, "Exhibits and Financial Statement Schedules," also has been amended to include currently dated certifications from the Company's Chief Executive Officer and Chief Financial Officer as required by sections 302 and 906 of the Sarbanes Oxley Act of 2002. The certifications are attached to this Amended Filing as Exhibits 31.1, 31.2, 32.1 and 32.2.

Other than the inclusion within this Amended Filing of new certifications by management and a new consent of our independent registered certified public accounting firm (and related amendment to the exhibit index that is incorporated by reference into Item 15 of the Original Filing to reflect the addition of such certifications and consent and related changes to the footnotes to that exhibit index), this Amended Filing speaks only as of the date of the Original Filing and does not modify or update any other disclosures contained in our Original Filing. Specifically, there are no changes to our consolidated financial statements set forth in the Original Filing. This Amended Filing should be read in conjunction with the Original Filing and reports filed with the SEC subsequent to the Original Filing.

QUAKER CHEMICAL CORPORATION
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PART II

Item 8. ***Financial Statements and Supplementary Data.***

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Report of Independent Registered Public Accounting Firm

To the Shareholders and Board of Directors of Quaker Chemical Corporation

Opinions on the Financial Statements and Internal Control over Financial Reporting

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

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017**,** and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2018 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company did not maintain, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO because a material weakness in internal control over financial reporting existed as of that date related to the design and maintenance of controls over certain aspects of the Company's information technology.

A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the annual or interim financial statements will not be prevented or detected on a timely basis. The material weakness referred to above is described in Management's Report on Internal Control over Financial Reporting appearing under Item 9A. We considered this material weakness in determining the nature, timing, and extent of audit tests applied in our audit of the 2018 consolidated financial statements, and our opinion regarding the effectiveness of the Company's internal control over financial reporting does not affect our opinion on those consolidated financial statements.

Restatement of Management's Conclusion Regarding Internal Control over Financial Reporting

Management and we previously concluded that the Company maintained effective internal control over financial reporting as of December 31, 2018. However, management has subsequently determined that a material weakness in internal control over financial reporting related to certain aspects of its controls over information technology existed as of that date. Accordingly, management's report has been restated and our present opinion on internal control over financial reporting, as presented herein, is different from that expressed in our previous report.

Basis for Opinions

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

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

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

Definition and Limitations of Internal Control over Financial Reporting

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

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

/s/ PricewaterhouseCoopers LLP

Philadelphia, Pennsylvania

February 28, 2019, except with respect to our opinion on internal control over financial reporting insofar as it relates to the effects of the matter described in the penultimate paragraph of Management's Report on Internal Control over Financial Reporting, as to which the date is July 24, 2019

We have served as the Company's auditor since at least 1972. We have not been able to determine the specific year we began serving as auditor of the Company.

QUAKER CHEMICAL CORPORATION
CONSOLIDATED STATEMENTS OF INCOME
(Dollars in thousands, except per share data)

	Year Ended December 31,		
	2018	**2017**	**2016**
Net sales	$ 867,520	$ 820,082	$ 746,665
Costs and expenses			
Cost of goods sold	555,206	528,587	466,555
Selling, general and administrative expenses	207,872	198,813	193,665
Restructuring and related activities	—	—	(439)
Combination-related expenses	16,661	29,938	1,531
	779,739	757,338	661,312
Operating income	87,781	62,744	85,353
Other expense, net	(642)	(718)	(492)
Interest expense	(6,158)	(3,892)	(2,889)
Interest income	2,117	2,534	2,037
Income before taxes and equity in net income of associated companies	83,098	60,668	84,009
Taxes on income before equity in net income of associated companies	25,050	41,653	23,226
Income before equity in net income of associated companies	58,048	19,015	60,783
Equity in net income of associated companies	1,763	3,285	2,256
Net income	59,811	22,300	63,039
Less: Net income attributable to noncontrolling interest	338	2,022	1,636
Net income attributable to Quaker Chemical Corporation	$ 59,473	$ 20,278	$ 61,403
Earnings per common share data:			
Net income attributable to Quaker Chemical Corporation Common Shareholders – basic	$ 4.46	$ 1.53	$ 4.64
Net income attributable to Quaker Chemical Corporation Common Shareholders – diluted	$ 4.45	$ 1.52	$ 4.63

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

QUAKER CHEMICAL CORPORATION
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME
(Dollars in thousands)

	Year Ended December 31,		
	2018	**2017**	**2016**
Net income	$ 59,811	$ 22,300	$ 63,039
Other comprehensive (loss) gain, net of tax			
Currency translation adjustments	(17,519)	21,076	(13,772)
Defined benefit retirement plans			
Net gain (loss) arising during the period, other	1,119	(96)	(2,990)
Amortization of actuarial loss	2,507	2,255	2,155
Amortization of prior service gain	(84)	(84)	(82)
Unrealized (loss) gain on available-for-sale securities	(1,728)	(130)	537
Other comprehensive (loss) gain	(15,705)	23,021	(14,152)
Comprehensive income	44,106	45,321	48,887
Less: Comprehensive income attributable to noncontrolling interest	(248)	(2,736)	(1,575)
Comprehensive income attributable to Quaker Chemical Corporation	$ 43,858	$ 42,585	$ 47,312

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

QUAKER CHEMICAL CORPORATION
CONSOLIDATED BALANCE SHEETS
(Dollars in thousands, except par value and share amounts)

	December 31,	
	2018	**2017**
ASSETS		
Current assets		
Cash and cash equivalents	$ 104,147	$ 89,879
Accounts receivable, net	202,139	208,358
Inventories, net	94,090	87,221
Prepaid expenses and other current assets	18,134	21,128
Total current assets	418,510	406,586
Property, plant and equipment, net	83,923	86,704
Goodwill	83,333	86,034
Other intangible assets, net	63,582	71,603
Investments in associated companies	21,316	25,690
Non-current deferred tax assets	6,946	15,460
Other assets	32,055	30,049
Total assets	$ 709,665	$ 722,126
LIABILITIES AND EQUITY		
Current liabilities		
Short-term borrowings and current portion of long-term debt	$ 670	$ 5,736
Accounts payable	87,819	93,008
Dividends payable	4,935	4,724
Accrued compensation	25,727	22,846
Accrued pension and postretirement benefits	1,211	1,108
Other current liabilities	31,108	27,321
Total current liabilities	151,470	154,743
Long-term debt	35,934	61,068
Non-current deferred tax liabilities	10,003	9,653
Non-current accrued pension and postretirement benefits	32,360	35,548
Other non-current liabilities	43,529	51,496
Total liabilities	273,296	312,508
Commitments and contingencies (Note 25)		
Equity		
Common stock $1 par value; authorized 30,000,000 shares; issued and outstanding 2018 – 13,338,026 shares; 2017 – 13,307,976 shares	13,338	13,308
Capital in excess of par value	97,304	93,528
Retained earnings	405,125	365,936
Accumulated other comprehensive loss	(80,715)	(65,100)
Total Quaker shareholders' equity	435,052	407,672
Noncontrolling interest	1,317	1,946
Total equity	436,369	409,618
Total liabilities and equity	$ 709,665	$ 722,126

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

QUAKER CHEMICAL CORPORATION
CONSOLIDATED STATEMENTS OF CASH FLOWS
(Dollars in thousands)

	Year Ended December 31,		
	2018	**2017**	**2016**
Cash flows from operating activities			
Net income	$ 59,811	$ 22,300	$ 63,039
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation	12,373	12,598	12,557
Amortization	7,341	7,368	7,009
Equity in undistributed earnings of associated companies, net of dividends	2,784	(2,895)	(1,969)
Deferred income taxes	8,197	3,754	5,488
Uncertain tax positions (non-deferred portion)	(89)	(817)	(3,206)
Non-current income taxes payable	(8,181)	15,825	—
Deferred compensation and other, net	2,984	1,074	(424)
Share-based compensation	3,724	4,190	6,349
Restructuring and related activities	—	—	(439)
(Gain) loss on disposal of property, plant and equipment and other assets	(657)	79	(18)
Insurance settlement realized	(1,055)	(762)	(1,023)
Combination-related expenses, net of payments	2,727	4,952	503
Pension and other postretirement benefits	(1,392)	(123)	(3,420)
(Decrease) increase in cash from changes in current assets and current liabilities, net of acquisitions:			
Accounts receivable	(2,822)	(1,941)	(11,705)
Inventories	(10,548)	(6,135)	(1,870)
Prepaid expenses and other current assets	(1,540)	(2,932)	(703)
Accounts payable and accrued liabilities	190	12,381	14,063
Restructuring liabilities	—	(675)	(5,252)
Estimated taxes on income	4,932	(3,479)	(5,226)
Net cash provided by operating activities	78,779	64,762	73,753
Cash flows from investing activities			
Investments in property, plant and equipment	(12,886)	(10,872)	(9,954)
Payments related to acquisitions, net of cash acquired	(500)	(5,363)	(15,024)
Proceeds from disposition of assets	866	1,577	186
Insurance settlement interest earned	162	50	32
Net cash used in investing activities	(12,358)	(14,608)	(24,760)
Cash flows from financing activities			
Repayments of long-term debt	(26,791)	(2,853)	(14,513)
Dividends paid	(19,319)	(18,613)	(17,625)
Stock options exercised, other	82	(1,956)	(811)
Payments for repurchase of common stock	—	—	(5,859)
Excess tax benefit related to stock option exercises	—	—	678
Purchase of noncontrolling interest in affiliates, net	—	(31,787)	—
Distributions to noncontrolling affiliate shareholders	(877)	—	—
Net cash used in financing activities	(46,905)	(55,209)	(38,130)
Effect of foreign exchange rate changes on cash	(6,141)	5,404	(4,089)
Net increase in cash, cash equivalents and restricted cash	13,375	349	6,774
Cash, cash equivalents and restricted cash at the beginning of the period	111,050	110,701	103,927
Cash, cash equivalents and restricted cash at the end of the period	$ 124,425	$ 111,050	$ 110,701
Supplemental cash flow disclosures:			
Cash paid during the year for:			
Income taxes	$ 19,617	$ 21,544	$ 25,043
Interest	2,417	2,767	2,481
Non-cash activities:			
Change in accrued purchases of property, plant and equipment, net	$ 281	$ (240)	$ 363

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

QUAKER CHEMICAL CORPORATION
CONSOLIDATED STATEMENTS OF CHANGES IN EQUITY
(Dollars in thousands, except per share amounts)

	Common stock	Capital in excess of par value	Retained earnings	Accumulated other comprehensive loss	Noncontrolling interest	Total
Balance as of December 31, 2015	13,288	106,333	326,740	(73,316)	8,198	381,243
Net income	—	—	61,403	—	1,636	63,039
Amounts reported in other comprehensive loss	—	—	—	(14,091)	(61)	(14,152)
Repurchases of common stock	(84)	—	(5,775)	—	—	(5,859)
Dividends ($1.355 per share)	—	—	(17,954)	—	—	(17,954)
Acquisition of noncontrolling interest	—	—	—	—	73	73
Shares issued upon exercise of stock options and other	11	(1,313)	—	—	—	(1,302)
Shares issued for employee stock purchase plan	6	485	—	—	—	491
Equity based compensation plans	57	6,292	—	—	—	6,349
Excess tax benefit from stock option exercises	—	678	—	—	—	678
Balance as of December 31, 2016	13,278	112,475	364,414	(87,407)	9,846	412,606
Net income	—	—	20,278	—	2,022	22,300
Amounts reported in other comprehensive loss	—	—	—	22,307	714	23,021
Dividends ($1.41 per share)	—	—	(18,756)	—	—	(18,756)
Acquisition of noncontrolling interest	—	(21,151)	—	—	(10,636)	(31,787)
Shares issued upon exercise of stock options and other	5	(2,456)	—	—	—	(2,451)
Shares issued for employee stock purchase plan	4	491	—	—	—	495
Equity based compensation plans	21	4,169	—	—	—	4,190
Balance as of December 31, 2017	$ 13,308	$ 93,528	$ 365,936	$ (65,100)	$ 1,946	$ 409,618
Cumulative effect of an accounting change	—	—	(754)	—	—	(754)
Balance as of January 1, 2018	$ 13,308	$ 93,528	$ 365,182	$ (65,100)	$ 1,946	$ 408,864
Net income	—	—	59,473	—	338	59,811
Amounts reported in other comprehensive loss	—	—	—	(15,615)	(90)	(15,705)
Dividends ($1.465 per share)	—	—	(19,530)	—	—	(19,530)
Distributions to noncontrolling affiliate shareholders	—	—	—	—	(877)	(877)
Shares issued upon exercise of stock options and other	9	(432)	—	—	—	(423)
Shares issued for employee stock purchase plan	3	502	—	—	—	505
Equity based compensation plans	18	3,706	—	—	—	3,724
Balance as of December 31, 2018	$ 13,338	$ 97,304	$ 405,125	$ (80,715)	$ 1,317	$ 436,369

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

Note 1 – Significant Accounting Policies

Principles of consolidation: All majority-owned subsidiaries are included in the Company's consolidated financial statements, with appropriate elimination of intercompany balances and transactions. Investments in associated companies (less than majority-owned and in which the Company has significant influence) are accounted for under the equity method. The Company's share of net income or losses in these investments in associated companies is included in the Consolidated Statements of Income. The Company periodically reviews these investments for impairments and, if necessary, would adjust these investments to their fair value when a decline in market value or other impairment indicators are deemed to be other than temporary. See Note 16 of Notes to Consolidated Financial Statements. The Company is not the primary beneficiary of any variable interest entities ("VIEs") and therefore the Company's consolidated financial statements do not include the accounts of any VIEs.

Translation of foreign currency: Assets and liabilities of non-U.S. subsidiaries and associated companies are translated into U.S. dollars at the respective rates of exchange prevailing at the end of the year. Income and expense accounts are translated at average exchange rates prevailing during the year. Translation adjustments resulting from this process are recorded directly in equity as accumulated other comprehensive (loss) income ("AOCI") and will be included as income or expense only upon sale or liquidation of the underlying entity or asset. Generally, all of the Company's non-U.S. subsidiaries use their local currency as their functional currency.

Cash and cash equivalents: The Company invests temporary and excess funds in money market securities and financial instruments having maturities within 90 days. The Company considers all highly liquid investments with original maturities of three months or less to be cash equivalents. The Company has not experienced losses from the aforementioned investments.

Inventories: Inventories are valued at the lower of cost or net realizable value, and are valued using the first-in, first-out method. See Note 13 of Notes to Consolidated Financial Statements.

Long-lived assets: Property, plant and equipment are stated at cost. Depreciation is computed using the straight-line method on an individual asset basis over the following estimated useful lives: buildings and improvements, 10 to 45 years; and machinery and equipment, 1 to 15 years. The carrying values of long-lived assets are evaluated whenever changes in circumstances or current events indicate the carrying amount of such assets may not be recoverable. An estimate of undiscounted cash flows produced by the asset, or the appropriate group of assets, is compared with the carrying value to determine whether an impairment exists. If necessary, the Company recognizes an impairment loss for the difference between the carrying amount of the assets and their estimated fair value. Fair value is based on current and anticipated future cash flows. Upon sale or other dispositions of long-lived assets, the applicable amounts of asset cost and accumulated depreciation are removed from the accounts and the net amount, less proceeds from disposals, is recorded in the Consolidated Statements of Income. Expenditures for renewals or improvements that increase the estimated useful life or capacity of the assets are capitalized, whereas expenditures for repairs and maintenance are expensed when incurred. See Notes 8 and 14 of Notes to Consolidated Financial Statements.

Capitalized software: The Company capitalizes certain costs in connection with developing or obtaining software for internal use, depending on the associated project. These costs are amortized over a period of 3 to 5 years once the assets are ready for their intended use. In connection with the implementations and upgrades to the Company's global transaction, consolidation and other related systems, approximately $1.1 million and $1.3 million of net costs were capitalized in property, plant and equipment on the Company's December 31, 2018 and 2017 Consolidated Balance Sheets, respectively.

Goodwill and other intangible assets: The Company records goodwill, definite-lived intangible assets and indefinite-lived intangible assets at fair value at the date of acquisition. Goodwill and indefinite-lived intangible assets are not amortized but tested for impairment at least annually. These tests will be performed more frequently if triggering events indicate potential impairment. Definite-lived intangible assets are amortized over their estimated useful lives, generally for periods ranging from 4 to 20 years. The Company continually evaluates the reasonableness of the useful lives of these assets, consistent with the discussion of long-lived assets, above. See Note 15 of Notes to Consolidated Financial Statements.

Revenue recognition: During the first quarter of 2018, the Company adopted the provisions of the Financial Accounting Standards Board's ("FASB's") revenue recognition guidance which required the Company to recognize revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the Company expects to be entitled in exchange for those goods or services. To do this, the Company applies the five-step model in the FASB's guidance, which requires the Company to: (i) identify the contract with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when, or as, the Company satisfies a performance obligation. The Company adopted the new revenue recognition guidance electing to use a modified retrospective adoption approach applied to those contracts which were not completed as of January 1, 2018. Therefore, comparative information has not been restated and continues to be accounted for and reported under the historical revenue recognition accounting standards in effect for those periods. Prior to this adoption, the Company recognized revenue in accordance with the terms of the underlying agreements, when title and risk of loss had been transferred, when collectability was reasonably assured, and when pricing was fixed or determinable. This generally occurred when products were shipped or delivered to customers or, for consignment-type arrangements, upon usage by the customer and when services were performed. See Notes 3 and 4 of Notes to Consolidated Financial Statements.

Accounts receivable and allowance for doubtful accounts: Trade accounts receivable subject the Company to credit risk. Trade accounts receivable are recorded at the invoiced amount and generally do not bear interest. The allowance for doubtful accounts is the Company's best estimate of the amount of probable credit losses with its existing accounts receivable. Reserves for customers filing for bankruptcy protection are established based on a percentage of the amount outstanding at the bankruptcy filing date. However, initially establishing a reserve and the amount thereto is dependent on the Company's evaluation of likely proceeds to be received from the bankruptcy process, which could result in the Company recognizing minimal or no reserve at the date of bankruptcy. Large and/or financially distressed customers are generally reserved for on a specific review basis while a general reserve is established for other customers based on historical experience. The Company performs a formal review of its allowance for doubtful accounts quarterly. Account balances are charged off against the allowance when the Company deems it is probable the receivable will not be recovered. The Company does not have any off-balance-sheet credit exposure related to its customers. See Notes 4 and 12 of Notes to Consolidated Financial Statements.

Research and development costs: Research and development costs are expensed as incurred and are included in selling, general and administrative expenses ("SG&A"). Research and development expenses were $24.5 million, $23.9 million and $22.5 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Environmental liabilities and expenditures: Accruals for environmental matters are recorded when it is probable that a liability has been incurred and the amount of the liability can be reasonably estimated. If there is a range of estimated liability and no amount in that range is considered more probable than another, then the Company records the lowest amount in the range in accordance with generally accepted accounting principles in the United States ("U.S. GAAP"). Accrued liabilities are exclusive of claims against third parties and are not discounted. Environmental costs and remediation costs are capitalized if the costs extend the life, increase the capacity or improve safety or efficiency of the property from the date acquired or constructed, and/or mitigate or prevent contamination in the future. See Note 25 of Notes to Consolidated Financial Statements.

Asset retirement obligations: The Company follows the FASB's guidance regarding asset retirement obligations, which addresses the accounting and reporting for obligations associated with the retirement of tangible long-lived assets and the associated retirement costs. Also, the Company follows the FASB's guidance for conditional asset retirement obligations ("CARO"), which relates to legal obligations to perform an asset retirement activity in which the timing and (or) method of settlement are conditional on a future event that may or may not be within the control of the entity. In accordance with this guidance, the Company records a liability when there is enough information regarding the timing of the CARO to perform a probability-weighted discounted cash flow analysis. As of December 31, 2018 and 2017, the Company had limited exposure to such obligations and had immaterial liabilities recorded for such on its Consolidated Balance Sheets.

