2017 Minerals Yearbook

NITROGEN [ADVANCE RELEASE]

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Nitrogen

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In 2017, U.S. anhydrous ammonia production contained 11.6 million metric tons (Mt) of nitrogen, 14% more than production in 2016, and apparent consumption increased slightly from that in 2016 (table 1). According to the U.S. Census Bureau, exports of ammonia more than tripled compared with those in 2016, and imports decreased by 19% from those of 2016 (tables 1, 8, 9). Export quantities of contained nitrogen in ammonia were small at 612,000 metric tons (t) compared with 3.09 Mt of imports. Most (94%) of the imports in 2017 were from Canada and Trinidad and Tobago. About 88% of the domestically produced and imported ammonia consumed in the United States was used in fertilizer applications. Global ammonia production in 2017, which was estimated to contain 142 Mt of nitrogen, was slightly lower than that in 2016. China, Russia, the United States, and India, in descending order by tonnage, were the leading producers; combined they accounted for about 57% of the total. In the United States, the increased supply of shale gas has lowered prices for domestic natural gas, which is an essential feedstock for nitrogen production, and over the past few years has resulted in the development of new nitrogen capacity to replace higher cost imports.

Nitrogen is an essential element of life and a part of all plant and animal proteins. Some crops, such as alfalfa, garden peas, peanuts, and soybeans, can convert atmospheric nitrogen into a usable form in a process called fixation. Most nitrogen available for crop production, however, comes from decomposing animal and plant waste or from commercially produced fertilizers.

All commercial fertilizers contain nitrogen in the form of ammonium and (or) nitrate or in a form that is quickly converted to these after the fertilizer is applied to the soil. Commercial production of anhydrous ammonia is based on reacting nitrogen with hydrogen under high temperatures and pressures. The source of nitrogen is air, which is almost 80% nitrogen. Hydrogen can be derived from a variety of raw materials, including water and crude oil, or coal, but it most often comes from natural gas hydrocarbons. Other nitrogen fertilizers are produced from ammonia feedstock through a variety of chemical processes.

Legislation and Government Programs

On June 14, 2017, the U.S. Environmental Protection Agency (EPA) delayed the effective date of the Risk Management Program (RMP) Amendments under the Clean Air Act for an additional 20 months. The amendments were finalized on January 30, 2017; however, the EPA requested additional time to conduct a reconsideration proceeding and consider other issues that may benefit from additional comment. These amendments were intended to update EPA's RMP regulations, which directed the Federal Government to carry out a number of tasks intended to prevent chemical incidents. The amendments modified accident prevention program elements, emergency preparedness requirements, and provisions related to information sharing with the public and local emergency planners and (or) responders (U.S. Environmental Protection Agency, 2017a).

Production and Stocks

Industry statistics for anhydrous ammonia and derivative products from 2013 through 2017 were developed by The Fertilizer Institute and adjusted by the U.S. Geological Survey. In 2017, production of anhydrous ammonia (82.2% nitrogen) increased by 14% to 11.6 Mt of contained nitrogen compared with 10.2 Mt in 2016 (table 1). Of the total produced, 88% was used as fertilizer and 12% was used in other chemical and industrial sectors (table 2).

The United States was a leading producer and consumer of elemental and fixed types of nitrogen. In decreasing order of contained nitrogen, urea, ammonium nitrate, nitric acid, ammonium phosphates [diammonium phosphate (DAP) and monoammonium phosphate (MAP)], and ammonium sulfate were the major downstream products derived from domestic and imported ammonia in the United States. Their combined production was 9.66 Mt of contained nitrogen, with urea accounting for about 37% of the total production; ammonium nitrate, 28%; nitric acid, 16%; ammonium phosphates, 12%; and ammonium sulfate, 6% (table 3).

Ammonia producers in the United States operated at about 86% of design capacity in 2017; this percentage included capacities at plants that operated during any part of the year and did not include plants that were idle for all of 2017. More than 70% of U.S. anhydrous ammonia production capacity was concentrated in Louisiana (34%), Oklahoma (16%), Iowa (13%), Georgia (5%), and Texas (5%), where large reserves of feedstock natural gas occur. CF Industries Holdings, Inc.; PCS Nitrogen, Inc.; Koch Nitrogen Co., LLC; and Dyno Nobel Inc., in descending order, accounted for 70% of total U.S. ammonia production capacity (table 4).