Pension and other postretirement benefits: The Company maintains various noncontributory retirement plans, the largest of which is in the U.S., covering a portion of its employees in the U.S. and certain other countries. The plans of the Company's subsidiaries in the Netherlands, the United Kingdom, Mexico and Sweden are subject to the provisions of FASB's guidance regarding employers' accounting for defined benefit pension plans. The plans of the remaining non-U.S. subsidiaries are, for the most part, either fully insured or integrated with the local governments' plans and are not subject to the provisions of the guidance. The guidance requires that employers recognize on a prospective basis the funded status of their defined benefit pension and other postretirement plans on their consolidated balance sheet and, also, recognize as a component of AOCI, net of tax, the gains or losses and prior service costs or credits that arise during the period but are not recognized as components of net periodic benefit cost. In addition, the guidance requires that an employer recognize a settlement charge in their consolidated statement of income when certain events occur, including plan termination or the settlement of certain plan liabilities. A settlement charge represents the immediate recognition into expense of a portion of the unrecognized loss within AOCI on the balance sheet in proportion to the share of the projected benefit obligation that was settled. The Company's U.S. pension plan year ends on November 30 and the measurement date is December 31. The measurement date for the Company's other postretirement benefits plan is December 31.

The Company's global pension investment policies are designed to ensure that pension assets are invested in a manner consistent with meeting the future benefit obligations of the pension plans and maintaining compliance with various laws and regulations including the Employee Retirement Income Security Act of 1974. The Company establishes strategic asset allocation percentage targets and appropriate benchmarks for significant asset classes with the aim of achieving a prudent balance between return and risk.

The Company's investment horizon is generally long term, and, accordingly, the target asset allocations encompass a long-term perspective of capital markets, expected risk and return and perceived future economic conditions while also considering the profile of plan liabilities. To the extent feasible, the short-term investment portfolio is managed to immunize the short-term obligations, the intermediate portfolio duration is immunized to reduce the risk of volatility in intermediate plan distributions, and the total return portfolio is expected to maximize the long-term real growth of plan assets. The critical investment principles of diversification, assessment of risk and targeting the optimal expected returns for given levels of risk are applied. The Company's investment guidelines prohibit the use of securities such as letter stock and other unregistered securities, commodities or commodity contracts, short sales, margin transactions, private placements (unless specifically addressed by addendum), or any derivatives, options or futures for the purpose of portfolio leveraging.

The target asset allocation is reviewed periodically and is determined based on a long-term projection of capital market outcomes, inflation rates, fixed income yields, returns, volatilities and correlation relationships. The interaction between plan assets and benefit obligations is periodically studied to assist in establishing such strategic asset allocation targets. Asset performance is monitored with an overall expectation that plan assets will meet or exceed benchmark performance over rolling five-year periods. The Company's pension committee, as authorized by the Company's Board of Directors, has discretion to manage the assets within established asset allocation ranges approved by senior management of the Company. As of December 31, 2018, the plan's investments were in compliance with all approved ranges of asset allocations. See Note 20 of Notes to Consolidated Financial Statements.

Comprehensive income (loss): The Company presents other comprehensive income (loss) in its Statements of Comprehensive Income. The Company follows the FASB's guidance regarding the disclosure of reclassifications from AOCI which requires the disclosure of significant amounts reclassified from each component of AOCI, the related tax amounts and the income statement line items affected by such reclassifications. See Note 22 of Notes to Consolidated Financial Statements.

Income taxes and uncertain tax positions: The provision for income taxes is determined using the asset and liability approach of accounting for income taxes. Under this approach, deferred taxes represent the future tax consequences expected to occur when the reported amounts of assets and liabilities are recovered or paid. The provision for income taxes represents income taxes paid or payable for the current year and the change in deferred taxes during the year. Deferred taxes result from differences between the financial and tax bases of the Company's assets and liabilities and are adjusted for changes in tax rates and tax laws when changes are enacted. Valuation allowances are recorded to reduce deferred tax assets when it is more likely than not that a tax benefit will not be realized. The FASB's guidance regarding accounting for uncertainty in income taxes prescribes the recognition threshold and measurement attributes for financial statement recognition and measurement of tax positions taken or expected to be taken on a tax return. The guidance further requires the determination of whether the benefits of tax positions are probable or more likely than not sustained upon audit based upon the technical merits of the tax position. For tax positions that are determined to be more likely than not sustained upon audit, a company recognizes the largest amount of benefit that is greater than 50% likely of being realized upon ultimate settlement in the financial statements. For tax positions that are not determined to be more likely than not sustained upon audit, a company does not recognize any portion of the benefit in the financial statements. Additionally, the Company monitors and adjusts for derecognition, classification, and penalties and interest in interim periods, with appropriate disclosure and transition thereto. Also, the amount of interest expense and income related to uncertain tax positions is computed by applying the applicable statutory rate of interest to the difference between the tax position recognized, including timing differences, and the amount previously taken or expected to be taken in a tax return. The Company's continuing practice is to recognize interest and/or penalties related to income tax matters in income tax expense. Finally, when applicable, the Company nets its liability for unrecognized tax benefits against deferred tax assets related to net operating losses or other tax credit carryforwards that would apply if the uncertain tax position were settled for the presumed amount at the balance sheet date.

Pursuant to the Tax Cuts and Jobs Act ("U.S. Tax Reform"), specifically the one-time tax on deemed repatriation (the "Transition Tax"), the Company has provided for U.S. income tax on its undistributed earnings of non-U.S. subsidiaries, however, the Company is subject to and will incur other taxes, such as withholding taxes and dividend distribution taxes, if these undistributed earnings were ultimately remitted to the U.S. It is the Company's current intention to reinvest its future undistributed earnings of non-U.S. subsidiaries to support working capital needs and certain other growth initiatives. However, in certain cases the Company has and may in the future change its indefinite reinvestment assertion for any or all of these undistributed earnings. In this case, the Company would estimate and record a tax liability and corresponding tax expense for the amount of non-U.S. income taxes it will incur to ultimately remit these earnings to the U.S. See Note 9 of Notes to Consolidated Financial Statements.

Derivatives: The Company is exposed to the impact of changes in interest rates, foreign currency fluctuations, changes in commodity prices and credit risk. The Company is currently not using derivative instruments to mitigate the risks associated with foreign currency fluctuations, changes in commodity prices or credit risk, but has used derivative financial instruments primarily for purposes of hedging exposures to fluctuations in interest rates in the past. If used in the future, the Company will recognize the entire change in the fair value of the hedging instrument in the same income statement line as the hedged item. The Company currently uses no derivative instruments designated as hedges and, also, has not entered into derivative contracts for trading or speculative purposes.

Fair value measurements: The Company utilizes the FASB's guidance regarding fair value measurements, which establishes a common definition for fair value to be applied to guidance requiring use of fair value, establishes a framework for measuring fair value and expands disclosure about such fair value measurements. Specifically, the guidance utilizes a fair value hierarchy that prioritizes the inputs to valuation techniques used to measure fair value into three broad levels. See Notes 20 and 24 of Notes to Consolidated Financial Statements. The following is a brief description of those three levels:

- Level 1: Observable inputs such as quoted prices (unadjusted) in active markets for identical assets or liabilities.
- Level 2: Inputs other than quoted prices that are observable for the asset or liability, either directly or indirectly. These include quoted prices for similar assets or liabilities in active markets and quoted prices for identical or similar assets or liabilities in markets that are not active.
- Level 3: Unobservable inputs that reflect the reporting entity's own assumptions.

Share-based compensation: The Company applies the FASB's guidance regarding share-based payments, which requires the recognition of the fair value of share-based compensation as a component of expense. The Company has a long-term incentive program ("LTIP") for key employees which provides for the granting of options to purchase stock at prices not less than its market value on the date of the grant. Most options become exercisable between one and three years after the date of the grant for a period of time determined by the Company, but not to exceed seven years from the date of grant. Restricted stock awards and restricted stock units issued under the LTIP program are generally subject to time vesting over a one to four-year period. In addition, as part of the Company's Global Annual Incentive Plan, nonvested shares may be issued to key employees, which generally vest over a two to five-year period. In addition, while the FASB's guidance permits the Company to make an accounting policy election to account for forfeitures as they occur for service condition aspects of certain share-based awards, the Company has decided not to elect this accounting policy and instead has elected to continue utilizing a forfeiture rate assumption. Based on historical experience, the Company has assumed a forfeiture rate of 13% on certain of its nonvested stock awards. The Company will record additional expense if the actual forfeiture rate is lower than estimated and will record a recovery of prior expense if the actual forfeiture is higher than estimated. See Note 7 of Notes to Consolidated Financial Statements.

Earnings per share: The Company follows the FASB's guidance regarding the calculation of earnings per share for nonvested stock awards with rights to non-forfeitable dividends. The guidance requires nonvested stock awards with rights to non-forfeitable dividends to be included as part of the basic weighted average share calculation under the two-class method. See Note 10 of Notes to Consolidated Financial Statements.

Segments: The Company's operating segments reflect the structure of the Company's internal organization, the method by which the Company's resources are allocated and the manner by which the Company assesses its performance. The Company's operating segments are organized by geography as follows: (i) North America, (ii) Europe, Middle East and Africa ("EMEA"), (iii) Asia/Pacific and (iv) South America. The Company's reportable segments are the same as the Company's operating segments. See Note 5 of Notes to Consolidated Financial Statements.

Hyper-inflationary accounting: Economies that have a cumulative three-year rate of inflation exceeding 100 percent are considered hyper-inflationary in accordance with U.S. GAAP. A legal entity which operates within an economy deemed to be hyper-inflationary is required to remeasure its monetary assets and liabilities to the applicable published exchange rates and record the associated gains or losses resulting from the remeasurement directly to the Consolidated Statements of Income.

Venezuela's economy has been considered hyper-inflationary under U.S. GAAP since 2010. The Company has a 50-50 joint venture in a Venezuelan affiliate, Kelko Quaker Chemical, S.A ("Kelko Venezuela"). Due to heightened foreign exchange controls, current economic circumstances and other restrictions in Venezuela, during the third quarter of 2018 the Company concluded that it no longer had significant influence over this affiliate. Prior to this determination, the Company historically accounted for this affiliate under the equity method. As of December 31, 2018, the Company has no remaining carrying value for its investment in Kelko Venezuela. See Note 16 of Notes to Consolidated Financial Statements.

Based on various indices or index compilations currently being used to monitor inflation in Argentina as well as recent economic instability, effective July 1, 2018, Argentina's economy was considered hyper-inflationary under U.S. GAAP. As a result, the Company began applying hyper-inflationary accounting with respect to the Company's wholly owned Argentina subsidiary beginning July 1, 2018. As of, and for the year ended December 31, 2018, the Company's Argentina subsidiary represented less than 1% of the Company's consolidated total assets and less than 1% of the Company's consolidated net sales. During the years ended December 31, 2018, 2017 and 2016, the Company recorded $0.7 million, $0.4 million, and $0.1 million, respectively, of hyper-inflationary accounting remeasurement losses associated with the applicable currency conversions related to Venezuela and Argentina.

Business combinations: The Company accounts for business combinations under the acquisition method of accounting. This method requires the recording of acquired assets, including separately identifiable intangible assets and assumed liabilities at their respective acquisition date estimated fair values. Any excess of the purchase price over the estimated fair value of the identifiable net assets acquired is recorded as goodwill. The determination of the estimated fair value of assets acquired and liabilities assumed requires significant estimates and assumptions. Based on the assessment of additional information during the measurement period, which may be up to one year from the acquisition date, the Company may record adjustments to the estimated fair value of assets acquired and liabilities assumed. See Note 23 of Notes to Consolidated Financial Statements.

Restructuring activities: Restructuring programs consist of employee severance, rationalization of manufacturing or other facilities and other related items. To account for such programs, the Company applies FASB's guidance regarding exit or disposal cost obligations. This guidance requires that a liability for a cost associated with an exit or disposal activity be recognized when the liability is incurred, is estimable, and payment is probable. See Note 6 of Notes to Consolidated Financial Statements.

Reclassifications: Certain information has been reclassified to conform to the current year presentation. During the first quarter of 2018, the Company adopted guidance regarding the accounting for and disclosure of net sales and revenue recognition. The Company's adoption, using the modified retrospective adoption approach, resulted in certain adjustments as of January 1, 2018. In addition, during the first quarter of 2018, the Company adopted an accounting standard update requiring that the statement of cash flows explain both the change in total cash and cash equivalents and also the amounts generally described as restricted cash or restricted cash equivalents. The guidance in this accounting standard update was required to be applied retrospectively which resulted in certain adjustments to the Company's Consolidated Statement of Cash Flows for the year ended December 31, 2017 and 2016. See Notes 3, 4 and 11 of Notes to Consolidated Financial Statements.

Accounting estimates: The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets, liabilities and disclosure of contingencies at the date of the financial statements and the reported amounts of net sales and expenses during the reporting period. Actual results could differ from such estimates.

Note 2 – Houghton Combination

In April 2017, Quaker entered into a share purchase agreement with Gulf Houghton Lubricants, Ltd. to purchase the entire issued and outstanding share capital of Houghton International, Inc. ("Houghton") (herein referred to as "the Combination"). The shares will be bought for aggregate purchase consideration consisting of: (i) $172.5 million in cash; (ii) a number of shares of common stock, $1.00 par value per share, of the Company comprising 24.5% of the common stock outstanding upon the closing of the Combination; and (iii) the Company's assumption of Houghton's net indebtedness as of the closing of the Combination, which was approximately $690 million at signing. At closing, the total aggregate purchase consideration is dependent on the Company's stock price and the level of Houghton's indebtedness.

The Company secured $1.15 billion in commitments from Bank of America Merrill Lynch and Deutsche Bank to fund the Combination and to provide additional liquidity, and has since replaced these commitments with a syndicated bank agreement ("the New Credit Facility") with a group of lenders for $1.15 billion. The New Credit Facility is contingent upon and will not be effective until the closing of the Combination. During the fourth quarter of 2018, the Company extended the bank commitment for the New Credit Facility through March 15, 2019. The New Credit Facility is comprised of a $400.0 million multicurrency revolver, a $600.0 million USD term loan and a $150.0 million EUR equivalent term loan, each with a five-year term from the date the New Credit Facility becomes effective. The maximum amount available under the New Credit Facility can be increased by $200.0 million at the Company's option if the lenders agree and the Company satisfies certain conditions. Borrowings under the New Credit Facility will bear interest at a base rate, LIBOR rate plus a margin, or Euribor rate plus a margin. The Company currently estimates the annual floating rate cost will be in the 3.75% to 4.0% range based on current market interest rates. The New Credit Facility will be subject to certain financial and other covenants, including covenants that the Company's consolidated net debt to adjusted EBITDA ratio cannot exceed 4.25 to 1 and the Company's consolidated adjusted EBITDA to interest expense ratio cannot be less than 3.0 to 1. Both the USD and EUR equivalent term loans will have quarterly principal amortization during their respective five-year terms, with 5.0% amortization of the principal balance due in years 1 and 2, 7.5% in year 3, and 10.0% in years 4 and 5, with the remaining principal amounts due at maturity. Until closing, the Company will incur certain interest costs paid to maintain the bank commitment ("ticking fees"), which began to accrue on September 29, 2017 and bear an interest rate of 0.30% per annum.

The Company received regulatory approval for the Combination from China and Australia in 2017. In addition, at a shareholder meeting held during 2017, the Company's shareholders overwhelmingly approved the issuance of the new shares of the Company's common stock at closing of the Combination. The European Commission ("EC") conditionally approved the Combination in December 2018, including the remedy proposed by Quaker and Houghton. The Company expects final approval from the EC once the final purchase agreement is in place between Quaker, Houghton, and the buyer of the divested product lines. The Company continues to be in productive discussions with the U.S. Federal Trade Commission ("FTC"), although the process is taking longer than anticipated. Given the time lapse since the Company's initial filing, the FTC requested updated information as part of their approval process late in the fourth quarter of 2018. In addition, the government shutdown in the U.S. during the first quarter of 2019 extended the timeline to receive the final approval. Given current information, the Company estimates that FTC and EC final approval and closing of the combination will occur within the next few months.

The Company incurred costs of $19.5 million, $30.8 million and $1.5 million during the years ended December 31, 2018, 2017 and 2016, respectively, primarily for certain legal, environmental, financial, and other advisory and consultant costs related to due diligence, regulatory and shareholder approvals, integration planning associated with the Combination and ticking fees. As of December 31, 2018 and 2017, the Company had current liabilities related to the Combination of $8.2 million and $5.5 million, respectively, primarily recorded within other current liabilities on its Consolidated Balance Sheets.

Note 3 – Recently Issued Accounting Standards

The FASB issued an accounting standard update in October 2018 to provide guidance on the risks associated with financial assets and liabilities that are permitted to be hedged. The amendments in this update permit use of the Overnight Index Swap ("OIS") rate based on the Secured Overnight Financing Rate (SOFR) as a U.S. benchmark interest rate in addition to the other four rates: interest rates on direct Treasury obligations of the U.S. government (UST), the London Interbank Offered Rate (LIBOR) swap rate, the OIS rate based on the Fed Funds Effective Rate and the Securities Industry and Financial Markets Association (SIFMA) Municipal Swap Rate. The amendments in this update also apply to all entities that elect to apply hedge accounting to benchmark interest rate hedges. The guidance within this accounting standard update is effective for fiscal years beginning after December 15, 2018, and interim periods within those fiscal years. The amendments in this update should be adopted on a prospective basis for qualifying new or re-designated hedging relationships entered into on or after the date of adoption. Early adoption is permitted. The Company has elected to early adopt the guidance in this accounting standard update during the fourth quarter of 2018, with no impact to its financial statements. The Company does not currently use any derivative instruments designated as hedges but may choose to in the future.

The FASB issued an accounting standard update in August 2018 that modifies certain disclosure requirements for employers that sponsor defined benefit pension or other postretirement plans. The amendments in this accounting standard update remove disclosures that are no longer considered cost beneficial, clarify the specific requirements of certain disclosures, and add new disclosure requirements as relevant. The guidance within this accounting standard update is effective for annual periods beginning after December 15, 2020, and should be applied retrospectively to all periods presented. Early adoption is permitted. The Company has not early adopted the guidance and is currently evaluating its implementation.

The FASB issued an accounting standard update in August 2018 that clarifies the accounting for implementation costs incurred in a cloud computing arrangement under a service contract. This guidance generally aligns the requirements for capitalizing implementation costs incurred in a hosting arrangement under a service contract with the requirements for capitalizing implementation costs related to internal-use software. The guidance within this accounting standard update is effective for annual periods beginning after December 15, 2019 and should be applied either retrospectively or prospectively to all implementation costs incurred after the date of adoption. Early adoption is permitted. The Company has not early adopted the guidance and is currently evaluating its implementation.

The FASB issued an accounting standard update in August 2018 that modifies certain disclosure requirements for fair value measurements. The guidance removes certain disclosure requirements regarding transfers between levels of the fair value hierarchy as well as the valuation processes for certain fair value measurements. Further, the guidance added certain disclosure requirements including unrealized gains and losses and significant unobservable inputs used to develop certain fair value measurements. The guidance within this accounting standard update is effective for annual and interim periods beginning after December 15, 2019, and should be applied prospectively in the initial year of adoption or prospectively to all periods presented, depending on the amended disclosure requirement. Early adoption is permitted. The Company has not early adopted the guidance and is currently evaluating its implementation.

The FASB issued an accounting standard update in June 2018 to simplify the accounting for share-based payment transactions with non-employees of the Company. The guidance within this accounting standard update generally requires that share-based payment transactions for acquiring goods or services from non-employees of the Company be accounted for under the same guidance and model as all other share-based payment transactions, including employees of the Company. The guidance within this accounting standard update is effective for annual and interim periods beginning after December 15, 2018. Early adoption is permitted. The Company elected to early adopt the guidance within this accounting standard updated in the second quarter of 2018 with no impact to its financial statements.

The FASB issued an accounting standard update in February 2018 that allows a reclassification from AOCI to retained earnings for stranded tax effects resulting from U.S. Tax Reform enacted in December 2017. The guidance within this accounting standard update is effective for annual and interim periods beginning after December 15, 2018, and should be applied either in the period of adoption or retrospectively to each period in which the effect of the change in the U.S. federal corporate income tax rate in U.S. Tax Reform is recognized. Early adoption is permitted. The Company has not early adopted the guidance and is currently evaluating its implementation.

The FASB issued an accounting standard update in January 2017 to clarify the definition of a business with the objective of adding guidance to assist companies with evaluating whether transactions should be accounted for as acquisitions (or disposals) of assets or businesses. The amendments in this accounting standard update provided a more robust framework to use in determining when a set of assets and activities is a business. The guidance within this accounting standard update was effective for annual and interim periods beginning after December 15, 2017. Early adoption was permitted in limited circumstances, and the amendments in this accounting standard update were required to be applied prospectively, with no disclosures required at transition. The Company adopted the guidance in the first quarter of 2018, as required, with no impact to its financial statements.

The FASB issued an accounting standard update in November 2016 requiring that the statement of cash flows explain both the change in the total cash and cash equivalents, and also the amounts generally described as restricted cash or restricted cash equivalents. This required amounts generally described as restricted cash or restricted cash equivalents be included with cash and cash equivalents when reconciling the beginning and ending amounts shown on the statement of cash flows. The guidance within this accounting standard update was effective for annual and interim periods beginning after December 15, 2017. Early adoption was permitted, and the guidance required application using a retrospective transition method to each period presented when adopted. The Company adopted the guidance in the first quarter of 2018, as required. Adoption of the guidance did not have an impact on the Company's earnings or balance sheet but did result in changes to certain disclosures within the statement of cash flows, including cash flows from investing activities and total cash, cash equivalents and restricted cash. See Note 11 of Notes to Consolidated Financial Statements.

The FASB issued an accounting standard update in October 2016 to improve the accounting for the income tax consequences of intra-entity transfers of assets other than inventory. The provisions in this update allowed an entity to recognize current and deferred income taxes of an intra-entity transfer of an asset other than inventory when the transfer occurs rather than when the asset has been sold to an outside party. The guidance within this accounting standard update was effective for annual and interim periods beginning after December 15, 2017. Early adoption was permitted, and the guidance required application on a modified retrospective basis through a cumulative-effect adjustment directly to retained earnings as of the beginning of the period of adoption. The Company adopted the guidance in the first quarter of 2018, as required, with no impact to its financial statements.

The FASB issued an accounting standard update in August 2016 to standardize how certain transactions are classified in the statement of cash flows. Specific transactions covered by the accounting standard update include debt prepayment or debt extinguishment costs, settlement of zero-coupon debt instruments, contingent consideration payments made after a business combination, proceeds from the settlement of insurance claims, proceeds from the settlement of corporate and bank owned life insurance policies, distributions received from equity method investments and beneficial interest in securitization transactions. The guidance within this accounting standard update was effective for annual and interim periods beginning after December 15, 2017. Early adoption was permitted, provided that all of the amendments were adopted in the same period. The guidance required application using a retrospective transition method. The Company adopted the guidance in the first quarter of 2018 as required, with no impact to its financial statements.

The FASB issued an accounting standard update in February 2016 regarding the accounting and disclosure for leases. During 2018, the FASB issued a series of accounting standard updates to clarify and expand on the original 2016 implementation guidance, including providing an accounting policy election for lessors, certain targeted improvements around comparative reporting requirements and accounting for lease and non-lease components by lessors as well as other technical corrections and improvements. The amendments in these 2018 updates did not change the core principles of the guidance previously issued in February 2016. The guidance within all of the leasing accounting standard updates are effective for annual and interim periods beginning after December 15, 2018, and should be applied on a modified retrospective basis, applying the transition requirements either (a) at the beginning of the earliest period presented in the financial statements in the year of adoption (January 1, 2017) or (b) in the period of adoption (January 1, 2019). Early adoption is permitted, but the Company has not early adopted. The Company will adopt the guidance in the first quarter of 2019, as required, using a modified retrospective transition approach. The Company will apply the transition requirements in the period of adoption (as of January 1, 2019), as permitted. As such the Company will neither restate comparative periods for the effects of this lease accounting guidance or provide the disclosures requirements for comparative periods. The Company anticipates electing to apply certain of the permitted practical expedients within the new lease accounting guidance, and the Company also anticipates making certain accounting policy elections as a result of adopting the new lease accounting guidance.

As of December 31, 2018, the Company has substantially completed its implementation planning and its impact assessment related to the new lease accounting guidance. Work performed to date includes developing a detailed project plan, identifying and establishing a cross-functional implementation team and developing pre-adoption internal controls. In addition, the Company gathered an inventory of the Company's explicit outstanding leases globally, performed certain review procedures to ensure completeness of its lease population and abstracted critical lease information from the lease population for inclusion within the Company's leasing software. Also, the Company has begun preliminary considerations for how the new lease accounting guidance may impact Houghton, as it pertains to the potential Combination. The Company has calculated a preliminary transition adjustment which will be finalized and reflected in the Company's financial statements starting after the effective date of January 1, 2019. While the Company's implementation of this lease accounting guidance is still on-going, the Company anticipates adoption of this guidance will have a material impact on its balance sheet as it expects the majority of its leases will be recorded on its balance sheet by establishing right of use assets and associated lease liabilities. Based on all current available information, the Company estimates that its right of use assets and associated lease liabilities will be approximately $20 million to $30 million as of January 1, 2019.

The FASB issued an accounting standard update in May 2014 regarding the accounting for and disclosure of revenue recognition. Specifically, the update outlined a single comprehensive model for entities to use in accounting for revenue arising from contracts with customers, which will be common to both U.S. GAAP and International Financial Reporting Standards. The guidance was effective for annual and interim periods beginning after December 15, 2016, and allowed for full retrospective adoption of prior period data or a modified retrospective adoption. Early adoption was not permitted. In August 2015, the FASB issued an accounting standard update to delay the effective date of the new revenue standard by one year, or, in other words, to be effective for annual and interim periods beginning after December 15, 2017. Entities were permitted to adopt the new revenue standard early but not before the original effective date. During 2016 and 2017, the FASB issued a series of accounting standard updates to clarify and expand on the implementation guidance, including principal versus agent considerations, identification of performance obligations, licensing, other technical corrections and adding certain practical expedients. The amendments in these 2016 and 2017 updates did not change the core principles of the guidance previously issued in May 2014.

As part of the Company's impact assessment for the implementation of the new revenue recognition guidance, the Company reviewed its historical accounting policies and practices to identify potential differences with the requirements of the new revenue recognition standard as it related to the Company's contracts and sales arrangements. In addition, the impact assessment and work performed included global and cross functional interviews and questionnaires, sales agreement and other sales document reviews, as well as technical considerations for the Company's future transactional accounting, financial reporting and disclosure requirements. The Company has also progressed its assessment of how the new revenue recognition guidance may impact Houghton, as it pertains to the pending Combination.

The Company adopted the guidance in the first quarter of 2018 as required, electing to use a modified retrospective adoption approach applied to those contracts which were not completed as of January 1, 2018. Comparative information has not been restated and continues to be reported under the accounting standards in effect for those periods. In addition, the Company elected to apply certain of the permitted practical expedients within the revenue recognition guidance and make certain accounting policy elections including those related to significant financing components, sales taxes and shipping and handling activities. Adoption of the revenue recognition guidance did not have a material impact on the Company's reported earnings or cash flows, however, adoption did increase the amount and level of disclosures concerning the Company's net sales and did result in one adjustment to the Company's balance sheet. As a result of the Company's impact assessment and adoption using the modified retrospective adoption approach, the Company recorded a cumulative effect of an accounting change as of January 1, 2018 to adjust the Company's estimate of variable consideration relating to customers' expected rights to return product. This adjustment resulted in an increase to other current liabilities of $1.0 million, an increase to non-current deferred tax assets of $0.2 million and a decrease to retained earnings of $0.8 million. There were no other impacts recorded as a result of adopting the revenue recognition guidance in 2018 or prior years and the Company expects the impact to be immaterial on an ongoing basis. See Note 4 and 18 of Notes to Consolidated Financial Statements.

Note 4 – Net Sales and Revenue Recognition

Business Description

The Company develops, produces, and markets a broad range of formulated chemical specialty products and offers chemical management services ("CMS") for various heavy industrial and manufacturing applications in a global portfolio throughout its four regions: North America, EMEA, Asia/Pacific and South America. The major product lines in the Company's global portfolio include: (i) rolling lubricants (used by manufacturers of steel in the hot and cold rolling of steel and by manufacturers of aluminum in the hot rolling of aluminum); (ii) machining and grinding compounds (used by metalworking customers in cutting, shaping, and grinding metal parts which require special treatment to enable them to tolerate the manufacturing process, achieve closer tolerance, and improve tool life); (iii) corrosion preventives (used by steel and metalworking customers to protect metal during manufacture, storage, and shipment); (iv) hydraulic fluids (used by steel, metalworking, and other customers to operate hydraulic equipment); (v) specialty greases (used in automotive and aerospace production processes and applications, the manufacturing of steel, and various other applications); and (vi) metal finishing compounds (used to prepare metal surfaces for special treatments such as galvanizing and tin plating and to prepare metal for further processing).

A substantial portion of the Company's sales worldwide are made directly through its own employees and its CMS programs, with the balance being handled through distributors and agents. The Company's employees visit the plants of customers regularly, work on site, and, through training and experience, identify production needs which can be resolved or alleviated either by adapting the Company's existing products or by applying new formulations developed in its laboratories. The chemical specialty industry comprises many companies of similar size as well as companies larger and smaller than Quaker. The offerings of many of the Company's competitors differ from those of Quaker; some offer a broad portfolio of fluids, including general lubricants, while others have a more specialized product range. All competitors provide different levels of technical services to individual customers. Competition in the industry is based primarily on the ability to provide products that meet the needs of the customer, render technical services and laboratory assistance to the customer and, to a lesser extent, on price.

As part of the Company's CMS, certain third-party product sales to customers are managed by the Company. Where the Company acts as a principal, revenues are recognized on a gross reporting basis at the selling price negotiated with its customers. Where the Company acts as an agent, revenue is generally recognized on a net reporting basis at the amount of the administrative fee earned by the Company for ordering the goods. In determining whether the Company is acting as a principal or an agent in each arrangement, the Company considers whether it is primarily responsible for fulfilling the promise to provide the specified good, has inventory risk before the specified good has been transferred to the customer and has discretion in establishing the prices for the specified goods. The Company transferred third-party products under arrangements resulting in net reporting of $47.1 million, $44.5 million and $43.5 million for the years ended December 31, 2018, 2017 and 2016.

A significant portion of the Company's revenues are realized from the sale of process fluids and services to manufacturers of steel, automobiles, aircraft, appliances, and durable goods, and, therefore, the Company is subject to the same business cycles as those experienced by these manufacturers and their customers. The Company's financial performance is generally correlated to the volume of global production within the industries it serves, rather than discretely related to the financial performance of such industries. Furthermore, steel customers typically have limited manufacturing locations compared to other metalworking customers and generally use higher volumes of products at a single location. During the year ended December 31, 2018, the Company's five largest customers accounted for approximately 17% of its consolidated net sales with the largest customer accounting for approximately 8% of the Company's consolidated net sales.

Revenue Recognition Model

The Company applies the FASB's guidance on revenue recognition which requires the Company to recognize revenue in an amount that reflects the consideration to which the Company expects to be entitled in exchange for goods or services transferred to its customers. To do this, the Company applies the five-step model in the FASB's guidance, which requires the Company to: (i) identify the contract with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when, or as, the Company satisfies a performance obligation.

The Company identifies a contract with a customer when a sales agreement indicates approval and commitment of the parties; identifies the rights of the parties; identifies the payment terms; has commercial substance; and it is probable that the Company will collect the consideration to which it will be entitled in exchange for the goods or services that will be transferred to the customer. In most instances, the Company's contract with a customer is the customer's purchase order. For certain customers, the Company may also enter into a sales agreement which outlines a framework of terms and conditions which apply to all future and subsequent purchase orders for that customer. In these situations, the Company's contract with the customer is both the sales agreement as well as the specific customer purchase order. Because the Company's contract with a customer is typically for a single transaction or customer purchase order, the duration of the contract is almost always one year or less. As a result, the Company has elected to apply certain practical expedients and omit certain disclosures of remaining performance obligations for contracts which have an initial term of one year or less as permitted by the FASB.

The Company identifies a performance obligation in a contract for each promised good or service that is separately identifiable from other promises in the contract and for which the customer can benefit from the good or service either on its own or together with other resources that are readily available to the customer. The Company determines the transaction price as the amount of consideration it expects to be entitled to in exchange for fulfilling the performance obligations, including the effects of any variable consideration, significant financing elements, amounts payable to the customer or noncash consideration. For any contracts that have more than one performance obligation, the Company allocates the transaction price to each performance obligation in an amount that depicts the amount of consideration to which the Company expects to be entitled in exchange for satisfying each performance obligation.

In accordance with the last step of the FASB's guidance, the Company recognizes revenue when, or as, it satisfies the performance obligation in a contract by transferring control of a promised good or service to the customer. The Company recognizes revenue over time whenever the customer simultaneously receives and consumes the benefits provided by the Company's performance; the Company's performance creates or enhances an asset that the customer controls as the asset is created or enhanced; or the Company's performance does not create an asset with an alternative use to the entity, and the entity has an enforceable right to payment, including a profit margin, for performance completed to date. For performance obligations not satisfied over time, the Company determines the point in time at which a customer obtains control of a promised asset and the Company satisfies a performance obligation by considering when the Company has a right to payment for the asset; the customer has legal title to the asset; the Company has transferred physical possession of the asset; the customer has the significant risks and rewards of ownership of the asset; or the customer has accepted the asset.

The Company typically satisfies its performance obligations and recognizes revenue at a point in time for product sales, generally when products are shipped or delivered to the customer, depending on the terms underlying each arrangement. In circumstances where the Company's products are on consignment, revenue is generally recognized upon usage or consumption by the customer. For any CMS or other services provided by the Company to the customer, the Company typically satisfies its performance obligations and recognizes revenue over time, as the promised services are performed. The Company uses input methods to recognize revenue over time related to these services, including labor costs and time incurred. The Company believes that these input methods represent the most indicative measure of the CMS or other service work performed by the Company.

Other Considerations

The Company does not have standard payment terms for all customers globally, however the Company's general payment terms require customers to pay for products or services provided after the performance obligation is satisfied. The Company does not have significant financing arrangements with its customers. The Company does not have significant amounts of variable consideration in its contracts with customers and where applicable, the Company's estimates of variable consideration are not constrained. The Company records certain third-party license fees in other expense, net, in its Consolidated Statement of Income, which generally include sales-based royalties in exchange for the license of intellectual property. These license fees are recognized in accordance with their agreed-upon terms and when performance obligations are satisfied, which is generally when the third party has a subsequent sale.

Practical Expedients and Accounting Policy Elections

The Company made certain accounting policy elections and elected to use certain practical expedients as permitted by the FASB in applying the guidance on revenue recognition. It is the Company's policy to not adjust the promised amount of consideration for the effects of a significant financing component as the Company expects, at contract inception, that the period between when the Company transfers a promised good or service to the customer and when the customer pays for that good or service will be one year or less. In addition, it is the Company's policy to expense costs to obtain a contract as incurred when the expected period of benefit, and therefore the amortization period, is one year or less. It is also the Company's accounting policy to exclude from the measurement of the transaction price all taxes assessed by a governmental authority that are both imposed on and concurrent with a specific revenue-producing transaction and collected by the entity from a customer, including sales, use, value added, excise and various other taxes. Lastly, the Company has elected to account for shipping and handling activities that occur after the customer has obtained control of a good as a fulfilment cost rather than an additional promised service.

Contract Assets and Liabilities

The Company recognizes a contract asset or receivable on its Consolidated Balance Sheet when the Company performs a service or transfers a good in advance of receiving consideration. A receivable is the Company's right to consideration that is unconditional and only the passage of time is required before payment of that consideration is due. A contract asset is the Company's right to consideration in exchange for goods or services that the Company has transferred to a customer. The Company had no contract assets recorded on its Consolidated Balance Sheets as of December 31, 2018 or 2017.

A contract liability is recognized when the Company receives consideration, or if it has the unconditional right to receive consideration, in advance of performance. A contract liability is the Company's obligation to transfer goods or services to a customer for which the Company has received consideration, or a specified amount of consideration is due, from the customer. The Company's contract liabilities primarily represent deferred revenue recorded for customer payments received by the Company prior to the Company satisfying the associated performance obligation. Deferred revenues are presented within other current liabilities in the Company's Consolidated Balance Sheets. The Company had approximately $1.3 million and $1.5 million of deferred revenue as of December 31, 2018 and 2017, respectively. During the year ended December 31, 2018, the Company satisfied all of the associated performance obligations and recognized into revenue the advance customer payments received and recorded as of December 31, 2017.

Disaggregated Revenue

The Company sells its various industrial process fluids, its chemical specialties and its technical expertise as a global product portfolio. The Company generally manages and evaluates its performance by geography first, and then by customer industry, rather than by individual product lines. Also, net sales of each of the Company's major product lines are generally spread throughout all four of the Company's regions, and, in most cases, are relatively proportionate to the level of total sales in each region.

The following tables present disaggregated information regarding the Company's net sales, first by product lines that represent approximately 10% of consolidated net sales for any of the years ended December 31, 2018, 2017 and 2016, and followed then by a disaggregation of the Company's net sales by region, customer industry, and timing of revenue recognized for the year ended December 31, 2018.

	2018	2017	2016
Rolling lubricants	16.9%	17.8%	19.0%
Machining and grinding compounds	16.1%	15.8%	14.9%
Corrosion preventives	11.6%	11.4%	11.8%
Hydraulic fluids	11.4%	11.6%	12.0%
Specialty greases	9.7%	10.0%	10.1%

	2018				
	North America	EMEA	Asia/Pacific	South America	Consolidated Total
Net sales	$ 383,471	$ 233,597	$ 214,157	$ 36,295	$ 867,520
Customer Industries					
Primary metals	$ 156,906	$ 102,417	$ 134,395	$ 19,818	$ 413,536
Metalworking	167,829	116,076	74,867	14,827	373,599
Coatings and other	58,736	15,104	4,895	1,650	80,385
	$ 383,471	$ 233,597	$ 214,157	$ 36,295	$ 867,520
Timing of Revenue Recognized					
Product sales at a point in time	$ 372,392	$ 233,372	$ 206,112	$ 36,010	$ 847,886
Services transferred over time	11,079	225	8,045	285	19,634
	$ 383,471	$ 233,597	$ 214,157	$ 36,295	$ 867,520

Note 5 – Business Segments

The Company's reportable operating segments are organized by geography as follows: (i) North America, (ii) EMEA, (iii) Asia/Pacific and (iv) South America. Operating earnings, excluding indirect operating expenses, for the Company's reportable operating segments is comprised of revenues less cost of goods sold ("COGS") and SG&A directly related to the respective region's product sales. The indirect operating expenses consist of SG&A not directly attributable to the product sales of each respective reportable operating segment. Other items not specifically identified with the Company's reportable operating segments include interest expense, interest income, license fees from non-consolidated affiliates, amortization expense and other expense, net.