In April 2017, Agrium, Inc. commissioned its new 610,000-metric-ton-per-year (t/yr) urea plant at its nitrogen facility in Borger, TX. Approximately 100,000 t/yr of urea from this plant would be used to produce diesel exhaust fluid. The $720 million Borger expansion began in February 2014 (Green Markets, 2017a).

Iowa Fertilizer Co. completed its new $3 billion nitrogen plant in Wever, IA, in April 2017. Capacity at the plant was 195,000 t/yr of salable ammonia, 420,000 t/yr of urea, 1.5 million metric tons per year (Mt/yr) of urea ammonium nitrate (UAN), and 315,000 t/yr of diesel exhaust fluid. Construction of the nitrogen plant began in 2012 (Green Markets, 2017d).

Dakota Gasification Co. was building a new 300,000-t/yr urea plant that was scheduled for completion in 2018. Urea would be produced from ammonia available onsite.

Coal gasification was the feedstock used to produce ammonia, methanol, and other products at the plant (Nitrogen + Syngas, 2017i).

Fortigen Geneva LLC's new 30,800-t/yr ammonia plant located in Geneva, NE, was operational by the third quarter of 2017. Farmers Cooperative, based in Dorchester, NE, was the sole buyer of the ammonia produced at the Geneva plant. Construction of the plant began in April 2016 at a cost of $75 million (Green Markets, 2017g).

Koch Nitrogen Co.'s $1.3 billion nitrogen expansion at its Enid, OK, facility was completed by yearend. A new 816,000-t/yr urea plant was constructed at the facility (Green Markets, 2017e).

Pacific Coast Fertilizer LLC planned to develop a nitrogen fertilizer facility at the Mint Farm Industrial Park in Longview, WA. The capacity of the plant was expected to be 1,500 metric tons per day (t/d) of anhydrous ammonia at a cost of $1 billion, with completion expected in late 2021 or early 2022 (Green Markets, 2017c).

J.R. Simplot Co's. 540-t/d anhydrous ammonia plant, which was part of the Rock Springs, WY, phosphate fertilizer complex began operation in September 2017. The ammonia plant, using natural gas as a feedstock, would allow Simplot to produce its own ammonia instead of importing ammonia by rail. Simplot began construction of the ammonia plant in 2014 at a cost of $350 million (Green Markets, 2017h).

Stocks of ammonia at yearend 2017 were estimated to be 320,000 t, a 20% decrease from comparable stocks at yearend 2016 (table 7).

Environment

Hypoxia, or oxygen depletion, is caused by excess nutrients in bodies of water. The nutrients can come from many sources including fertilizers, soil erosion, sewage discharge, and deposition of atmospheric nitrogen. Hypoxia has become a controversial environmental concern for the fertilizer industry and an issue that spawned significant research efforts to determine its cause. Hypoxia occurs where water near the bottom of an affected area of a large body of water, such as the Gulf of Mexico, contains less than 2 parts per million dissolved oxygen. Hypoxia can cause stress or death in bottom-dwelling organisms that cannot move out of the hypoxic or "dead" zone.

Dead zones in coastal oceans have been reported in more than 400 ecosystems, affecting a total area of more than 245,000 square kilometers (km^2) worldwide. The number of dead zones has approximately doubled each decade since the 1960s. More recently, dead zones have developed in continental seas, such as the Baltic Sea, Black Sea, East China Sea, Gulf of Mexico, and Kattegat (Virginia Institute of Marine Science, 2018).

The Mississippi River/Gulf of Mexico Hypoxia Task Force (HTF) was established in the fall of 1997 as a partnership among five Federal agencies; Tribes; and environmental quality, agricultural, and conservation agencies working together to address the issue of nutrient pollution and the dead zone in the Gulf of Mexico. The HTF released its 2017 Report to Congress on the actions the Federal, State, and Tribal members have taken towards reducing nitrogen and phosphorous pollution in the Mississippi/Atchafalaya River Basin and reducing the size of the Gulf of Mexico hypoxic zone. This report highlights progress achieved in the basin towards nutrient load reductions, the response of the hypoxic zone, and water quality. Also, the report evaluated lessons learned and appropriate actions needed to continue to implement or, if necessary, revise the strategy set forth in the Gulf Hypoxia Action Plan 2008 (U.S. Environmental Protection Agency, 2017c).

In 2017, the Gulf of Mexico dead zone was 22,720 km^2. The 2017 dead zone was above the five-year average (15,039 km^2) and more than four times the HTF's goal of 5,000 km^2. Researchers suggested that the May discharge into the Mississippi River was the result of excessive rainfall in the Midwest during May, which resulted in the larger dead zone measurement (U.S. Environmental Protection Agency, 2017b).