The following tables present information about the performance of the Company's reportable operating segments for the years ended December 31, 2018, 2017 and 2016:

	2018	2017	2016
Net sales			
North America	$ 383,471	$ 356,598	$ 336,174
EMEA	233,597	226,243	200,917
Asia/Pacific	214,157	201,008	179,131
South America	36,295	36,233	30,443
Total net sales	$ 867,520	$ 820,082	$ 746,665

	2018	2017	2016
Operating earnings, excluding indirect operating expenses			
North America	$ 88,276	$ 77,694	$ 77,833
EMEA	35,970	35,350	33,810
Asia/Pacific	56,056	48,342	45,866
South America	3,881	3,927	1,386
Total operating earnings, excluding indirect operating expenses	184,183	165,313	158,895
Non-operating charges	(72,223)	(65,142)	(65,316)
Restructuring and related activities	—	—	439
Combination-related expenses	(16,661)	(29,938)	(1,531)
Depreciation of corporate assets and amortization	(7,518)	(7,489)	(7,134)
Operating income	87,781	62,744	85,353
Other expense, net	(642)	(718)	(492)
Interest expense	(6,158)	(3,892)	(2,889)
Interest income	2,117	2,534	2,037
Income before taxes and equity in net income of associated companies	$ 83,098	$ 60,668	$ 84,009

The following tables present information regarding the Company's reportable operating segments' assets and long-lived assets as of December 31, 2018, 2017 and 2016:

	2018	2017	2016
Segment assets			
North America (including Corporate)	$ 317,934	$ 324,260	$ 321,404
EMEA	157,111	177,267	147,021
Asia/Pacific	212,545	196,891	200,218
South America	22,075	23,708	23,385
Total segment assets	$ 709,665	$ 722,126	$ 692,028

	2018	2017	2016
Segment long-lived assets			
North America (including Corporate)	$ 84,876	$ 88,818	$ 86,775
EMEA	26,239	28,507	25,630
Asia/Pacific	23,650	22,427	22,040
South America	2,529	2,691	2,858
Total segment long-lived assets	$ 137,294	$ 142,443	$ 137,303

The following tables present information regarding the Company's reportable operating segments' capital expenditures and depreciation for the years ended December 31, 2018, 2017 and 2016:

	2018	2017	2016
Capital expenditures			
North America (including Corporate)	$ 4,574	$ 3,919	$ 2,918
EMEA	2,081	3,936	3,263
Asia/Pacific	6,059	2,458	3,269
South America	172	559	504
Total segment capital expenditures	$ 12,886	$ 10,872	$ 9,954

	2018	2017	2016
Depreciation			
North America	$ 5,770	$ 5,791	$ 5,672
EMEA	3,434	3,368	3,323
Asia/Pacific	2,552	2,669	2,765
South America	440	649	672
Total segment depreciation	$ 12,196	$ 12,477	$ 12,432

During the years ended December 31, 2018, 2017 and 2016, the North America segment had approximately $50.8 million, $49.2 million and $35.8 million of net sales, respectively, which were attributable to non-U.S. operations. As of December 31, 2018, 2017 and 2016, the North America segment had approximately $4.5 million, $4.9 million and $4.9 million of long-lived assets, respectively, which were attributable to non-U.S. operations.

Inter-segment revenue for the years ended December 31, 2018, 2017 and 2016 was $9.7 million, $9.4 million and $8.3 million for North America, $22.0 million, $22.0 million and $18.1 million for EMEA, $0.5 million, $0.4 million and $0.7 million for Asia/Pacific and less than $0.1 million for the years ended December 31, 2018, 2017 and 2016 for South America, respectively. However, all inter-segment transactions have been eliminated from each reportable operating segment's net sales and earnings for all periods presented in the above tables.

Note 6 – Restructuring and Related Activities

In response to weak economic conditions and market declines in many regions, Quaker's management approved a global restructuring plan (the "2015 Program") in the fourth quarter of 2015 to reduce its operating costs. The 2015 Program included provisions for the reduction of total headcount by approximately 65 employees globally. The Company substantially completed all of the initiatives under the 2015 Program in 2016 and settlement of these charges occurred primarily in 2016 as well. During the fourth quarter of 2016, the Company recognized a restructuring credit of $0.4 million in connection with the 2015 Program, due to customary and routine adjustments to initial estimates for employee separation costs. The Company completed all of the remaining initiatives under the 2015 Program during the first half of 2017 and does not expect to incur further restructuring charges under this program.

There were no accrued restructuring liabilities as of December 31, 2017 and no associated cash payments or other restructuring activity during the year ended December 31, 2018. Restructuring activity recognized in each reportable operating segment in connection with the 2015 Program during the years ended December 31, 2017 and 2016 is as follows:

	North America	EMEA	Asia/Pacific	South America	Total
Accrued restructuring as of December 31, 2015	$ 1,867	$ 4,265	$ 135	$ 36	$ 6,303
Restructuring credits	—	(439)	—	—	(439)
Cash payments	(1,671)	(3,404)	(138)	(39)	(5,252)
Currency translation adjustments	—	52	3	3	58
Accrued restructuring as of December 31, 2016	196	474	—	—	670
Restructuring charges and adjustments	(126)	126	—	—	—
Cash payments	(70)	(605)	—	—	(675)
Currency translation adjustments	—	5	—	—	5
Accrued restructuring as of December 31, 2017	$ —	$ —	$ —	$ —	$ —

Note 7 – Share-Based Compensation

The Company recognized the following share-based compensation expense in SG&A in its Consolidated Statements of Income for the years ended December 31, 2018, 2017 and 2016:

	2018	2017	2016
Stock options	$ 1,053	$ 958	$ 848
Nonvested restricted stock awards and restricted stock units	2,459	2,935	3,121
Employee stock purchase plan	89	88	87
Non-elective and elective 401(k) matching contribution in stock	—	72	2,124
Director stock ownership plan	123	137	169
Total share-based compensation expense	$ 3,724	$ 4,190	$ 6,349

During the first quarter of 2017, the Company began matching non-elective and elective 401(k) contributions in cash rather than stock. Also, the Company's estimated tax payable as of December 31, 2016, was sufficient to fully recognize $0.7 million of excess tax benefits related to stock option exercises as cash inflows from financing activities in its Consolidated Statements of Cash Flows.

Stock option activity under all plans is as follows:

	Number of Options	Weighted Average Exercise Price (per option)	Weighted Average Remaining Contractual Term (years)	Aggregate Intrinsic Value
Options outstanding as of January 1, 2018	111,255	$ 97.71		
Options granted	35,842	151.75		
Options exercised	(25,025)	83.96		
Options outstanding as of December 31, 2018	122,072	$ 116.39	5.0	$ 7,185
Options expected to vest after December 31, 2018	86,635	$ 125.48	5.3	$ 4,312
Options exercisable as of December 31, 2018	35,437	$ 94.17	4.2	$ 2,873

The total intrinsic value of options exercised during the years ended December 31, 2018, 2017 and 2016 was approximately $2.0 million, $3.4 million and $2.9 million, respectively. Intrinsic value is calculated as the difference between the current market price of the underlying security and the strike price of a related option.

A summary of the Company's outstanding stock options as of December 31, 2018 is as follows:

Range of Exercise Prices	Number of Options Outstanding	Weighted Average Remaining Contractual Term (years)	Weighted Average Exercise Price (per option)	Number of Options Exercisable	Weighted Average Exercise Price (per option)
$ 50.01 - $ 60.00	874	1.2	58.26	874	58.26
$ 60.01 - $ 70.00	—	—	—	—	—
$ 70.01 - $ 80.00	42,272	4.1	72.19	19,791	72.26
$ 80.01 - $ 90.00	2,797	3.2	87.30	2,797	87.30
$ 90.01 - $ 130.00	—	—	—	—	—
$ 130.01 - $ 140.00	40,287	5.2	134.60	11,975	134.60
$ 140.01 - $ 150.00	—	—	—	—	—
$ 150.01 - $ 160.00	35,842	6.2	151.75	—	—
	122,072	5.0	116.39	35,437	94.17

As of December 31, 2018, unrecognized compensation expense related to options granted in 2018, 2017 and 2016 was $0.8 million, $0.4 million and less than $0.1 million, respectively, to be recognized over a weighted average period of 1.8 years.

The Company granted stock options under its LTIP plan that are subject only to time vesting over a three-year period in the first quarters of 2018, 2017, 2016 and 2015. For the purposes of determining the fair value of stock option awards, the Company uses the Black-Scholes option pricing model and the assumptions set forth in the table below:

	2018	2017	2016	2015
Number of stock options granted	35,842	42,477	67,444	38,698
Dividend yield	1.37%	1.49%	1.49%	1.55%
Expected volatility	24.73%	25.52%	28.39%	36.32%
Risk-free interest rate	2.54%	1.67%	1.08%	1.22%
Expected term (years)	4.0	4.0	4.0	4.0

These awards are being amortized on a straight-line basis over the respective vesting period of each award. The compensation expense recorded on each award during the years ended December 31, 2018, 2017 and 2016, respectively, is as follows:

	2018	2017	2016
2018 Stock option awards	$ 310	$ —	$ —
2017 Stock option awards	$ 367	$ 308	$ —
2016 Stock option awards	$ 332	$ 332	$ 282
2015 Stock option awards	$ 44	$ 276	$ 276

Activity of nonvested restricted stock awards granted under the Company's LTIP plan is shown below:

	Number of Shares	Weighted Average Grant Date Fair Value (per share)
Nonvested awards, December 31, 2017	72,164	$ 91.03
Granted	16,166	$ 152.38
Vested	(34,954)	$ 87.08
Forfeited	(591)	$ 121.43
Nonvested awards, December 31, 2018	52,785	$ 112.09

The fair value of the nonvested stock is based on the trading price of the Company's common stock on the date of grant. The Company adjusts the grant date fair value for expected forfeitures based on historical experience for similar awards. As of December 31, 2018, unrecognized compensation expense related to these awards was $2.1 million, to be recognized over a weighted average remaining period of 1.7 years.

Activity of nonvested restricted stock units granted under the Company's LTIP plan is shown below:

	Number of Units	Weighted Average Grant Date Fair Value (per unit)
Nonvested awards, December 31, 2017	4,277	$ 95.53
Granted	1,549	$ 153.84
Vested	(1,176)	$ 87.30
Nonvested awards, December 31, 2018	4,650	$ 117.03

The fair value of the nonvested restricted stock units is based on the trading price of the Company's common stock on the date of grant. The Company adjusts the grant date fair value for expected forfeitures based on historical experience for similar awards. As of December 31, 2018, unrecognized compensation expense related to these awards was $0.2 million, to be recognized over a weighted average remaining period of 1.8 years.

Employee Stock Purchase Plan

In 2000, the Board adopted an Employee Stock Purchase Plan ("ESPP") whereby employees may purchase Company stock through a payroll deduction plan. Purchases are made from the plan and credited to each participant's account at the end of each month (the "Investment Date"). The purchase price of the stock is 85% of the fair market value on the Investment Date. The plan is compensatory, and the 15% discount is expensed on the Investment Date. All employees, including officers, are eligible to participate in this plan. A participant may withdraw all uninvested payment balances credited to a participant's account at any time. An employee whose stock ownership of the Company exceeds five percent of the outstanding common stock is not eligible to participate in this plan.

2013 Director Stock Ownership Plan

In 2013, the Company adopted the 2013 Director Stock Ownership Plan (the "Plan"), to encourage the Directors to increase their investment in the Company, which was approved at the Company's May 2013 shareholders' meeting. The Plan authorizes the issuance of up to 75,000 shares of Quaker common stock in accordance with the terms of the Plan in payment of all or a portion of the annual cash retainer payable to each of the Company's non-employee directors in 2013 and subsequent years during the term of the Plan. Under the Plan, each director who, on May 1 of the applicable calendar year, owns less than 400% of the annual cash retainer for the applicable calendar year, divided by the average of the closing price of a share of Quaker Common Stock as reported by the composite tape of the New York Stock Exchange for the previous calendar year (the "Threshold Amount"), is required to receive 75% of the annual cash retainer in Quaker common stock and 25% of the retainer in cash, unless the director elects to receive a greater percentage of Quaker common stock, up to 100% of the annual cash retainer for the applicable year. Each director who owns more than the Threshold Amount may elect to receive common stock in payment of a percentage (up to 100%) of the annual cash retainer. The annual retainer is $0.1 million and the retainer payment date is June 1.

Note 8 – Other Expense, net

Other expense, net, for the years ended December 31, 2018, 2017 and 2016 are as follows:

	2018	2017	2016
Income from third party license fees	$ 862	$ 861	$ 978
Foreign exchange (losses) gains, net	(807)	891	172
Gain (loss) on fixed asset disposals, net	657	(79)	50
Non-income tax refunds and other related credits	668	1,015	398
Pension and postretirement benefit costs, non-service components	(2,285)	(4,234)	(2,302)
Insurance insolvency recovery	90	600	—
Other non-operating income	425	380	338
Other non-operating expense	(252)	(152)	(126)
Total other expense, net	$ (642)	$ (718)	$ (492)

Foreign exchange (losses) gains, net, during the year ended December 31, 2018 include both a foreign currency transaction loss of approximately $0.4 million related to hyper-inflationary accounting for the Company's Argentina subsidiary effective July 1, 2018 and a foreign currency transaction gain of approximately $0.4 million related to the liquidation of an inactive legal entity. In addition, gain (loss) on fixed asset disposals, net, during the year ended December 31, 2018 and 2017 includes a $0.6 million gain and a $0.1 million loss, respectively, on the sale of held-for-sale assets in each period. Pension and postretirement benefit costs, non-service components during the year ended December 31, 2017 includes a $1.9 million pension settlement charge. See Note 20 of Notes to Consolidated Financial Statements. Insurance insolvency recovery during the years ended December 31, 2018 and 2017 represents cash proceeds from an insolvent insurance carrier with respect to a previously filed recovery claim by an inactive subsidiary of the Company.

Note 9 – Taxes on Income

On December 22, 2017, the U.S. government enacted comprehensive tax legislation commonly referred to as U.S. Tax Reform. U.S. Tax Reform included multiple changes to the U.S. tax code with varying effects on the Company's 2017 results, including, but not limited to, (i) a revaluation of the Company's U.S. deferred tax assets and liabilities based upon the reduction of the U.S. federal statutory corporate income tax rate from 35% to 21% and (ii) implementation of a new system of taxation for non-U.S. earnings which eliminates U.S. federal income taxes on dividends from certain foreign subsidiaries and imposes a one-time transition tax on the deemed repatriation of undistributed earnings of certain foreign subsidiaries that is payable over eight years. U.S. Tax Reform also made changes to the U.S. tax code that have impacted 2018 and will impact future years, including, but not limited to, (i) reduction of the U.S. federal statutory corporate tax rate; (ii) elimination of the corporate alternative minimum tax; (iii) the creation of the base erosion anti-abuse tax, a new minimum tax; (iv) a general elimination of U.S. federal income taxes on dividends from foreign subsidiaries; (v) a new provision designed to tax global intangible low-taxed income ("GILTI"), which allows for the possibility of using foreign tax credits and a deduction of up to 50 percent to offset the income tax liability (subject to some limitations); (vi) a new limitation on deductible interest expense; (vii) the repeal of the U.S. production activity deduction; (viii) limitations on the deductibility of certain executive compensation; (ix) limitations on the use of foreign tax credits to reduce the U.S. income tax liability; (x) a reduction in the dividends received deduction from 70% to 50% (in the case of less-than-20%-owned subsidiaries) and from 80% to 65% (in the case of less-than-80%-owned subsidiaries); and (xi) limitations on net operating losses generated after December 31, 2017 to 80 percent of taxable income.

Also, in 2017, the Securities and Exchange Commission issued guidance on accounting for the tax effects of U.S. Tax Reform and provided a one-year measurement period for companies to complete the accounting. The Company's initial analysis of the impact of U.S. Tax Reform resulted in an incremental tax expense of $22.2 million recorded during the fourth quarter of 2017. U.S. Tax Reform reduced the U.S. federal statutory corporate tax rate from 35% to 21% effective January 1, 2018. Consequently, the Company recorded a decrease in U.S. net deferred tax assets of approximately $4.5 million with a corresponding net adjustment to deferred income tax expense during the fourth quarter of 2017. This initial estimate was not adjusted during 2018. The Transition Tax is a tax on previously untaxed accumulated and current earnings and profits of certain of the Company's foreign subsidiaries as of either the November 2, 2017 or December 31, 2017 measurement date provided within U.S. Tax Reform. The Company made a reasonable estimate of its Transition Tax and recorded a gross provisional Transition Tax obligation during the fourth quarter of 2017 of $18.4 million, or $17.8 million, net of the impact of eliminating U.S. Federal income taxes on dividends from certain foreign subsidiaries received during 2017.

Subsequent to numerous temporary regulations, notices, and other formal guidance published by the Internal Revenue Service ("IRS"), U.S. Treasury, and various state taxing authorities in 2018, the Company completed its accounting for the tax effects of U.S. Tax Reform as of December 22, 2018 and refined the total incremental tax expense related to U.S. Tax Reform to approximately $28.0 million. Based on proposed regulations published by the U.S. federal and state taxing authorities, the Company recorded a $2.5 million tax benefit to adjust its net Transition Tax to $15.3 million. The Company elected to pay its Transition Tax in installments over eight years as provided for in U.S. Tax Reform. In addition, the Company recorded deferred income tax expense of $0.3 million in 2018 related to the deductibility of certain executive compensation based on formal guidance issued by the IRS in 2018. As a result of the impacts from U.S. Tax Reform, the Company re-evaluated its global cash strategy resulting in a change to its indefinite reinvestment assertion attributable to a portion of its undistributed foreign earnings and recognized a deferred tax liability and corresponding deferred tax expense of $7.9 million, which primarily represents the Company's estimate of the non-U.S. income taxes the Company will incur to ultimately remit those earnings to the U.S. The Company's reinvestment assertions are further explained below.