Consumption

In 2017, U.S. apparent consumption of ammonia was 14.1 Mt of contained nitrogen, a slight increase from that of 2016 (table 1). Apparent consumption is calculated as production plus imports minus exports, adjusted to reflect any changes in stocks.

Consumption of nitrogen fertilizers in the United States for the 2016 and 2017 crop-years (ending June 30, 2017) is listed in table 5. In 2017, consumption of fertilizers was estimated to be 11.9 Mt of contained nitrogen, which was slightly more than that of 2016. Anhydrous ammonia (82% nitrogen), nitrogen solutions (mostly UAN solutions containing 29.8% to 29.9% nitrogen), and urea (45.9% nitrogen) were the principal nitrogen fertilizer products, representing 24%, 27%, and 25% of fertilizer consumption, respectively. Ammonium nitrate (33.9% nitrogen) constituted 2% and ammonium sulfate constituted 3% of 2017 nitrogen fertilizer consumption. The remaining 19% consisted of multiple-nutrient (various combinations of nitrogen, phosphate, and potassium) and other nitrogen fertilizers. The leading nitrogen-consuming States in the 2017 crop-year (July 1, 2016, to June 30, 2017) were, in descending order, Iowa, Illinois, Nebraska, North Dakota, Minnesota, Kansas, and California, accounting for about 50% of total fertilizer consumption (J.V. Slater, Association of American Plant Food Control Officials Inc., written commun., November 13, 2018).

Transportation

Ammonia was transported by refrigerated barge, rail car, pipeline, and tank truck. Three companies served 11 States with 5,090 kilometers (km) of pipelines and 4,800 km of river barge transport; rail and truck were used primarily for interstate or local delivery.

NuStar Energy L.P. continued to operate an ammonia pipeline. The 3,200-km ammonia pipeline originated in the Louisiana Delta, where it had access to three marine terminals and three anhydrous ammonia plants on the Mississippi River. The capacity of this pipeline was about 2 Mt/yr of ammonia, with a storage capacity of more than 1 Mt. In 2017, about 1.14 Mt of ammonia was shipped through the Gulf Central ammonia pipeline (NuStar Energy L.P., 2018, p. 7).

Magellan Midstream Partners, L.P. owned a common carrier ammonia pipeline system. The 1,770-km pipeline system, which transported and distributed ammonia from production facilities in Oklahoma and Texas to various distribution plants in the Midwest, had a delivery capacity of about 820,000 t/yr (Magellan Midstream Partners, L.P., 2018, p. 1).

Tampa Pipeline Corp. operated the 135-km Tampa Bay pipeline system, which moved ammonium phosphate and nitrogen compounds for fertilizer producers in Hillsborough and Polk Counties, FL.

Prices

Midyear and yearend prices for nitrogen materials are listed in table 6. According to Green Markets, the average gulf coast ammonia price began 2017 at $257 per short ton and remained at this price through early February when prices increased to $310 per ton. Ammonia prices then decreased again and reached a low of $165 per ton in mid-July that continued through late September. At yearend, the price was $290 per ton, an 18% increase in yearend price from that of 2016 but a 31% decrease in yearend price from that of 2015.

The average gulf coast granular urea price fluctuated throughout 2017, beginning the year at $238 per ton. The average price reached a low of $161 per ton in late June and finished the year with a high of $252 per ton in December.

The average ammonium nitrate price, which began 2017 at $250 per ton, increased throughout the year. The average price increased to $265 per ton by yearend, returning to prices seen in early 2016 but still below 2015 prices of $335 per ton.

Ammonium sulfate prices do not necessarily follow the same trend as other nitrogen products, which correlate to natural gas prices, mainly because a substantial amount of ammonium sulfate is produced as a byproduct of caprolactam production. Caprolactam, an organic compound, is the precursor to Nylon 6, a widely used synthetic polymer. The average price of ammonium sulfate, which began 2017 at about $234 per ton, fluctuated throughout the year. By yearend, the price averaged $248 per ton.

In 2017, the annual average price paid index for all types of fertilizers decreased by 6% from the 2016 index (U.S. Department of Agriculture, Economic Research Service, 2018a). Fertilizer prices decreased as a result of lower demand for ammonia, which led to increased supply and lower global cost for nitrogen fertilizers.

In 2017, as a result of strong domestic shale gas production, natural gas prices were $2.99 per million British thermal units compared with $2.52 per million British thermal units in 2016 and $2.62 per million British thermal units in 2015. Natural gas prices in the United States have typically been higher than those in the rest of the world, and lower natural gas prices made U.S. ammonia production more competitive with offshore imports. Depending on its price, natural gas can account for approximately 70% to 85% of the U.S. cash cost of producing ammonia. Favorable natural gas prices continued to provide North American producers with a delivered-cost advantage to domestic markets over most offshore suppliers, prompting the announcement of several regional expansions and new nitrogen projects over the past few years. In addition to the United States, the Middle East, North Africa, and Russia have large supplies of lower cost natural gas compared with other countries, which gives them a cost advantage in producing and exporting ammonia. China and Europe have experienced rising natural gas prices; thus, producers in these regions were higher cost suppliers and played an important role in setting prices in the world marketplace (Potash Corp. of Saskatchewan Inc., 2018, p. 4).

Foreign Trade

Ammonia exports more than tripled in 2017 compared with those in 2016 because of increased U.S. ammonia production (table 8). Chile, the Republic of Korea, Mexico, and Morocco were the leading destinations for United States exports of ammonia, accounting for 81% of the total quantity.

Ammonia imports decreased by 19% compared with those in 2016 but dwarfed the quantity of exports. The average value of ammonia imports decreased to about $312 per metric ton from $336 per metric ton in 2016 (table 9). Trinidad and Tobago (67%) continued to be the leading import source. Canada (28%) was another significant import source. The decline in U.S. imports of anhydrous ammonia was the result of increased U.S. ammonia capacity (table 4).

Tables 10 and 11 list trade data for other nitrogen materials and include information on principal destination or source countries. Exports of ammonium nitrate, ammonium sulfate, DAP, and MAP decreased in 2017, whereas those of anhydrous ammonia and urea increased. Imports of all nitrogen materials in 2017 decreased by 11% compared with those in 2016. However, imports of some nitrogen compounds (calcium nitrate, DAP, MAP, potassium nitrate, potassium nitrate and sodium nitrate mixtures, and sodium nitrate) increased.

World Review

Anhydrous ammonia and other nitrogen materials were produced in more than 60 countries. Global ammonia production in 2017, estimated to be 142 Mt, was slightly lower than that of 2016 (table 12). China, with 31% of total production, was the leading world producer of ammonia. By region, Asia contributed 46% of total world ammonia production; Eastern Europe, 16%; North America, 11%; the Middle East, 10%; Western Europe, 7%; the Caribbean, Central America, and South America, 5%; and Africa and Oceania, 5%.

In 2017, world ammonia trade was 15.4 Mt of contained nitrogen, which increased slightly compared with that in 2016. Russia and Trinidad and Tobago accounted for 36% of world exports. Asia (primarily India) imported about one-third of global ammonia trade, followed by Western Europe and North America (International Fertilizer Association, 2018).

Bolivia.—In September 2017, Yacimientos Petroliferos Fiscales Bolivianos (YPFB), Bolivia’s state-owned oil company, began operating its new nitrogen plant in Cochabamba in the Province of Carrasco. Construction began in 2012 to build the $843 million, 2,100-t/d urea plant. The plant was expected to meet Bolivia’s domestic needs, with additional product available for export (Green Markets, 2017f).

Brunei.—Brunei Fertilizer Industries Sdn Bhd awarded thyssenkrupp Industrial Solutions the engineering, procurement, and construction for a new 2,200-t/d ammonia and 3,900-t/d urea plant at the Sungai Liang Industrial Park. Completion of the plant was scheduled for 2021 (Nitrogen + Syngas, 2017a).

China.—In December 2017, Stamicarbon B.V. signed a contract with Jiujiang Xinlianxin Fertilizer Co. Ltd for licensing, technology, and delivery of proprietary equipment for a new ultra-low-energy 3,900-t/d urea plant to be built in Jiujiang, Jiangxi. The urea plant was expected to be operational at yearend 2020 (Green Markets, 2017i).

Egypt.—thyssenkrup Industrial Solutions commissioned Egypt's largest fertilizer plant in 2017, 160 km northeast of Cairo. The plant was to be operated by the Egyptian Nitrogen Products Co. At full capacity, the plant was expected to produce 2,400 t/d of ammonia and 3,850 t/d of urea (Nitrogen + Syngas, 2017b).

Malaysia.—In April 2017, the Governments of India and Malaysia signed a memorandum of understanding to construct a $2.1 billion ammonia-urea facility in Malaysia. The plant would produce 1.35 Mt/yr of ammonia and 2.4 Mt/yr of urea. According to the agreement, a portion of the output was to be shipped to India in order to ensure a constant supply of urea and ammonia to India at a lower price than would be available on the international market. No timetable for the completion of the plant was announced (Nitrogen + Syngas, 2017c).