Taxes on income before equity in net income of associated companies for the years ended December 31, 2018, 2017 and 2016 are as follows:

	2018	2017	2016
Current:			
Federal	$ 6,583	$ 21,265	$ 4,680
State	(1,844)	2,529	518
Foreign	12,114	14,105	12,540
	16,853	37,899	17,738
Deferred:			
Federal	7,859	6,889	4,601
State	(173)	(36)	104
Foreign	511	(3,099)	783
Total	$ 25,050	$ 41,653	$ 23,226

The components of earnings before income taxes for the years ended December 31, 2018, 2017 and 2016 are as follows:

	2018	2017	2016
U.S.	$ 27,387	$ 10,468	$ 31,175
Foreign	55,711	50,200	52,834
Total	$ 83,098	$ 60,668	$ 84,009

Total deferred tax assets and liabilities are composed of the following as of December 31, 2018 and 2017:

	2018	2017
Retirement benefits	$ 3,532	$ 5,472
Allowance for doubtful accounts	1,160	1,134
Insurance and litigation reserves	396	497
Postretirement benefits	896	1,056
Supplemental retirement benefits	2,862	2,679
Performance incentives	4,347	3,779
Equity-based compensation	753	1,071
Insurance settlement	4,374	4,581
Operating loss carryforward	8,434	8,602
Foreign tax credit and other credits	1,929	3,043
Uncertain tax positions	(400)	(410)
Other	2,645	2,816
	30,928	34,320
Valuation allowance	(7,520)	(7,401)
Total deferred tax assets, net	$ 23,408	$ 26,919
Depreciation	4,049	4,444
Foreign pension and other	1,062	1,295
Amortization and other	13,497	15,373
Unremitted Earnings	7,857	—
Total deferred tax liabilities	$ 26,465	$ 21,112

The following are the changes in the Company's deferred tax asset valuation allowance for the years ended December 31, 2018, 2017 and 2016:

	Balance at Beginning of Period	Additional Valuation Allowance	Allowance Utilization and Other	Effect of Exchange Rate Changes	Balance at End of Period
Valuation Allowance					
Year ended December 31, 2018	$ 7,401	$ 650	$ (471)	$ (60)	$ 7,520
Year ended December 31, 2017	$ 6,344	$ 1,127	$ (61)	$ (9)	$ 7,401
Year ended December 31, 2016	$ 6,259	$ 294	$ (187)	$ (22)	$ 6,344

The Company's net deferred tax assets and liabilities are classified in the Consolidated Balance Sheets as of December 31, 2018 and 2017 as follows:

	2018	2017
Non-current deferred tax assets	$ 6,946	$ 15,460
Non-current deferred tax liabilities	10,003	9,653
Net deferred tax (liability) asset	$ (3,057)	$ 5,807

The following is a reconciliation of income taxes at the Federal statutory rate with income taxes recorded by the Company for the years ended December 31, 2018, 2017 and 2016:

	2018	2017	2016
Income tax provision at the Federal statutory tax rate	$ 17,458	$ 21,229	$ 29,403
Unremitted Earnings	7,857	—	—
Transition Tax	(3,118)	18,388	—
Revaluation of U.S. deferred tax assets and liabilities	—	4,470	—
Global intangible low taxed income	1,211	—	—
Foreign derived intangible income	(1,034)	—	—
Non-deductible acquisition expenses	1,019	4,779	696
Share-based compensation	259	(1,419)	—
Differences in tax rates on foreign earnings and remittances	1,081	(2,663)	(2,862)
Foreign dividends	—	—	2,939
Excess foreign tax credit utilization	—	(2,761)	(5,493)
Research and development activities credit utilization	(230)	(235)	(238)
Uncertain tax positions	(79)	(651)	(833)
U.S. domestic production activities deduction	—	(1,155)	(875)
State income tax provisions, net	196	569	357
Non-deductible entertainment and business meals expense	415	248	238
Miscellaneous items, net	15	854	(106)
Taxes on income before equity in net income of associated companies	$ 25,050	$ 41,653	$ 23,226

As of December 31, 2018, the Company had a net deferred tax liability of $2.0 million in the U.S. In addition, the Company has foreign tax loss carryforwards of $6.6 million of which none will expire through 2023, and $0.6 million expires thereafter. The remaining foreign tax losses have no expiration dates. A partial valuation allowance has been established with respect to the tax benefit of these losses for $0.4 million.

Pursuant to U.S. Tax Reform, specifically the Transition Tax, the Company has recorded a charge for U.S. income taxes on its undistributed earnings of non-U.S. subsidiaries; however, the Company could be subject to other taxes, such as withholding taxes and dividend distribution taxes if these undistributed earnings are ultimately remitted to the U.S. As a result of the impacts from U.S. Tax reform, the Company re-evaluated its global cash strategy, resulting in a change to its indefinite reinvestment assertion attributable to a portion of its undistributed foreign earnings, and recognized a deferred tax liability and corresponding deferred tax expense of $7.9 million as of December 31, 2018, which primarily represents the Company's estimate of the non-U.S. taxes the Company will incur to ultimately remit these earnings to the U.S. It is the Company's current intention to reinvest its additional undistributed earnings of non-U.S. subsidiaries to support working capital needs and certain other growth initiatives. The amount of such undistributed earnings at December 31, 2018 was approximately $210.0 million. Any tax liability which might result from ultimate remittance of these earnings is expected to be substantially offset by foreign tax credits (subject to certain limitations). It is currently impractical to estimate any such incremental tax expense.

As of December 31, 2018, the Company's cumulative liability for gross unrecognized tax benefits was $7.1 million. The Company had accrued approximately $0.8 million for cumulative penalties and $0.6 million for cumulative interest as of December 31, 2018. As of December 31, 2017, the Company's cumulative liability for gross unrecognized tax benefits was $6.8 million. The Company had accrued approximately $1.0 million for cumulative penalties and $0.6 million for cumulative interest as of December 31, 2017.

The Company continues to recognize interest and penalties associated with uncertain tax positions as a component of tax expense on income before equity in net income of associated companies in its Consolidated Statements of Income. The Company recognized a credit of $0.2 million for penalties and an expense of $0.1 million for interest (net of expirations and settlements) in its Consolidated Statement of Income for the year ended December 31, 2018, a credit of $0.7 million for penalties and a credit of $0.2 million for interest (net of expirations and settlements) in its Consolidated Statement of Income for the year ended December 31, 2017, and a credit of $0.2 million for penalties and a credit of $0.7 million for interest (net of expirations and settlements) in its Consolidated Statement of Income for the year ended December 31, 2016.

The Company estimates that during the year ending December 31, 2019, it will reduce its cumulative liability for gross unrecognized tax benefits by approximately $0.9 million due to the expiration of the statute of limitations with regard to certain tax positions. This estimated reduction in the cumulative liability for unrecognized tax benefits does not consider any increase in liability for unrecognized tax benefits with regard to existing tax positions or any increase in cumulative liability for unrecognized tax benefits with regard to new tax positions for the year ending December 31, 2019. A reconciliation of the beginning and ending amounts of unrecognized tax benefits for the years ended December 31, 2018, 2017 and 2016, respectively, is as follows:

	2018	2017	2016
Unrecognized tax benefits as of January 1	$ 6,761	$ 6,240	$ 11,032
Decrease in unrecognized tax benefits taken in prior periods	(183)	(308)	(869)
Increase in unrecognized tax benefits taken in current period	2,023	2,347	1,921
Decrease in unrecognized tax benefits due to lapse of statute of limitations	(1,292)	(2,116)	(5,744)
(Decrease) increase due to foreign exchange rates	(259)	598	(100)
Unrecognized tax benefits as of December 31	$ 7,050	$ 6,761	$ 6,240

The amount of unrecognized tax benefits above that, if recognized, would impact the Company's tax expense and effective tax rate is $2.2 million, $2.2 million and $1.8 million for the years ended December 31, 2018, 2017 and 2016, respectively.

The Company and its subsidiaries are subject to U.S. Federal income tax, as well as the income tax of various state and foreign tax jurisdictions. Tax years that remain subject to examination by major tax jurisdictions include Brazil from 2000, Italy from 2007, the Netherlands from 2012, the United Kingdom and Mexico from 2013, Spain and China from 2014, India from fiscal year beginning April 1, 2016 and ending March 31, 2017, the U.S. from 2015, and various U.S. state tax jurisdictions from 2009.

As previously reported, the Italian tax authorities have assessed additional tax due from the Company's subsidiary, Quaker Italia S.r.l., relating to the tax years 2007 through 2013. The Company has filed for competent authority relief from these assessments under the Mutual Agreement Procedures ("MAP") of the Organization for Economic Co-Operation and Development for all years except 2007. During the second quarter of 2018, the Italian tax authorities assessed additional tax due from Quaker Italia, S.r.l., relating to the tax years 2014 and 2015. The Company met with the Italian tax authorities in the fourth quarter of 2018 to discuss these assessments and no resolution was agreed upon, so the Company filed an appeal with the first level of tax court in Italy. If the appeal is not successful in materially reducing the assessed tax, then the Company will further evaluate its options including potentially filing for competent authority relief from these assessments under MAP, consistent with the Company's previous filings for 2008 through 2013. As of December 31, 2018, the Company believes it has adequate reserves for uncertain tax positions with respect to these and all other audits.

Note 10 – Earnings Per Share

The following table summarizes earnings per share calculations for the years ended December 31, 2018, 2017 and 2016:

	2018	2017	2016
Basic earnings per common share			
Net income attributable to Quaker Chemical Corporation	$ 59,473	$ 20,278	$ 61,403
Less: income allocated to participating securities	(253)	(137)	(515)
Net income available to common shareholders	$ 59,220	$ 20,141	$ 60,888
Basic weighted average common shares outstanding	13,268,047	13,204,872	13,136,138
Basic earnings per common share	$ 4.46	$ 1.53	$ 4.64
Diluted earnings per common share			
Net income attributable to Quaker Chemical Corporation	$ 59,473	$ 20,278	$ 61,403
Less: income allocated to participating securities	(252)	(137)	(514)
Net income available to common shareholders	$ 59,221	$ 20,141	$ 60,889
Basic weighted average common shares outstanding	13,268,047	13,204,872	13,136,138
Effect of dilutive securities	36,685	41,074	24,331
Diluted weighted average common shares outstanding	13,304,732	13,245,946	13,160,469
Diluted earnings per common share	$ 4.45	$ 1.52	$ 4.63

Certain stock options and restricted stock units are not included in the diluted earnings per share calculation since the effect would have been anti-dilutive. The calculated amount of anti-diluted shares not included were 1,808 in 2018, 3,671 in 2017 and 678 in 2016.

Note 11 – Restricted Cash

The Company has restricted cash recorded in Other assets related to proceeds from an inactive subsidiary of the Company which previously executed separate settlement and release agreements with two of its insurance carriers for an original total value of $35.0 million. The proceeds of both settlements are restricted and can only be used to pay claims and costs of defense associated with the subsidiary's asbestos litigation. The proceeds of the settlement and release agreements have been deposited into interest bearing accounts which earned $0.2 million and less than $0.1 million in the years ended December 31, 2018 and 2017, respectively, offset by $1.1 million and $0.8 million of net payments in 2018 and 2017, respectively. Due to the restricted nature of the proceeds, a corresponding deferred credit was established in Other non-current liabilities for an equal and offsetting amount, and will remain until the restrictions lapse or the funds are exhausted via payments of claims and costs of defense. See also Notes 17, 21 and 25 of Notes to Consolidated Financial Statements.

The following table provides a reconciliation of cash, cash equivalents and restricted cash as December 31, 2018, 2017, 2016 and 2015:

	2018	2017	2016	2015
Cash and cash equivalents	$ 104,147	$ 89,879	$ 88,818	$ 81,053
Restricted cash included in other assets	20,278	21,171	21,883	22,874
Cash, cash equivalents and restricted cash	$ 124,425	$ 111,050	$ 110,701	$ 103,927

Note 12 – Accounts Receivable and Allowance for Doubtful Accounts

As of December 31, 2018 and 2017, the Company had gross trade accounts receivable totaling $207.3 million and $213.8 million with trade accounts receivable greater than 90 days past due of $13.2 million and $15.2 million, respectively. The following are changes in the allowance for doubtful accounts during the years ended December 31, 2018, 2017 and 2016:

	Balance at Beginning of Period	Changes to Costs and Expenses	Write-Offs Charged to Allowance	Exchange Rate Changes and Other Adjustments	Balance at End of Period
Allowance for Doubtful Accounts					
Year ended December 31, 2018	$ 5,457	$ 493	$ (295)	$ (468)	$ 5,187
Year ended December 31, 2017	$ 7,220	$ 137	$ (2,206)	$ 306	$ 5,457
Year ended December 31, 2016	$ 7,818	$ 1,375	$ (1,949)	$ (24)	$ 7,220

Included in exchange rate changes and other adjustments for the year ended December 31, 2018 is a reclassification of $0.3 million to Other assets related to certain customer receivables due greater than a year. There were no similar adjustments in 2017 or 2016. Included in write-offs charged to allowance during the years ended December 31, 2017 and 2016 were outstanding receivables related to certain prior year customer bankruptcies, which the Company previously reserved for, but settled during 2017 and 2016, respectively. Included in December 31, 2016 is an allowance for doubtful accounts of less than $0.1 million acquired in 2017 business acquisitions. There were no similar adjustments in 2018 or 2017.

Note 13 – Inventories

Inventories, net, as of December 31, 2018 and 2017 were as follows:

	2018	2017
Raw materials and supplies	$ 48,134	$ 44,439
Work in process, finished goods and reserves	45,956	42,782
Total inventories, net	$ 94,090	$ 87,221

Note 14 – Property, Plant and Equipment

Property, plant and equipment as of December 31, 2018 and 2017 were as follows:

	2018	2017
Land	$ 10,170	$ 10,635
Building and improvements	84,980	87,111
Machinery and equipment	151,180	153,312
Construction in progress	7,907	4,932
Property, Plant and Equipment, at cost	254,237	255,990
Less accumulated depreciation	(170,314)	(169,286)
Total Property, Plant and Equipment, net	$ 83,923	$ 86,704

As of December 31, 2018, property, plant and equipment include less than $0.1 million of a capital lease asset and future minimum lease payments in the Company's Asia/Pacific segment.

Note 15 – Goodwill and Other Intangible Assets

The Company completes its annual goodwill impairment test during the fourth quarter of each year, or more frequently if triggering events indicate a possible impairment in one or more of its reporting units. The Company continually evaluates financial performance, economic conditions and other relevant developments in assessing if an interim period impairment test for one or more of its reporting units is necessary. The Company completed its annual impairment assessment during the fourth quarter of 2018 and no impairment charge was warranted. In addition, the Company has recorded no impairment charges in its past.

Changes in the carrying amount of goodwill for the years ended December 31, 2018 and 2017 were as follows:

	North America	EMEA	Asia/Pacific	South America	Total
Balance as of December 31, 2016	$ 45,490	$ 18,189	$ 14,566	$ 2,559	$ 80,804
Goodwill additions	1,832	—	—	—	1,832
Currency translation adjustments	249	2,315	890	(56)	3,398
Balance as of December 31, 2017	47,571	20,504	15,456	2,503	86,034
Currency translation adjustments	(268)	(1,169)	(869)	(395)	(2,701)
Balance as of December 31, 2018	$ 47,303	$ 19,335	$ 14,587	$ 2,108	$ 83,333

Gross carrying amounts and accumulated amortization for definite-lived intangible assets as of December 31, 2018 and 2017 were as follows:

	Gross Carrying Amount		Accumulated Amortization	
	2018	2017	2018	2017
Customer lists and rights to sell	$ 74,989	$ 76,581	$ 29,587	$ 25,394
Trademarks, formulations and product technology	33,275	33,025	16,469	14,309
Other	5,840	6,114	5,566	5,514
Total definite-lived intangible assets	$ 114,104	$ 115,720	$ 51,622	$ 45,217

The Company recorded $7.3 million, $7.4 million and $7.0 million of amortization expense during the years ended December 31, 2018, 2017 and 2016, respectively. Estimated annual aggregate amortization expense for the subsequent five years is as follows:

For the year ended December 31, 2019	$ 7,160
For the year ended December 31, 2020	6,879
For the year ended December 31, 2021	6,529
For the year ended December 31, 2022	6,374
For the year ended December 31, 2023	6,155

The Company has two indefinite-lived intangible assets totaling $1.1 million for trademarks as of December 31, 2018 and 2017.

Note 16 – Investments in Associated Companies

As of December 31, 2018, the Company held a 50% investment in and had significant influence over Nippon Quaker Chemical, Ltd. (Japan) and Kelko Quaker Chemical, S.A. (Panama) and held a 33% investment in and had significant influence over Primex, Ltd. (Barbados). The carrying amount of the Company's equity investments as of December 31, 2018 was $21.3 million, which includes its investments of $14.7 million in Primex, Ltd. (Barbados); $6.2 million in Nippon Quaker Chemical, Ltd. (Japan); and $0.4 million in Kelko Quaker Chemical, S.A. (Panama).

The Company has a 50-50 joint venture in a Venezuelan affiliate, Kelko Venezuela. Due to heightened foreign exchange controls, current economic circumstances and other restrictions in Venezuela, during the third quarter of 2018 the Company concluded that it no longer had significant influence over this affiliate. Prior to this determination, the Company historically accounted for this affiliate under the equity method. As of December 31, 2018, the Company has no remaining carrying value for its investment in Kelko Venezuela.

Summarized financial information of Nippon Quaker Chemical, Ltd. (Japan) and Kelko Quaker Chemical, S.A. (Panama) for 2018 and Nippon Quaker Chemical, Ltd. (Japan), Kelko Quaker Chemical, S.A. (Panama) and Kelko Quaker Chemical, S.A. (Venezuela) for 2017 and 2016, in the aggregate, is as follows:

	As of December 31,	
	2018	**2017**
Current assets	$ 43,581	$ 37,683
Noncurrent assets	990	936
Current liabilities	29,632	24,858
Noncurrent liabilities	1,685	1,457

	Year Ended December 31,		
	2018	**2017**	**2016**
Net sales	$ 43,875	$ 42,555	$ 41,448
Gross margin	12,983	13,440	13,082
Income before income taxes	2,494	2,900	2,289
Net income	1,874	1,471	1,210

Summarized financial information of Primex, Ltd. is as follows:

	As of December 31,	
	2018	**2017**
Total assets	$ 103,705	$ 120,154
Total liabilities	53,049	54,258

	Year Ended December 31,		
	2018	**2017**	**2016**
Revenue	$ 5,841	$ 14,042	$ 5,632
Income before income taxes	3,688	11,705	5,622
Net income	2,954	7,788	5,148

Note 17 – Other Assets

Other assets as of December 31, 2018 and 2017 were as follows:

	2018	**2017**
Restricted insurance settlement	$ 20,278	$ 21,171
Uncertain tax positions	4,861	4,543
Supplemental retirement income program	1,491	1,594
Pension assets	3,656	1,184
Other	1,769	1,557
Total other assets	$ 32,055	$ 30,049

As of December 31, 2018 and 2017, one of the Company's U.S. pension plan's fair value of plan assets exceeded its gross benefit obligation and was therefore over-funded, which is represented by the line Pension assets in the table above. See also Note 20 of Notes to Consolidated Financial Statements.

Note 18 – Other Current Liabilities

Other current liabilities as of December 31, 2018 and 2017 were as follows:

	2018	2017
Non-income taxes	$ 8,462	$ 9,196
Accrued interest	4,340	884
Professional fees	3,831	5,019
Selling expenses	3,582	2,846
Freight	2,188	1,780
Customer advances and sales return reserves	2,187	1,507
Current income taxes payable	1,358	841
Legal	1,067	1,169
Accrued rent and facilities	763	775
Other	3,330	3,304
Total other current liabilities	$ 31,108	$ 27,321

Note 19 – Debt

Debt as of December 31, 2018 and 2017 includes the following:

	2018	2017
Credit facilities	$ 24,034	$ 48,514
Industrial development bonds	10,000	15,000
Municipality-related loans	2,549	3,290
Other debt obligations (including capital leases)	21	—
Total debt	36,604	66,804
Current portion of long-term debt	(670)	(5,736)
Long-term debt	$ 35,934	$ 61,068

Credit facilities

The Company's primary credit facility ("the Credit Facility") is a $300.0 million syndicated multicurrency credit agreement with a group of lenders. The maximum amount available under the Credit Facility can be increased to $400.0 million at the Company's option if the lenders agree and the Company satisfies certain conditions. Borrowings under the Credit Facility generally bear interest at a base rate or LIBOR rate plus a margin. The Credit Facility has certain financial and other covenants, with the key financial covenant requiring that the Company's consolidated total debt to adjusted EBITDA ratio cannot exceed 3.50 to 1. As of December 31, 2018 and 2017, the Company's consolidated total debt to adjusted EBITDA ratio was below 1.0 to 1, and the Company was also in compliance with all of its other covenants. During the fourth quarter of 2018, the Credit Facility was amended and restated to extend the maturity date to March 15, 2020. As of December 31, 2018 and 2017, the Company had total credit facility borrowings of $24.0 million and $48.5 million, primarily under the Credit Facility, at weighted average borrowing rates of 1.00% and 1.88%, respectively.