Oman.—SNC-Lavalin was awarded the engineering, procurement, and construction contract for a new 1,000-t/d ammonia plant in Salalah, Oman. No timetable for the completion of the plant was announced (Nitrogen + Syngas, 2017d).

Russia.—KBR, Inc. was awarded an operator training simulator and reliability-based maintenance services contract by JSR EuroChem Northwest for a new 1.0-Mt/yr ammonia plant in Kingisepp that is under construction. No timetable for the completion of the plant was announced (Nitrogen + Syngas, 2017f).

KBR was awarded a licensing and basic engineering contract to revamp Dorogobuzh JSC's ammonia plant in Russia's Smolensk region. Under the agreement, the plant, which was originally constructed by KBR, would license KBR's ammonia technology to increase the ammonia capacity to 690,000 t/yr. The upgrade was expected to cost $75 million and was scheduled to be completed in the second half of 2019 (Nitrogen + Syngas, 2017e).

PJSC KuibyshevAzot partnered with Italy's Maire Tecnimont SpA to build and operate a joint-venture 495,000-t/yr urea plant at KuibyshevAzot's existing site at Togliatti. KuibyshevAzot would hold 68% interest in the new facility and Maire Tecnimont would hold the remaining 32%. The plant was estimated to cost 150 million euros and was expected to be completed by 2021 (Nitrogen + Syngas, 2017h).

PJSC Metafrax awarded Casale SA (Switzerland) a contract for engineering, equipment supply, and construction to build a new ammonia, urea, melamine facility in Gubakha. Casale would provide the technology for the entire project, which includes a 290,000-t/yr ammonia plant, 570,000-t/yr urea plant, and a 40,000-t/yr melamine plant. No timetable for the completion of the facility was announced (Nitrogen + Syngas, 2017g).

Turkmenistan.—State-owned Turkmenhimiya began commissioning its large-scale ammonia plant and urea plant at Garabogaz, which has a capacity of 2,000 t/d of ammonia and 3,500 t/d of urea. The $1.5 billion complex was scheduled to be operational by June 2018 (Green Markets, 2017b).

Outlook

Large corn plantings increase the demand for nitrogen fertilizers. According to the U.S. Department of Agriculture (USDA), U.S. corn growers intend to plant 35.6 million hectares (Mha) of corn for all purposes in the 2018 crop-year, a slight decrease from that in 2017. Corn acreage utilization is expected to decrease or remain unchanged across most of the major corn producing States with the exception of Ohio, which is expecting an increase in acreage from that of 2017. A reduction in planted corn acreage for 2018 is due to expected lower returns on corn compared with those of other crops (U.S. Department of Agriculture, National Agricultural Statistics Service, 2018, p. 30).

Domestic corn-based ethanol production is projected to increase slightly during the next few years. Most U.S. ethanol production used corn as a feedstock; about 35% of the total corn produced is expected to go to ethanol production through 2027. No gains for corn-based ethanol are projected during the 10-year period compared with those of past years (U.S. Department of Agriculture, Economic Research Service, 2018b, p. 22).

The U.S. Department of Energy projected that the Henry Hub natural gas spot price in the United States would average $3.15 per million British thermal units in 2018 (up by 16 cents from 2017 levels) and $2.89 in 2019 (U.S. Energy Information Administration, 2019, p. 13).

The future of U.S. ammonia production depends on the variability in natural gas prices and construction costs. The United States is the world's leading importer of ammonia and the second-ranked consumer. Beginning in 2014, low natural gas prices in the United States prompted some companies to upgrade existing U.S. plants and other companies to construct new U.S. nitrogen projects. After the planned increases in ammonia capacity through 2018, no new ammonia capacity is expected within the next 5 years; however, at least four new nitrogen projects are being considered. The increase in U.S. ammonia capacity is expected to change the supply structure and flows of ammonia and nitrogen products in the United States, which would translate into lower U.S. imports of nitrogen products (such as ammonia, urea, and some UAN) and the potential for increased exports of these nitrogen products (Prud'homme, 2018, p. 20, 23).

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TABLE 1
SALIENT AMMONIA STATISTICS[1]

(Thousand metric tons of contained nitrogen unless otherwise specified)

		2013	2014	2015	2016	2017
United States:						
Production[2]		9,170	9,330	9,590	10,200	11,600
Exports[3]		196	111	93	183 r	612
Imports for consumption[3]		4,960	4,150	4,320	3,840	3,090
Consumption, apparent[4]		13,900	13,300	13,700	13,800	14,100
Stocks, December 31, producers		240 e	280	420	400	320
Average annual price, free on board gulf coast[5]	dollars per short ton	541	531	481	267	247
Net import reliance[6]	percent of apparent consumption	34	30	30	26	18
Natural gas price, wellhead, average price[7]	dollars per million British thermal units	3.73	4.37	2.62	2.52	2.99
World:						
Production[e]		140,000 r	140,000 r	142,000 r	144,000	142,000
Trade[8]		15,000	15,100	15,100	15,200	15,400

[e]Estimated. [r]Revised.
[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits.
[2]Source: The Fertilizer Institute; data adjusted by the U.S. Geological Survey.
[3]Source: U.S. Census Bureau.
[4]Defined as production plus imports minus exports; adjusted for industry stock changes.
[5]Source: Green Markets.
[6]Defined as imports minus exports; adjusted for industry stock changes.
[7]Source: Natural Gas Monthly, U.S. Energy Information Administration.
[8]Source: International Fertilizer Industry Association Statistics, World Anhydrous Ammonia Trade.

TABLE 2
ANHYDROUS AMMONIA SUPPLY AND DEMAND IN THE UNITED STATES[1]

(Thousand metric tons of contained nitrogen)

	2015	2016	2017
Production:[2]			
Fertilizer:			
January–June	4,220	4,450	4,880
July–December	4,220	4,480	5,290
Total	8,440	8,930	10,200
Nonfertilizer:			
January–June	576	608	665
July–December	575	611	721
Total	1,150	1,220	1,390
Grand total	9,590	10,200	11,600
Exports:			
January–June	68	29	203
July–December	25	154	409
Total	93	182	612
Imports for consumption:			
January–June	2,330	2,100	1,770
July–December	1,980	1,740	1,320
Total	4,320	3,840	3,090
Stocks, end of period:			
January–June	320	320	420
July–December	420	400	320
Apparent consumption:[3]			
January–June	7,020	7,230	7,090
July–December	6,650	6,590	7,020
Total	13,700	13,800	14,100

[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Source: The Fertilizer Institute; data adjusted by the U.S. Geological Survey.
[3]Defined as production plus imports minus exports; adjusted for industry stock changes.

Source: U.S. Census Bureau.

TABLE 3
MAJOR DOWNSTREAM NITROGEN COMPOUNDS PRODUCED IN THE UNITED STATES[1]

(Thousand metric tons)

	2016						2017					
	January–June		July–December		Total		January–June		July–December		Total	
	Gross weight	Nitrogen content	Gross weight	Nitrogen content	Gross weight	Nitrogen content	Gross weight	Nitrogen content	Gross weight	Nitrogen content	Gross weight	Nitrogen content
Ammonium nitrate[e]	3,890	1,320	3,850	1,300	7,740	2,620	4,050	1,370	4,000	1,360	8,050	2,730
Ammonium phosphates[2]	4,130	576	4,150	579	8,280	1,160	4,100	571	4,260	596	8,360	1,170
Ammonium sulfate[3]	1,540	327	1,330	281	2,870	608	1,470	311	1,390	295	2,860	606
Nitric acid[e]	3,410	750	3,380	743	6,780	1,490	3,540	780	3,510	772	7,050	1,550
Urea[e]	3,460	1,590	3,160	1,450	6,610	3,040	4,110	1,890	3,760	1,720	7,860	3,610

[e]Estimated.
[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Diammonium phosphate and monoammonium phosphate.
[3]Excludes coke plant ammonium sulfate.

Source: The Fertilizer Institute; data adjusted by the U.S. Geological Survey.

TABLE 4
DOMESTIC PRODUCERS OF ANHYDROUS AMMONIA IN 2017[1]

(Thousand metric tons per year of ammonia)