Industrial development bonds

As of December 31, 2018 and 2017, the Company had a fixed rate, industrial development authority bond for $10.0 million due in 2028 and bearing interest at a rate of 5.26%. As of December 31, 2017, the Company also had a $5.0 million industrial development authority bond bearing interest at a rate of 5.60%, which matured and was paid off during the fourth quarter of 2018. These bonds have similar covenants to the Credit Facility, noted above.

Municipality-related loans

As part of a past expansion project at the Company's Middletown, Ohio facility, it agreed to a low interest rate $3.5 million loan with the Ohio Department of Development. Principal repayment on this loan began in September 2010 with its final maturity being in February 2021. The current interest rate of 2% will rise to 3% beginning March 2019 until final maturity. As of December 31, 2018 and 2017, there was $0.8 million and $1.1 million, respectively, outstanding on this loan.

The Company's Verkol S.A.U. ("Verkol") subsidiary has certain loans issued by the local government which are either interest-free or bear interest at a subsidized rate. These loans mature periodically, with the last maturity occurring in 2028. The Company records these loans at fair value based on market interest rates on the date of acquisition and continues to measure the loans at amortized cost, recognizing the implicit interest incurred. As of December 31, 2018 and 2017, there was $1.8 million and $2.2 million, respectively, outstanding for these loans.

During the next five years, payments on the Company’s debt are due as follows:

2019	$	670
2020		24,730
2021		398
2022		270
2023		240

As of December 31, 2018 and 2017, the amounts at which the Company’s debt is recorded are not materially different from their fair market value.

Note 20 – Pension and Other Postretirement Benefits

The following table shows the Company’s plans’ funded status reconciled with amounts reported in the Consolidated Balance Sheets as of December 31, 2018 and 2017:

	Pension Benefits						Other Post-Retirement Benefits	
	2018			2017			2018	2017
Change in benefit obligation	**Foreign**	**U.S.**	**Total**	**Foreign**	**U.S.**	**Total**	**U.S.**	**U.S.**
Gross benefit obligation at beginning of year	$ 118,352	$ 62,977	$ 181,329	$ 103,491	$ 67,254	$ 170,745	$ 4,729	$ 4,730
Service cost	3,426	383	3,809	3,219	337	3,556	7	8
Interest cost	2,254	1,847	4,101	2,066	1,932	3,998	130	144
Employee contributions	73	—	73	68	—	68	—	—
Plan settlements	(10)	—	(10)	—	(4,341)	(4,341)	—	—
Benefits paid	(1,639)	(4,330)	(5,969)	(2,503)	(4,031)	(6,534)	(317)	(448)
Plan expenses and premiums paid	(161)	—	(161)	(210)	—	(210)	—	—
Actuarial (gain) loss	(5,561)	(2,143)	(7,704)	(1,164)	1,826	662	(443)	295
Translation differences and other	(5,418)	—	(5,418)	13,385	—	13,385	—	—
Gross benefit obligation at end of year	$ 111,316	$ 58,734	$ 170,050	$ 118,352	$ 62,977	$ 181,329	$ 4,106	$ 4,729
Change in plan assets								
Fair value of plan assets at year beginning of year	$ 98,622	$ 51,964	$ 150,586	$ 86,844	$ 49,197	$ 136,041	$ —	$ —
Actual return on plan assets	(2,670)	457	(2,213)	116	6,865	6,981	—	—
Employer contributions	5,269	1,574	6,843	2,867	4,574	7,441	317	448
Employee contributions	73	—	73	68	—	68	—	—
Plan settlements	(10)	—	(10)	—	(4,341)	(4,341)	—	—
Benefits paid	(1,639)	(4,330)	(5,969)	(2,503)	(4,031)	(6,534)	(317)	(448)
Plan expenses and premiums paid	(161)	(250)	(411)	(210)	(300)	(510)	—	—
Translation differences	(4,658)	—	(4,658)	11,440	—	11,440	—	—
Fair value of plan assets at end of year	$ 94,826	$ 49,415	$ 144,241	$ 98,622	$ 51,964	$ 150,586	$ —	$ —
Net benefit obligation recognized	$ (16,490)	$ (9,319)	$ (25,809)	$ (19,730)	$ (11,013)	$ (30,743)	$ (4,106)	$ (4,729)
Amounts recognized in the balance sheet consist of:								
Non-current assets	$ —	$ 3,656	$ 3,656	$ —	$ 1,184	$ 1,184	$ —	$ —
Current liabilities	(206)	(559)	(765)	(89)	(560)	(649)	(446)	(459)
Non-current liabilities	(16,284)	(12,416)	(28,700)	(19,641)	(11,637)	(31,278)	(3,660)	(4,270)
Net benefit obligation recognized	$ (16,490)	$ (9,319)	$ (25,809)	$ (19,730)	$ (11,013)	$ (30,743)	$ (4,106)	$ (4,729)
Amounts not yet reflected in net periodic benefit costs and included in accumulated other comprehensive loss:								
Prior service credit (cost)	$ 1,497	$ —	$ 1,497	$ 1,744	$ (59)	$ 1,685	$ —	$ —
Accumulated loss	(20,089)	(25,310)	(45,399)	(22,598)	(27,133)	(49,731)	(338)	(823)
AOCI	(18,592)	(25,310)	(43,902)	(20,854)	(27,192)	(48,046)	(338)	(823)
Cumulative employer contributions in excess of or (below) net periodic benefit cost	2,102	15,991	18,093	1,124	16,179	17,303	(3,768)	(3,906)
Net benefit obligation recognized	$ (16,490)	$ (9,319)	$ (25,809)	$ (19,730)	$ (11,013)	$ (30,743)	$ (4,106)	$ (4,729)

The accumulated benefit obligation for all defined benefit pension plans was $165.3 million ($57.6 million U.S. and $107.7 million Foreign) and $176.3 million ($62.2 million U.S. and approximately $114.1 million Foreign) as of December 31, 2018 and 2017, respectively.

Information for pension plans with an accumulated benefit obligation in excess of plan assets:

	2018			2017		
	Foreign	U.S.	Total	Foreign	U.S.	Total
Projected benefit obligation	$ 111,316	$ 12,975	$ 124,291	$ 118,352	$ 12,197	$ 130,549
Accumulated benefit obligation	107,685	11,808	119,493	114,069	11,456	125,525
Fair value of plan assets	94,826	—	94,826	98,622	—	98,622

Information for pension plans with a projected benefit obligation in excess of plan assets:

	2018			2017		
	Foreign	U.S.	Total	Foreign	U.S.	Total
Projected benefit obligation	$ 111,316	$ 12,975	$ 124,291	$ 118,352	$ 12,197	$ 130,549
Fair value of plan assets	94,826	—	94,826	98,622	—	98,622

Components of net periodic benefit costs – pension plans:

	2018			2017		
	Foreign	U.S.	Total	Foreign	U.S.	Total
Service cost	$ 3,426	$ 383	$ 3,809	$ 3,219	$ 337	$ 3,556
Interest cost	2,254	1,847	4,101	2,066	1,932	3,998
Expected return on plan assets	(2,228)	(2,803)	(5,031)	(1,994)	(3,067)	(5,061)
Settlement loss	2	—	2	—	1,946	1,946
Actuarial loss amortization	881	2,276	3,157	862	2,396	3,258
Prior service (credit) cost amortization	(175)	59	(116)	(167)	63	(104)
Net periodic benefit cost	$ 4,160	$ 1,762	$ 5,922	$ 3,986	$ 3,607	$ 7,593

	2016		
	Foreign	U.S.	Total
Service cost	$ 2,378	$ 298	$ 2,676
Interest cost	2,314	2,114	4,428
Expected return on plan assets	(2,026)	(3,316)	(5,342)
Actuarial loss amortization	839	2,336	3,175
Prior service (credit) cost amortization	(164)	63	(101)
Net periodic benefit cost	$ 3,341	$ 1,495	$ 4,836

Other changes recognized in other comprehensive income – pension plans:

	2018			2017		
	Foreign	U.S.	Total	Foreign	U.S.	Total
Net (gain) loss arising during the period	$ (663)	$ 453	$ (210)	$ 715	$ (1,672)	$ (957)
Recognition of amortization in net periodic benefit cost						
Prior service credit (cost)	175	(59)	116	167	(63)	104
Actuarial loss	(883)	(2,276)	(3,159)	(862)	(4,342)	(5,204)
Effect of exchange rates on amounts included in AOCI	(890)	—	(890)	2,308	—	2,308
Total recognized in other comprehensive (income) loss	(2,261)	(1,882)	(4,143)	2,328	(6,077)	(3,749)
Total recognized in net periodic benefit cost and other comprehensive loss (income)	$ 1,899	$ (120)	$ 1,779	$ 6,314	$ (2,470)	$ 3,844

	2016		
	Foreign	U.S.	Total
Net gain arising during period	$ 2,401	$ 3,576	$ 5,977
Recognition of amortization in net periodic benefit			
Prior service credit (cost)	164	(63)	101
Actuarial loss	(839)	(2,336)	(3,175)
Effect of exchange rates on amounts included in AOCI	(1,347)	—	(1,347)
Total recognized in other comprehensive loss	379	1,177	1,556
Total recognized in net periodic benefit cost and other comprehensive loss	$ 3,720	$ 2,672	$ 6,392

Components of net periodic benefit costs – other postretirement plan:

	2018	2017	2016
Service cost	$ 7	$ 8	$ 10
Interest cost	130	144	142
Actuarial loss amortization	42	54	—
Net periodic benefit costs	$ 179	$ 206	$ 152

Other changes recognized in other comprehensive income – other postretirement benefit plans:

	2018	2017	2016
Net (gain) loss arising during period	$ (443)	$ 295	$ (401)
Amortization of actuarial loss in net periodic benefit costs	(42)	(54)	—
Total recognized in other comprehensive (income) loss	(485)	241	(401)
Total recognized in net periodic benefit cost and other comprehensive (income) loss	$ (306)	$ 447	$ (249)

Estimated amounts that will be amortized from accumulated other comprehensive loss over the next fiscal year:

	Pension Plans			Other Post-Retirement
	Foreign	U.S.	Total	Benefits
Actuarial loss	$ 769	$ 2,330	$ 3,099	$ —
Prior service credit	(169)	—	(169)	—
	$ 600	$ 2,330	$ 2,930	$ —

Weighted-average assumptions used to determine benefit obligations as of December 31, 2018 and 2017:

	Pension Benefits		Other Postretirement Benefits	
	2018	2017	2018	2017
U.S. Plans:				
Discount rate	4.07%	3.44%	4.03%	3.39%
Rate of compensation increase	3.63%	3.63%	N/A	N/A
Foreign Plans:				
Discount rate	2.47%	2.31%	N/A	N/A
Rate of compensation increase	2.89%	2.89%	N/A	N/A

Weighted-average assumptions used to determine net periodic benefit costs for the years ended December 31, 2018 and 2017:

	Pension Benefits		Other Postretirement Benefits	
	2018	2017	2018	2017
U.S. Plans:				
Discount rate	3.44%	3.88%	3.39%	3.73%
Expected long-term return on plan assets	5.95%	7.00%	N/A	N/A
Rate of compensation increase	3.63%	3.63%	N/A	N/A
Foreign Plans:				
Discount rate	2.33%	2.17%	N/A	N/A
Expected long-term return on plan assets	2.22%	2.12%	N/A	N/A
Rate of compensation increase	2.89%	2.48%	N/A	N/A

The long-term rates of return on assets were selected from within the reasonable range of rates determined by (a) historical real returns for the asset classes covered by the investment policy and (b) projections of inflation over the long-term period during which benefits are payable to plan participants. See Note 1 of Notes to Consolidated Financial Statements for further information.

Assumed health care cost trend rates as of December 31, 2018 and 2017:

	2018	2017
Health care cost trend rate for next year	6.20%	6.40%
Rate to which the cost trend rate is assumed to decline (the ultimate trend rate)	4.50%	4.50%
Year that the rate reaches the ultimate trend rate	2037	2037

Assumed health care cost trend rates could have a significant effect on the amounts reported for the health care plans. A one-percentage-point change in assumed health care cost trend rates would have the following effects:

	1% Point Increase	1% Point Decrease
Effect on total service and interest cost	$ 11	$ (9)
Effect on postretirement benefit obligations	299	(311)

Plan Assets and Fair Value

The Company's pension plan target asset allocation and the weighted-average asset allocations as of December 31, 2018 and 2017 by asset category were as follows:

Asset Category	Target	2018	2017
U.S. Plans			
Equity securities	10%	9%	59%
Debt securities	89%	90%	40%
Other	1%	1%	1%
Total	100%	100%	100%
Foreign Plans			
Equity securities and other	24%	24%	25%
Debt securities	76%	76%	75%
Total	100%	100%	100%

During the year ended December 31, 2018, the Company elected to adjust its U.S. Plans' asset allocation along a glide path based on the funded status of the U.S. Plan. As funded status improved, the assets were allocated more heavily to debt securities with lengthened duration to match projected liability movements.

As of December 31, 2018 and 2017, "Other" consisted principally of cash and cash equivalents (approximately 1% of plan assets in each respective period).

The following is a description of the valuation methodologies used for the investments measured at fair value, including the general classification of such instruments pursuant to the valuation hierarchy, where applicable:

Cash and Cash Equivalents

Cash and cash equivalents consist of cash and money market funds and are classified as Level 1 investments.

Common Stock

Common stock is valued based on quoted market prices on an exchange in an active market and is classified as Level 1 investments.

Commingled Funds

Investments in the U.S. pension plan and foreign pension plan commingled funds represent pooled institutional investments, including primarily collective investment trusts. These commingled funds are not available on an exchange or in an active market and these investments are valued using their net asset value ("NAV"), which is generally based on the underlying asset values of the pooled investments held in the trusts.

As of December 31, 2018, the U.S. pension plan commingled funds included approximately 10 percent of investments in equity securities and 90 percent of investments in fixed income securities. As of December 31, 2018, foreign pension plan commingled funds included approximately 30 percent of investments in equity securities, 60 percent of investments in fixed income securities, and 10 percent of other non-related investments, primarily real estate.

Pooled Separate Accounts

Investments in the U.S. pension plan pooled separate accounts consist of insurance annuity contracts and are valued based on the reported unit value at year end. Units of the pooled separate account are not traded on an exchange or in an active market and these investments are valued using their NAV.

Insurance Contract

Investments in the foreign pension plan insurance contract are valued at the highest value available for the Company at year end, either the reported cash surrender value of the contract or the vested benefit obligation. Both the cash surrender value and the vested benefit obligation are determined based on unobservable inputs, which are contractually or actuarially determined, regarding returns, fees, the present value of the future cash flows of the contract and benefit obligations. The contract is classified as a Level 3 investment.

Diversified Equity Securities - Registered Investment Companies

Investments in the foreign pension plans diversified equity securities of registered investment companies are based upon the quoted redemption value of shares in the fund owned by the plan at year end. The shares of the fund are not available on an exchange or in an active market; however, the fair value is determined based on the underlying investments in the fund as traded on an exchange in an active market and are classified as Level 2 investments.

Fixed Income – Foreign Registered Investment Companies

Investments in the foreign pension plans fixed income securities of foreign registered investment companies are based upon the quoted redemption value of shares in the fund owned by the plan at year end. The shares of the fund are not available on an exchange or in an active market; however, the fair value is determined based on the underlying investments in the fund as traded on an exchange in an active market and are classified as Level 2 investments.

Real Estate

The foreign pension plan's investment in real estate consists of an investment in a property fund. The fund's underlying investments consist of real property, which are valued using unobservable inputs. The property fund is classified as a Level 3 investment.

As of December 31, 2018 and 2017, the U.S. and foreign plans' investments measured at fair value on a recurring basis were as follows:

	Total Fair Value	Fair Value Measurements at December 31, 2018 Using Fair Value Hierarchy		
		Level 1	Level 2	Level 3
U.S. Pension Assets				
Cash and cash equivalents	$ 450	$ 450	$ —	$ —
Subtotal U.S. pension plan assets in fair value hierarchy	$ 450	$ 450	$ —	$ —
Commingled funds measured at NAV	48,965			
Total U.S. pension plan assets	$ 49,415			
Foreign Pension Assets				
Cash and cash equivalents	$ 209	$ 209	$ —	$ —
Insurance contract	79,873	—	—	79,873
Diversified equity securities - registered investment companies	7,701	—	7,701	—
Fixed income - foreign registered investment companies	2,658	—	2,658	—
Real estate - registered investment companies	2,382	—	—	2,382
Sub-total of foreign pension assets in fair value hierarchy	$ 92,823	$ 209	$ 10,359	$ 82,255
Commingled funds measured at NAV	2,003			
Total foreign pension assets	$ 94,826			
Total pension assets in fair value hierarchy	$ 93,273	$ 659	$ 10,359	$ 82,255
Total pension assets measured at NAV	50,968			
Total pension assets	$ 144,241			

	Total Fair Value	Fair Value Measurements at December 31, 2017 Using Fair Value Hierarchy		
		Level 1	Level 2	Level 3
U.S. Pension Assets				
Cash and cash equivalents	$ 449	$ 449	$ —	$ —
Small capitalization common stock	1,508	1,508	—	—
Subtotal U.S. pension plan assets in fair value hierarchy	$ 1,957	$ 1,957	$ —	$ —
Commingled funds measured at NAV	48,527			
Pooled separate accounts measured at NAV	1,480			
Total U.S. pension plan assets	$ 51,964			
Foreign Pension Assets				
Cash and cash equivalents	$ 26	$ 26	$ —	$ —
Insurance contract	82,092	—	—	82,092
Diversified equity securities - registered investment companies	9,002	—	9,002	—
Fixed income - foreign registered investment companies	2,951	—	2,951	—
Real estate - registered investment companies	2,428	—	—	2,428
Subtotal foreign pension assets in fair value hierarchy	$ 96,499	$ 26	$ 11,953	$ 84,520
Commingled funds measured at NAV	2,123			
Total foreign pension plan assets	$ 98,622			
Total pension assets in fair value hierarchy	$ 98,456	$ 1,983	$ 11,953	$ 84,520
Total pension assets measured at NAV	52,130			
Total pension assets	$ 150,586			

Certain investments that are measured at fair value using the NAV per share (or its equivalent) have not been classified in the fair value hierarchy. The fair value amounts presented for these investments in the preceding tables are intended to permit reconciliation of the fair value hierarchies to the line items presented in the statements of net assets available for benefits.

Changes in the fair value of the foreign plans' Level 3 investments during the years ended December 31, 2018 and 2017 were as follows:

	Insurance Contract	Real Estate Fund	Total
Balance as of December 31, 2016	$ 72,778	$ 2,041	$ 74,819
Purchases	2,350	—	2,350
Settlements	(1,661)	—	(1,661)
Unrealized (losses) gains	(1,425)	188	(1,237)
Currency translation adjustment	10,050	199	10,249
Balance as of December 31, 2017	82,092	2,428	84,520
Purchases	4,707	—	4,707
Settlements	(1,399)	—	(1,399)
Unrealized (losses) gains	(1,817)	94	(1,723)
Currency translation adjustment	(3,710)	(140)	(3,850)
Balance as of December 31, 2018	$ 79,873	$ 2,382	$ 82,255

U.S. pension assets include Company common stock in the amount of $1.5 million (3% of total U.S. plan assets) as of December 31, 2017. There was no Company common stock held in U.S. pension assets as of December 31, 2018.

During the second quarter of 2017, the Company's primary noncontributory U.S. pension plan (the "U.S. Pension Plan") offered a cash settlement to its vested terminated participants, which allowed them to receive the value of their pension benefits as a single lump sum payment. As payments from the U.S. Pension Plan for this cash out offering exceeded the service and interest cost components of the U.S. Pension Plan expense for the year ended December 31, 2017, the Company recorded a settlement charge of approximately $1.9 million. This settlement charge represented the immediate recognition into expense of a portion of the unrecognized loss within AOCI on the balance sheet in proportion to the share of the projected benefit obligation that was settled by these payments. The gross pension benefit obligation was reduced by approximately $4.0 million as a result of these payments. The settlement charge was recognized through other expense, net, on the Company's Consolidated Statements of Income.