Company	Location	Capacity[2]
Agrium Inc.	Borger, TX	490
Do.	Kenai, AK[3]	280
Do.	Kennewick, WA[3]	180
CF Industries Holdings, Inc.	Donaldsonville, LA (5 plants)	3,900
Do.	Port Neal, IA	1,090
Do.	Verdigris, OK (2 plants)	1,020
Do.	Woodward, OK	435
Do.	Yazoo City, MS	508
Coffeyville Resources Nitrogen Fertilizers, LLC	Coffeyville, KS	375
Dakota Gasification Co.	Beulah, ND	355
Dyno Nobel Inc.	Cheyenne, WY	178
Do.	St. Helens, OR	101
Dyno Nobel Louisiana Ammonia, LLC	Waggaman, LA	800
East Dubuque Nitrogen Fertilizer, LLC	East Dubuque, IL	337
Fortigen Geneva, LLC	Geneva, NE	31
Green Valley Chemical Corp.	Creston, IA	32
Honeywell International Inc.	Hopewell, VA	530
Iowa Fertilizer Co.	Wever, IA	770
J.R. Simplot Co.	Rock Springs, WY	184
Koch Nitrogen Co., LLC	Beatrice, NE	265
Do.	Dodge City, KS	280
Do.	Enid, OK	930
Do.	Fort Dodge, IA	350
LSB Industries, Inc.	Cherokee, AL	163
Do.	El Dorado, AR	400
Do.	Pryor, OK	210
Mosaic Company, The	Faustina (Donaldsonville), LA	508
OCI Partners LP	Beaumont, TX	331
PCS Nitrogen, Inc.	Augusta, GA	785
Do.	Geismar, LA	450
Do.	Lima, OH	612
Total		16,900

Do. Ditto.

[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to total shown.

[2]Engineering design capacity adjusted for 340 days per year of effective production capability.

[3]Idle.

TABLE 5

ESTIMATED U.S. NITROGEN FERTILIZER CONSUMPTION, BY PRODUCT TYPE[1, 2]

(Thousand metric tons of contained nitrogen)

Fertilizer material[3]	2016	2017
Single-nutrient:		
Anhydrous ammonia	2,840 r	2,880
Nitrogen solutions[4]	3,200 r	3,250
Urea	2,900 r	2,950
Ammonium nitrate	185 r	188
Ammonium sulfate	363 r	369
Aqua ammonia	54 r	55
Other[5]	504 r	512
Total	10,000	10,200
Multiple-nutrient[6]	1,680 r	1,700
Grand total	11,700 r	11,900

[r]Revised.

[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Fertilizer crop-years ending June 30.

[3]Ranked in relative order of importance by product type.

[4]Principally urea-ammonium nitrate solutions, 29.8% to 29.9% nitrogen.

[5]Includes other single-nutrient nitrogen materials, all natural organics, and statistical discrepancies.

[6]Various combinations of nitrogen (N), phosphate (P), and potassium (K): N-P-K, N-P, and N-K.

Source: J.V. Slater, Association of American Plant Food Control Officials Inc., written commun., November 13, 2018.

TABLE 6

PRICE QUOTATIONS FOR MAJOR NITROGEN COMPOUNDS AT END OF PERIOD[1]

(Dollars per short ton)

	2016		2017	
Compound	June	December	June	December
Ammonium nitrate, free on board (f.o.b.) Corn Belt[2]	260–270	245–255	255–265	260–270
Ammonium sulfate, f.o.b. Corn Belt[2]	220–255	210–250	215–265	240–255
Anhydrous ammonia:				
F.o.b. Corn Belt[2]	340–450	290–405	240–320	400–420
F.o.b. gulf coast[3]	275–280	245	190	280–300
Diammonium phosphate, f.o.b. central Florida	325	315	330	360–365
Urea:				
F.o.b. Corn Belt,[2] prilled and granular	215–240	255–275	190–210	270–280
F.o.b. gulf coast,[3] granular	175–182	232–242	158–163	243–260

[1]Table includes data available through May 10, 2019.

[2]Illinois, Indiana, Iowa, Missouri, Nebraska, and Ohio.

[3]Barge, New Orleans, LA.

Source: Green Markets.

TABLE 7
U.S. PRODUCER STOCKS OF FIXED NITROGEN COMPOUNDS AT END OF PERIOD[1]

(Thousand metric tons of contained nitrogen)

Material[2]	2016	2017
Ammonia:		
January–June	320	420
July–December	400	320
Nitrogen solutions:[3]		
January–June	330	450
July–December	450	480
Urea:		
January–June	NA	NA
July–December	NA	NA
Ammonium phosphates:[4]		
January–June	39	38
July–December	43	45
Ammonium nitrate:		
January–June	NA	NA
July–December	NA	NA
Ammonium sulfate:		
January–June	44	44
July–December	56	50
Yearend total[5]	949	895

NA Not available.
[1]Table includes data available through May 10, 2019.
[2]Ranked in relative order of importance.
[3]Urea-ammonium nitrate and ammoniacal solutions.
[4]Diammonium and monoammonium phosphates.
[5]Calendar year ending December 31.