In the fourth quarter of 2018, the Company began the process of terminating the U.S. Pension Plan after receiving Board of Director approval to do so. Prior to December 31, 2005, the U.S. Pension Plan covered substantially all employees of the Company's U.S. subsidiary who had at least one year of eligible service and had attained age 21. Effective December 31, 2005, the U.S. Pension Plan was amended to freeze benefit accruals with respect to participants who were not part of a collective bargaining unit and effective after November 30, 2013, the U.S. Pension Plan was further amended to freeze benefit accruals for the remaining members of a collective bargaining unit. U.S. Pension Plan participants will have their benefits either converted into a lump sum cash payment or an annuity contract placed with an insurance carrier. The U.S. Pension Plan is fully-funded on a U.S. GAAP basis. In order to terminate the plan in accordance with IRS and pension benefit guaranty corporation requirements, the Company will be required to fully fund the plan on a termination basis and will commit to contribute the additional assets necessary, if any, to do so. The amount necessary to do so is not yet known but is currently estimated to be between $0 and $10 million. In addition, the Company expects to record a pension settlement charge at plan termination. This settlement charge will include the immediate recognition into expense of the unrecognized losses within AOCI on the balance sheet as of the plan termination date. The Company does not have a current estimate for this future settlement charge, however, the gross AOCI related to this plan was approximately $19 million as of December 31, 2018. The Company currently estimates that the U.S. Pension Plan termination will be completed during 2020.

Cash Flows

Contributions

The Company expects to make minimum cash contributions of approximately $5.2 million to its pension plans (approximately $0.5 million U.S. and $4.7 million Foreign) and approximately $0.4 million to its other postretirement benefit plan in 2019.

Estimated Future Benefit Payments

Excluding any impact related to the U.S. Pension Plan termination process noted above, the following benefit payments, which reflect expected future service, as appropriate, are expected to be paid:

	Pension Benefits			Other Post-Retirement
	Foreign	U.S.	Total	Benefits
2019	$ 2,240	$ 4,515	$ 6,755	$ 446
2020	2,443	4,286	6,729	422
2021	3,166	4,220	7,386	393
2022	3,124	4,237	7,361	367
2023	3,336	4,860	8,196	349
2024 to 2028	19,212	22,107	41,319	1,380

The Company maintains a plan under which supplemental retirement benefits are provided to certain officers. Benefits payable under the plan are based on a combination of years of service and existing postretirement benefits. Included in total pension costs are charges of $1.6 million, $1.4 million and $0.9 million for the years ended December 31, 2018, 2017 and 2016, respectively, representing the annual accrued benefits under this plan.

Defined Contribution Plan

The Company has a 401(k) plan with an employer match covering a majority of its U.S. employees. The plan allows for and the Company previously paid a nonelective contribution on behalf of participants who have completed one year of service equal to 3% of the eligible participants' compensation in the form of Company common stock. During the first quarter of 2017, the Company began matching both non-elective and elective 401(k) contributions in cash, rather than stock. Total Company contributions were $3.1 million, $2.9 million and $2.7 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Note 21 – Other Non-Current Liabilities

Other non-current liabilities as of December 31, 2018 and 2017 were as follows:

	2018	2017
Restricted insurance settlement	$ 20,278	$ 21,171
Non-current income taxes payable	7,644	15,825
Uncertain tax positions (includes interest and penalties)	8,097	7,970
Deferred and other long-term compensation	6,886	5,905
Other	624	625
Total other non-current liabilities	$ 43,529	$ 51,496

Note 22 – Equity and Accumulated Other Comprehensive Loss

In May 2015, the Company's Board of Directors authorized a share repurchase program for the repurchase of up to $100.0 million of Quaker Chemical Corporation common stock (the "2015 Share Repurchase Program"). The 2015 Share Repurchase Program has no expiration date. The 2015 Share Repurchase Program provides a framework of conditions under which management can repurchase shares of the Company's common stock. These purchases may be made in the open market or in private and negotiated transactions and will be in accordance with applicable laws, rules and regulations.

In connection with the 2015 Share Repurchase Program, the Company acquired 83,879 shares of common stock for $5.9 million, during the year ended December 31, 2016. There were no share repurchases under the 2015 Share Repurchase Program during the years ended December 31, 2018 and 2017. The Company has elected not to hold treasury shares and therefore has retired the shares as they are repurchased. It is the Company's accounting policy to record the excess paid over par value as a reduction in retained earnings for all shares repurchased.

The Company has 30,000,000 shares of common stock authorized with a par value of $1, and 13,338,026 and 13,307,976 shares issued and outstanding as of December 31, 2018 and 2017, respectively. The change in shares issued and outstanding during 2018 was primarily related to 17,596 shares issued for equity-based compensation plans, 3,574 shares issued for the ESPP and 8,880 shares issued for the exercise of stock options and other employee and director-related share activity.

The Company is authorized to issue 10,000,000 shares of preferred stock with $1 par value, subject to approval by the Board of Directors. The Board of Directors may designate one or more series of preferred stock and the number of shares, rights, preferences, and limitations of each series. As of December 31, 2018, no preferred stock had been issued.

The following table shows the reclassifications from and resulting balances of AOCI for the years ended December 31, 2018, 2017 and 2016:

	Currency Translation Adjustments	Defined Benefit Pension Plans	Unrealized Gain (Loss) in Available-for-Sale Securities	Total
Balance as of December 31, 2015	$ (38,544)	$ (35,251)	$ 479	$ (73,316)
Other comprehensive (loss) income before reclassifications	(13,711)	(4,229)	834	(17,106)
Amounts reclassified from AOCI	—	3,075	(17)	3,058
Related tax amounts	—	237	(280)	(43)
Balance as of December 31, 2016	(52,255)	(36,168)	1,016	(87,407)
Other comprehensive income (loss) before reclassifications	20,362	(1,646)	2,299	21,015
Amounts reclassified from AOCI	—	5,154	(2,494)	2,660
Related tax amounts	—	(1,433)	65	(1,368)
Balance as of December 31, 2017	(31,893)	(34,093)	886	(65,100)
Other comprehensive (loss) income before reclassifications	(17,429)	1,543	(2,622)	(18,508)
Amounts reclassified from AOCI	—	3,085	435	3,520
Related tax amounts	—	(1,086)	459	(627)
Balance as of December 31, 2018	$ (49,322)	$ (30,551)	$ (842)	$ (80,715)

Approximately 30% and 70% of the amounts reclassified from AOCI to the Consolidated Statements of Income for defined benefit retirement plans during the years ended December 31, 2018, 2017 and 2016 were recorded in COGS and SG&A, respectively. See Note 20 of Notes to Consolidated Financial Statements for further information. All reclassifications related to unrealized gain (loss) in available-for-sale securities relate to the Company's equity interest in a captive insurance company and are recorded in equity in net income of associated companies. The amounts reported on the Consolidated Statements of Changes in Equity for non-controlling interest are related to currency translation adjustments.

Note 23 – Business Acquisitions

In March 2018, the Company purchased certain formulations and product technology for the mining industry for its North America reportable operating segment for $1.0 million. The Company allocated the entire purchase price to intangible assets representing formulations and product technology, to be amortized over 10 years. In accordance with the terms of the agreement, $0.5 million of the purchase price was paid at signing, with the remaining $0.5 million of the purchase price being paid during the first quarter of 2019. As of December 31, 2018, the remaining $0.5 million was recorded in Other current liabilities on the Company's Consolidated Balance Sheet.

In December 2017, the Company acquired the remaining 45% ownership interest in its India affiliate, Quaker Chemical India Private Limited ("QCIL") for 2,025.0 million INR, or approximately $31.8 million. QCIL is a part of the Company's Asia/Pacific reportable operating segment. As this acquisition was a change in an existing controlling ownership, the Company recorded $21.2 million of excess purchase price over the carrying value of the noncontrolling interest in Capital in excess of par value. In May 2017, the Company acquired assets associated with a business that markets, sells and manufactures certain metalworking fluids for its North America reportable operating segment for 7.3 million CAD, or approximately $5.4 million. As of December 31, 2018, the allocation of the purchase price for all of the Company's 2017 acquisitions have been finalized.

In November 2016, the Company acquired Lubricor Inc. and its affiliated entities ("Lubricor"), a metalworking fluids manufacturer headquartered in Waterloo, Ontario for its North America reportable operating segment for 16.0 million CAD, or approximately $12.0 million. During the first quarter of 2017, the Company identified and recorded an adjustment of less than $0.1 million to the allocation of the purchase price for the Lubricor acquisition. The adjustment was the result of finalizing a post-closing settlement based on the Company's assessment of additional information related to assets acquired and liabilities assumed. In May 2016, the Company acquired assets of a business that is associated with dust control products for the mining industry for its North America reportable operating segment for $1.9 million. As of December 31, 2017, the allocation of the purchase price for all of the Company's 2016 acquisitions have been finalized.

In July 2015, the Company acquired Verkol, a leading specialty grease and other lubricants manufacturer based in northern Spain, included in its EMEA reportable operating segment, for 37.7 million EUR, or approximately $41.4 million. This includes a post-closing adjustment of 1.3 million EUR, or approximately $1.4 million that was accrued as of December 31, 2015 and paid during the first quarter of 2016.

The results of operations of the acquired businesses and assets are included in the Consolidated Statements of Income from their respective acquisition dates. Transaction expenses associated with these acquisitions are included in SG&A in the Company's Consolidated Statements of Income. Certain pro forma and other information is not presented, as the operations of the acquired businesses are not material to the overall operations of the Company for the periods presented.

Note 24 – Fair Value Measures

The Company has valued its company-owned life insurance policies at fair value. These assets are subject to fair value measurement as follows:

	Total	Fair Value Measurements at December 31, 2018 Using Fair Value Hierarchy		
	Fair Value	Level 1	Level 2	Level 3
Assets				
Company-owned life insurance	$ 1,491	$ —	$ 1,491	$ —
Total	$ 1,491	$ —	$ 1,491	$ —

	Total	Fair Value Measurements at December 31, 2017 Using Fair Value Hierarchy		
	Fair Value	Level 1	Level 2	Level 3
Assets				
Company-owned life insurance	$ 1,594	$ —	$ 1,594	$ —
Total	$ 1,594	$ —	$ 1,594	$ —

The fair values of Company-owned life insurance are based on quotes for like instruments with similar credit ratings and terms. The Company did not have liabilities subject to fair value measurement and did not hold Level 3 investments as of December 31, 2018 or 2017, respectively, so related disclosures have not been included.

Note 25 – Commitments and Contingencies

In 1992, the Company identified certain soil and groundwater contamination at AC Products, Inc. ("ACP"), a wholly owned subsidiary. In voluntary coordination with the Santa Ana California Regional Water Quality Board, ACP has been remediating the contamination, the principal contaminant of which is perchloroethylene ("PERC"). In 2004, the Orange County Water District ("OCWD") filed a civil complaint against ACP and other parties seeking to recover compensatory and other damages related to the investigation and remediation of the contamination in the groundwater. Pursuant to a settlement agreement with OCWD, ACP agreed, among other things, to operate the two groundwater treatment systems to hydraulically contain groundwater contamination emanating from ACP's site until the concentrations of PERC released by ACP fell below the current Federal maximum contaminant level for four consecutive quarterly sampling events. In 2014, ACP ceased operation at one of its two groundwater treatment systems, as it had met the above condition for closure. As of December 31, 2018, ACP believes it is close to meeting the conditions for closure of the remaining groundwater treatment system but continues to operate this system while in discussions with the relevant authorities.

As of December 31, 2018, the Company believes that the range of potential-known liabilities associated with the balance of ACP water remediation program is approximately $0.1 million to $1.0 million. The low and high ends of the range are based on the length of operation of the treatment system as required by the conditions noted above, as determined by groundwater modeling. Costs of operation include the operation and maintenance of the extraction well, groundwater monitoring and program management.

The Company believes, although there can be no assurance regarding the outcome of other unrelated environmental matters, that it has made adequate accruals for costs associated with other environmental problems of which it is aware. Approximately $0.2 million was accrued as of December 31, 2018 and 2017, respectively, to provide for such anticipated future environmental assessments and remediation costs.

An inactive subsidiary of the Company that was acquired in 1978 sold certain products containing asbestos, primarily on an installed basis, and is among the defendants in numerous lawsuits alleging injury due to exposure to asbestos. The subsidiary discontinued operations in 1991 and has no remaining assets other than proceeds received from insurance settlements. To date, the overwhelming majority of these claims have been disposed of without payment and there have been no adverse judgments against the subsidiary. Based on a continued analysis of the existing and anticipated future claims against this subsidiary, it is currently projected that the subsidiary's total liability over the next 50 years for these claims is approximately $1.7 million (excluding costs of defense). Although the Company has also been named as a defendant in certain of these cases, no claims have been actively pursued against the Company, and the Company has not contributed to the defense or settlement of any of these cases pursued against the subsidiary. These cases were handled by the subsidiary's primary and excess insurers who had agreed in 1997 to pay all defense costs and be responsible for all damages assessed against the subsidiary arising out of existing and future asbestos claims up to the aggregate limits of their policies. A significant portion of this primary insurance coverage was provided by an insurer that is insolvent, and the other primary insurers asserted that the aggregate limits of their policies had been exhausted. The subsidiary challenged the applicability of these limits to the claims being brought against the subsidiary. In response, two of the three carriers entered into separate settlement and release agreements with the subsidiary in 2005 and 2007 for $15.0 million and $20.0 million, respectively. The proceeds of both settlements are restricted and can only be used to pay claims and costs of defense associated with the subsidiary's asbestos litigation.

In 2007, the subsidiary and the remaining primary insurance carrier entered into a Claim Handling and Funding Agreement, under which the carrier is paying 27% of defense and indemnity costs incurred by or on behalf of the subsidiary in connection with asbestos bodily injury claims. The agreement continues until terminated and can only be terminated by either party by providing a minimum of two years prior written notice. As of December 31, 2018, no notice of termination has been given under this agreement. At the end of the term of the agreement, the subsidiary may choose to again pursue its claim against this insurer regarding the application of the policy limits. The Company believes that, if the coverage issues under the primary policies with the remaining carrier are resolved adversely to the subsidiary and all settlement proceeds were used, the subsidiary may have limited additional coverage from a state guarantee fund established following the insolvency of one of the subsidiary's primary insurers. Nevertheless, liabilities in respect of claims may exceed the assets and coverage available to the subsidiary.

If the subsidiary's assets and insurance coverage were to be exhausted, claimants of the subsidiary may actively pursue claims against the Company because of the parent-subsidiary relationship. The Company does not believe that such claims would have merit or that the Company would be held to have liability for any unsatisfied obligations of the subsidiary as a result of such claims. After evaluating the nature of the claims filed against the subsidiary and the small number of such claims that have resulted in any payment, the potential availability of additional insurance coverage at the subsidiary level, the additional availability of the Company's own insurance and the Company's strong defenses to claims that it should be held responsible for the subsidiary's obligations because of the parent-subsidiary relationship, the Company believes it is not probable that the Company will incur losses. The Company has been successful to date having any claims naming it dismissed during initial proceedings. Since the Company may be in this stage of litigation for some time, it is not possible to estimate additional losses or range of loss, if any.

The Company is party to other litigation which management currently believes will not have a material adverse effect on the Company's results of operations, cash flows or financial condition.

The Company leases certain manufacturing and office facilities and equipment under non-cancelable operating leases with various terms from 1 to 15 years expiring in 2027. Rent expense for the years ended December 31, 2018, 2017 and 2016 was $7.2 million, $6.4 million, and $5.6 million, respectively.

The Company's minimum rental commitments under operating leases as of December 31, 2018 for future years were approximately:

2019	$	7,068
2020		5,635
2021		4,509
2022		3,523
2023		2,659
2024 and beyond		7,779

Note 26 – Quarterly Results (unaudited)

	First Quarter (1)	Second Quarter (2)	Third Quarter (3)	Fourth Quarter (4)
2018				
Net sales	$ 212,055	$ 221,962	$ 222,022	$ 211,481
Gross profit	75,447	80,937	81,093	74,838
Operating income	20,231	22,563	24,919	20,068
Net income attributable to Quaker Chemical Corporation	12,732	19,246	19,690	7,805
Net income attributable to Quaker Chemical Corporation Common Shareholders - Basic (5)	$ 0.96	$ 1.44	$ 1.48	$ 0.59
Net income attributable to Quaker Chemical Corporation Common Shareholders - Diluted (5)	$ 0.95	$ 1.44	$ 1.47	$ 0.58
2017				
Net sales	$ 194,909	$ 201,183	$ 212,918	$ 211,072
Gross profit	70,887	71,835	74,776	73,997
Operating income	13,758	17,903	14,009	17,074
Net income (loss) attributable to Quaker Chemical Corporation	6,992	11,906	11,142	(9,762)
Net income (loss) attributable to Quaker Chemical Corporation Common Shareholders - Basic (5)	$ 0.53	$ 0.90	$ 0.84	$ (0.73)
Net income (loss) attributable to Quaker Chemical Corporation Common Shareholders - Diluted (5)	$ 0.52	$ 0.89	$ 0.83	$ (0.73)

(1) Net income attributable to Quaker Chemical Corporation for both the first quarters of 2018 and 2017 includes a loss of $0.4 million and earnings of $0.6 million, respectively, from the Company's equity interest in a captive insurance company. Net income attributable to Quaker Chemical Corporation for both the first quarters of 2018 and 2017 includes Houghton combination-related expenses of $6.1 million and $9.1 million, respectively. Net income attributable to Quaker Chemical Corporation for the first quarter of 2018 includes a currency conversion charge of $0.2 million related to the impacts of hyper-inflationary accounting at the Company's 50% owned affiliate in Venezuela. Net income attributable to Quaker Chemical Corporation for the first quarter of 2017 also includes $0.3 million of cost streamlining expenses associated with certain actions taken to reorganize the Company's corporate staff.

(2) Net income attributable to Quaker Chemical Corporation for both the second quarters of 2018 and 2017 includes earnings from the Company's equity interest in a captive insurance company of $1.0 million and $0.4 million, respectively. Net income attributable to Quaker Chemical Corporation for both the second quarters of 2018 and 2017 includes Houghton combination-related expenses of $4.5 million and $4.3 million, respectively. Net income attributable to Quaker Chemical Corporation for both the second quarters of 2018 and 2017 includes currency conversion charges of less than $0.1 million and $0.3 million, respectively, related to the impacts of hyper-inflationary accounting at the Company's 50% owned affiliate in Venezuela. Net income attributable to Quaker Chemical Corporation for the second quarter of 2018 includes a tax adjustment of $1.2 million related to U.S. Tax Reform. Net income attributable to Quaker Chemical Corporation for the second quarter of 2017 includes a $1.9 million charge for the Company's U.S. pension plan settlement of its vested terminated participants.

(3) Net income attributable to Quaker Chemical Corporation for both the third quarters of 2018 and 2017 includes earnings from the Company's equity interest in a captive insurance company of $0.4 million, respectively, in both periods. Net income attributable to Quaker Chemical Corporation for both the third quarters of 2018 and 2017 includes Houghton combination-related expenses of $3.8 million and $9.7 million, respectively. Net income attributable to Quaker Chemical Corporation for both the third quarters of 2018 and 2017 includes currency conversion charges of $0.5 million and less than $0.1 million, respectively, related to the impacts of hyper-inflationary accounting at the Company's 50% owned affiliate in Venezuela and wholly owned Argentina subsidiary. Net income attributable to Quaker Chemical Corporation for the third quarter of 2018 also includes a $0.4 million foreign currency transaction gain related to the liquidation of an inactive legal entity and a tax adjustment of $1.1 million related to U.S. Tax Reform.

(4) Net income (loss) attributable to Quaker Chemical Corporation for both the fourth quarters of 2018 and 2017 includes a loss of $0.1 million and earnings of $1.1 million, respectively, from the Company's equity interest in a captive insurance company. Net income (loss) attributable to Quaker Chemical Corporation for both the fourth quarters of 2018 and 2017 includes Houghton combination-related expenses of $5.1 million and $7.7 million, respectively. Net income (loss) attributable to Quaker Chemical Corporation for both the fourth quarters of 2018 and 2017 includes other income of $0.1 million and $0.6 million, respectively, related to cash proceeds from an insolvent insurance carrier with respect to previously filed recovery claims by an inactive subsidiary of the Company. Net income (loss) attributable to Quaker Chemical Corporation for both the fourth quarters of 2018 and 2017 includes currency conversion impacts related to hyper-inflationary accounting, with the 2017 impact of a charge of $0.1 million at the Company's 50% owned affiliate in Venezuela and the 2018 impact of income of less than $0.1 million at the Company's wholly owned Argentina subsidiary. Net income (loss) attributable to Quaker Chemical Corporation for both the fourth quarters of 2018 and 2017 includes charges of $8.1 million and $22.2 million, respectively, related to U.S. Tax Reform. Net income (loss) attributable to Quaker Chemical Corporation for the fourth quarter of 2017 also includes a charge of $0.1 million related to a loss on disposal of a held-for-sale asset.

(5) Basic and diluted per share amounts of net income (loss) attributable to Quaker Chemical Corporation common shareholders for all four quarters above may not total to the full year amounts presented in the Company's consolidated financial statements for the years ended December 31, 2018 and 2017, respectively, due to rounding.

Item 9A. ***Controls and Procedures.***

Conclusion Regarding the Effectiveness of Disclosure Controls and Procedures

As required by Rule 13a-15(b) under the Securities Exchange Act of 1934, as amended (the "Exchange Act"), our management, including our principal executive officer and principal financial officer, has evaluated the effectiveness of our disclosure controls and procedures (as defined in Rule 13a-15(e) under the Exchange Act) as of the end of the period covered by this report. At the time we filed the Original Filing, our principal executive officer and principal financial officer had concluded that as of December 31, 2018 our disclosure controls and procedures were effective. Subsequent to that evaluation, PricewaterhouseCoopers LLP, the independent registered public accounting firm of the Company, performed an internal review over its 2018 audit of the Company's consolidated financial statements as reported in the Original Filing. Following this review, our principal executive officer and principal financial officer concluded that our disclosure controls and procedures were not effective as of December 31, 2018 because of the material weakness in our internal control over financial reporting, as described below.

Notwithstanding this material weakness, the Company has concluded that no material misstatements exist in the consolidated financial statements as filed in the Original Filing, and as included in this Amended Filing, and such financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2018, in conformity with accounting principles generally accepted in the United States of America.

Restated Management's Report on Internal Control over Financial Reporting

The management of Quaker is responsible for establishing and maintaining adequate internal control over financial reporting as such term is defined in Rule 13a-15(f) promulgated under the Exchange Act. 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.

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.

Our management, with the participation of our principal executive officer and principal financial officer, assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2018. In making this assessment, our management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission in *Internal Control—Integrated Framework (2013)*. A material weakness is a deficiency, or combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of annual or interim financial statements will not be prevented or detected on a timely basis. The Company did not design and maintain effective internal control over certain aspects of its information technology. Specifically, we did not design and maintain effective controls related to (i) user access controls to adequately restrict user and privileged access to certain financial applications and data to the appropriate personnel, including ensuring appropriate segregation of duties as it relates to the preparation and review of journal entries and (ii) monitoring, documenting and approving system or data changes. This control deficiency did not result in a misstatement of the Company's consolidated financial statements. However, this control deficiency could result in misstatements of the interim or annual consolidated financial statements and disclosures that would result in a material misstatement that would not be prevented or detected. Therefore, management has concluded that this control deficiency constitutes a material weakness.

In Management's Report on Internal Control over Financial Reporting included in the Original Filing, our management previously concluded that the Company maintained effective internal control over financial reporting as of December 31, 2018. Subsequent to the filing date of the Original Filing, management has concluded that the material weakness described above existed as of December 31, 2018. As a result, we have concluded that we did not maintain effective internal control over financial reporting as of December 31, 2018, based on the criteria in *Internal Control—Integrated Framework* (2013). Accordingly, management has restated its report on internal control over financial reporting.

The effectiveness of the Company's internal control over financial reporting as of December 31, 2018 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report, which is included in "Item 8. Financial Statements and Supplementary Data" of this Amended Filing.

Plan for Remediation of Material Weakness

The Company and its Board of Directors are committed to maintaining a strong internal control environment. Management has evaluated the material weakness described above and has made significant progress updating its design and implementation of internal controls to remediate the aforementioned control deficiency and enhance the Company's internal control environment. The remediation plan is being implemented and includes a revised risk assessment coupled with additional controls and procedures. Management is committed to successfully implementing the remediation plan as promptly as possible, and currently plans to evaluate its updated internal controls design and determine whether the controls have operated effectively during the third quarter of 2019 in order to fully remediate the aforementioned material weakness in the Company's internal control over financial reporting.

Changes in Internal Controls Over Financial Reporting

As required by Rule 13a-15(d) under the Exchange Act, our management, including our principal executive officer and principal financial officer, has evaluated our internal control over financial reporting to determine whether any changes to our internal control over financial reporting occurred during the fourth quarter of the year ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. Based on that evaluation, no such changes to our internal control over financial reporting occurred during the fourth quarter of the year ended December 31, 2018.

PART IV

Item 15. ***Exhibits and Financial Statement Schedules.***

(a) Exhibits and Financial Statement Schedules

1. Financial Statements and Supplementary Data

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2. Financial Statement Schedules

All schedules are omitted because they are not applicable or the required information is shown in the financial statements or notes thereto. Financial statements of 50% or less owned companies have been omitted because none of the companies meets the criteria requiring inclusion of such statements.

3. Exhibits - filed pursuant to, and numbered in accordance with Item 601 of Regulation S-K (all of which are under Commission File number 001-12019, except as otherwise noted):

3(i)(a) — Articles of Incorporation (as amended through July 31, 2013). Incorporated by reference to Exhibit 3.1 as filed by Registrant with Form 8-K filed on July 31, 2013.

3(i)(b) — Articles of Amendment dated September 7, 2017, to the Articles of Incorporation. Incorporated by reference to Exhibit 3.1 as filed by Registrant with Form 8-K filed on September 11, 2017.

3(ii) — By-laws (as amended and restated, effective May 6, 2015). Incorporated by reference to Exhibit 3.2 as filed by Registrant with Form 8-K filed on May 8, 2015.

10.1 — Settlement Agreement and Release between Registrant, an inactive subsidiary of the Registrant, and Hartford Accident and Indemnity Company dated December 12, 2005. Incorporated by reference to Exhibit 10 (nnn) as filed by the Registrant with Form 10-K for the year 2005.

10.2 — Employment Agreement by and between L. Willem Platzer and Quaker Chemical B.V., a Netherlands corporation and a subsidiary of Registrant, dated August 21, 2006. Incorporated by reference to Exhibit 10 as filed by the Registrant with Form 8-K filed on August 22, 2006. *

10.3 — Settlement Agreement and Release between Registrant, an inactive subsidiary of Registrant and Federal Insurance Company dated March 26, 2007. Incorporated by reference to Exhibit 10(zzz) as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2007.

10.4 — Change in Control Agreement by and between Registrant and L. Willem Platzer dated April 2, 2007, effective January 1, 2007. Incorporated by reference to Exhibit 10(aaaa) as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2007. *

10.5 — Change in Control Agreement by and between Registrant and Jan F. Nieman dated June 27, 2007, effective January 1, 2007. Incorporated by reference to Exhibit 10(cccc) as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2007. *

10.6 — Claim Handling and Funding Agreement between SB Decking, Inc., an inactive subsidiary of Registrant, and Employers Insurance Company of Wausau dated September 25, 2007. Incorporated by reference to Exhibit 10(ffff) as filed by the Registrant with Form 10-Q for the quarter ended September 30, 2007.

10.7 — Settlement Agreement and Mutual Release entered into between AC Products, Inc., wholly owned subsidiary of Registrant, and Orange County Water District, effective November 8, 2007. Incorporated by reference to Exhibit 10.47 as filed by the Registrant with Form 10-K for the year ended 2007.

10.8 — Financing Agreement by and among Butler County Port Authority and Registrant and Brown Brothers Harriman & Co. dated May 15, 2008. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2008.

10.9 — Employment Agreement by and between Registrant and Michael F. Barry dated July 1, 2008. Incorporated by reference to Exhibit 10.5 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2008. *

10.10 — Change in Control Agreement by and between Registrant and Michael F. Barry dated July 1, 2008. Incorporated by reference to Exhibit 10.6 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2008. *

10.11 — Butler County Port Authority Industrial Development Revenue Bond dated May 15, 2008. Incorporated by reference to Exhibit 10.7 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2008.

10.12 — Memorandum of Employment by and between Registrant and Joseph F. Matrange dated September 30, 2008. Incorporated by reference to Exhibit 10.48 as filed by the Registrant with Form 10-K for the year ended 2008. *

10.13 — Memorandum of Employment by and between Registrant and D. Jeffry Benoliel dated October 1, 2008. Incorporated by reference to Exhibit 10.49 as filed by the Registrant with Form 10-K for the year ended 2008. *

10.14 — Change in Control Agreement by and between Registrant and D. Jeffry Benoliel dated November 19, 2008, effective January 1, 2008. Incorporated by reference to Exhibit 10.54 as filed by the Registrant with Form 10-K for the year ended 2008. *

10.15 — Change in Control Agreement by and between Registrant and Joseph F. Matrange dated November 19, 2008, effective October 1, 2008. Incorporated by reference to Exhibit 10.55 as filed by the Registrant with Form 10-K for the year ended 2008. *

10.16 — Change in Control Agreement by and between Registrant and Ronald S. Ettinger dated November 19, 2008, effective October 1, 2008. Incorporated by reference to Exhibit 10.56 as filed by the Registrant with Form 10-K for the year ended 2008. *

10.17 — Supplemental Retirement Income Program (as amended and restated effective January 1, 2008), approved November 19, 2008. Incorporated by reference to Exhibit 10.58 as filed by the Registrant with Form 10-K for the year ended 2008. *

10.18 — Memorandum of Employment by and between Registrant and Joseph Berquist dated April 1, 2010. Incorporated by reference to Exhibit 10.2 as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2010. *

10.19 — Change in Control Agreement by and between Registrant and Joseph Berquist dated April 1, 2010. Incorporated by reference to Exhibit 10.3 as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2010. *

10.20 — Employment Agreement by and between Dieter Laininger and Quaker Chemical B.V., a subsidiary of the registrant, dated June 1, 2011, effective June 15, 2011. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2011. *

10.21 — Change in Control Agreement by and between Registrant and Dieter Laininger dated May 31, 2011, effective June 15, 2011. Incorporated by reference to Exhibit 10.2 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2011. *

10.22 — 2011 Long-Term Performance Incentive Plan. Incorporated by reference to Appendix C to the Registrant's definitive proxy statement filed on March 31, 2011. *

10.23 — Form of Restricted Stock Unit Agreement for executive officers and other employees under Registrant's 2011 Long-Term Performance Incentive Plan. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2012. *

10.24 — Expatriate Agreement by and between the Registrant and Adrian Steeples, dated January 29, 2013, effective July 1, 2013. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2013. *

10.25 — 2013 Director Stock Ownership Plan as approved May 8, 2013. Incorporated by reference to Appendix B to the Registrant's definitive proxy statement filed on March 28, 2013. *

10.26 — Amended and Restated Multicurrency Credit Agreement by and between Registrant and Bank of America, N.A. and certain other lenders dated June 14, 2013. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2013.

10.27 — Memorandum of Employment and Addendum by and between Registrant and Jan F. Nieman, effective August 1, 2013. Incorporated by reference to Exhibit 10.2 as filed by the Registrant with Form 10-Q for the quarter ended June 30, 2013. *

10.28 — Expatriate Agreement by and between the Registrant and Dieter Laininger, dated and effective February 27, 2014. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 10-Q for the quarter ended March 31, 2014. *

10.29 — Memorandum of Employment by and between Registrant and Mary Dean Hall, dated and effective November 30, 2015. Incorporated by reference to Exhibit 10.60 as filed by the Registrant with Form 10-K for the year ended 2015. *

10.30 — Change in control agreement by and between Registrant and Mary Dean Hall, dated and effective November 30, 2015. Incorporated by reference to Exhibit 10.61 as filed by the Registrant with Form 10-K for the year ended 2015. *

10.31 — Retirement Savings Plan, as amended and restated effective January 1, 2016. Incorporated by reference to Exhibit 10.62 as filed by the Registrant with Form 10-K for the year ended 2015. *

10.32 — Global Annual Incentive Plan (as amended and restated effective February 24, 2016). Incorporated by reference to Appendix B to the Registrant's definitive proxy statement filed on March 28, 2016. *

10.33 — 2016 Long-Term Performance Incentive Plan. Incorporated by reference to Appendix C to the Registrant's definitive proxy statement filed on March 28, 2016. *

10.34 — Form of Restricted Stock Award Agreement for executive officers and other employees under Registrant's 2016 Long-Term Performance Incentive Plan. Incorporated by reference to Exhibit 10.3 as filed by Registrant with Form 8-K filed on May 6, 2016. *

10.35 — Form of Restricted Stock Unit Agreement for executive officers and other employees under Registrant's 2016 Long-Term Performance Incentive Plan. Incorporated by reference to Exhibit 10.4 as filed by Registrant with Form 8-K filed on May 6, 2016. *

10.36 — Share Purchase Agreement, dated April 4, 2017, by and among Quaker Chemical Corporation, a Pennsylvania corporation, Gulf Houghton Lubricants, Ltd., an exempted company incorporated under the laws of the Cayman Islands, Global Houghton Ltd., an exempted company incorporated under the laws of the Cayman Islands, and certain members of the management of Global Houghton Ltd. and Gulf Houghton Lubricants, Ltd., as agent for the Sellers. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 8-K, filed on April 5, 2017. **

10.37 — Senior Secured Credit Facilities Commitment Letter, dated April 4, 2017, by and among Quaker Chemical Corporation, Bank of America, N.A., Merrill Lynch, Pierce, Fenner & Smith Incorporated, Deutsche Bank AG New York Branch and Deutsche Bank Securities Inc. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 8-K, filed on April 7, 2017.

10.38 — Amendment No. 1, dated as of May 23, 2017, to the Amended and Restated Multicurrency Credit Agreement, dated as of June 14, 2013. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 8-K, filed on May 25, 2017.

10.39 — Amendment No. 2, dated as of May 29, 2018, to the Amended and Restated Multicurrency Credit Agreement, dated as of June 14, 2013. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 8-K, filed on May 30, 2018.

10.40 — Amendment No. 3, dated as of August 1, 2018, to the Amended and Restated Multicurrency Credit Agreement, dated as of June 14, 2013. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 8-K, filed on August 3, 2018.

10.41 — Amendment No. 4, dated as of December 14, 2018, to the Amended and Restated Multicurrency Credit Agreement, dated as of June 14, 2013. Incorporated by reference to Exhibit 10.1 as filed by the Registrant with Form 8-K, filed on December 18, 2018.

21 — Subsidiaries and Affiliates of the Registrant.***

23 — Consent of Independent Registered Public Accounting Firm.****

31.1 — Certification of Chief Executive Officer of the Company pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934.****

31.2 — Certification of Chief Financial Officer of the Company pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934. ****

32.1 — Certification of Michael F. Barry pursuant to 18 U.S.C. Section 1350. †

32.2 — Certification of Mary Dean Hall pursuant to 18 U.S.C. Section 1350. †

101.INS — XBRL Instance Document***

101.SCH — XBRL Extension Schema Document***

101.CAL — XBRL Calculation Linkbase Document***

101.DEF — XBRL Definition Linkbase Document***

101.LAB — XBRL Label Linkbase Document***

101.PRE — XBRL Presentation Linkbase Document***

* This exhibit is a management contract or compensation plan or arrangement required to be filed as an exhibit to this Report.

** Certain exhibits and schedules have been omitted and the Company agrees to furnish supplementally to the Securities and Exchange Commission a copy of any omitted exhibits and schedules upon request.

*** Previously filed with our Annual Report on Form 10-K originally filed on February 28, 2019.

**** Filed herewith.

† These certifications are being furnished solely to accompany this Amended Filing pursuant to 18 U.S.C. Section 1350, and are not being filed for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, and are not to be incorporated by reference into any filing of the registrant, whether made before or after the date hereof, regardless of any general incorporation language in such filing.

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.

QUAKER CHEMICAL CORPORATION
Registrant

By: /s/ MICHAEL F. BARRY

Michael F. Barry
Chairman of the Board, Chief Executive Officer and President

Date: July 24, 2019

Exhibit 23

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statements on Form S-3 (Registration No. 333-155607) and on Forms S-8 (Registration Nos. 333-48130, 033-54158, 333-58676, 333-115713, 333-159513, 333-174145, 333-208188, 333-188594 and 333-211238) of Quaker Chemical Corporation of our report dated February 28, 2019 except with respect to our opinion on internal control over financial reporting insofar as it relates to the effects of the matter discussed in the penultimate paragraph of Management's Report on Internal Control Over Financial Reporting, as to which the date is July 24, 2019, relating to the financial statements, which appear in this Form 10-K/A.

/s/ PricewaterhouseCoopers LLP
Philadelphia, PA
July 24, 2019

EXHIBIT 31.1

CERTIFICATION OF CHIEF EXECUTIVE OFFICER OF THE COMPANY PURSUANT TO RULE 13a-14(a) OF THE SECURITIES EXCHANGE ACT OF 1934

I, Michael F. Barry, certify that:

1. I have reviewed this Annual Report on Form 10-K/A of Quaker Chemical Corporation;

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.

Date: July 24, 2019

/s/ MICHAEL F. BARRY

Michael F. Barry
Chief Executive Officer

EXHIBIT 31.2

CERTIFICATION OF CHIEF FINANCIAL OFFICER OF THE COMPANY PURSUANT TO RULE 13a-14(a) OF THE SECURITIES EXCHANGE ACT OF 1934

I, Mary Dean Hall, certify that:

1. I have reviewed this Annual Report on Form 10-K/A of Quaker Chemical Corporation;

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.

Date: July 24, 2019

/s/ MARY DEAN HALL

Mary Dean Hall
Chief Financial Officer

EXHIBIT 32.1

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350

The undersigned hereby certifies that the Form 10-K/A Annual Report of Quaker Chemical Corporation (the “Company”) for the annual period ended December 31, 2018 filed with the Securities and Exchange Commission (the “Report”) fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934 and that the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Dated: July 24, 2019

/s/ MICHAEL F. BARRY

Michael F. Barry

Chief Executive Officer of Quaker Chemical Corporation

EXHIBIT 32.2

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350

The undersigned hereby certifies that the Form 10-K/A Annual Report of Quaker Chemical Corporation (the “Company”) for the annual period ended December 31, 2018 filed with the Securities and Exchange Commission (the “Report”) fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934 and that the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Dated: July 24, 2019

/s/ MARY DEAN HALL

Mary Dean Hall

Chief Financial Officer of Quaker Chemical Corporation