Source: The Fertilizer Institute; data adjusted by the U.S. Geological Survey.

TABLE 8
U.S. EXPORTS OF ANHYDROUS AMMONIA, BY COUNTRY OR LOCALITY[1]

(Thousand metric tons of ammonia and thousand dollars)

	2016		2017	
Country or locality	Gross weight	Value[2]	Gross weight	Value[2]
Australia	--	--	32	9,060
Belgium	(3)	1,120	24	6,720
Canada	(3)	260	13	4,650
Chile	1	140	145	20,200
China	(3)	178	30	4,090
Korea, Republic of	26	6,520	90	19,000
Mexico	61	13,100	85	19,200
Morocco	115	25,800	285	50,200
Norway	--	--	16	3,500
South Africa	--	--	11	735
Sweden	4	1,080	--	--
Taiwan	--	--	12	2,790
Turkey	13	2,140	--	--
Other	(3)	1,900	1	2,260
Total	222	52,200	744	142,000

-- Zero.
[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Cost, insurance, and freight value.
[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9
U.S. IMPORTS OF ANHYDROUS AMMONIA, BY COUNTRY OR LOCALITY[1]

(Thousand metric tons of ammonia and thousand dollars)

Country or locality	2016 Gross weight	2016 Value[2]	2017 Gross weight	2017 Value[2]
Canada	1,250	629,000	1,040	466,000
Russia	46	19,400	--	--
Saudi Arabia	80	16,600	40	8,860
Trinidad and Tobago	3,120	852,000 r	2,510	656,000
Venezuela	108	28,900	150	35,100
Other	66 r	21,100 r	20	6,590
Total	4,670	1,570,000 r	3,760	1,170,000

[r]Revised. -- Zero.
[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Cost, insurance, and freight value.

Source: U.S. Census Bureau.

TABLE 10
U.S. EXPORTS OF MAJOR NITROGEN COMPOUNDS[1]

(Thousand metric tons)

Compound	2016 Gross weight	2016 Nitrogen content	2017 Gross weight	2017 Nitrogen content	Principal destinations in 2017
Ammonium nitrate[2]	320	108	301	102	Canada, 70%; Mexico, 28%.
Ammonium sulfate[2]	936	198	691	146	Brazil, 32%; Canada, 19%; Peru, 18%.
Anhydrous ammonia	222	182	744	612	Morocco, 38%; Chile, 19%; Republic of Korea, 12%; Mexico, 11%.
Diammonium phosphate	1,720	309	1,620	291	India, 31%; Mexico, 14%; Brazil, 13%; Peru, 8%.
Monoammonium phosphate	2,580	284	2,300	253	Canada, 40%; Brazil, 30%; Australia, 13%.
Urea	321	147	872	400	Canada, 45%; Chile, 26%; Mexico, 17%.
Total	6,090 r	1,230	6,520	1,800	

[r]Revised.
[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes industrial chemical products.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS OF MAJOR NITROGEN COMPOUNDS[1]

(Thousand metric tons and thousand dollars)

Compound	2016 Gross weight	2016 Nitrogen content	2016 Value[2]	2017 Gross weight	2017 Nitrogen content	2017 Value[2]	Principal sources in 2017
Ammonium nitrate[3]	365	124	88,600	295	100	67,300	Canada, 71%; Russia, 11%; Netherlands, 8%.
Ammonium nitrate and limestone mixtures	61	16	11,300	43	12	8,360	Netherlands, 88%; Germany, 10%.
Ammonium sulfate[3]	477	101	98,400	426	90	82,600	Canada, 47%; Belgium, 31%.
Anhydrous ammonia[4]	4,670	3,840	1,570,000	3,760	3,090	1,170,000	Trinidad and Tobago, 67%; Canada, 28%.
Calcium nitrate	52	9	9,280 r	64	11	10,500	Norway, 83%; Slovakia, 11%.
Diammonium phosphate	586	105	213,000	805	145	286,000	Morocco, 63%; Russia, 27%.
Monoammonium phosphate	853	94	334,000	1,040	114	406,000	Morocco, 62%; Russia, 31%.
Nitrogen solutions	2,810	840	511,000	2,620	784	454,000	Russia, 36%; Trinidad and Tobago, 33%; Canada, 18%; Lithuania, 7%.
Potassium nitrate	66	9	45,800	106	15	64,300	Chile, 75%; Germany, 13%.
Potassium nitrate and sodium nitrate mixtures	4	(5)	1,990	5	(5)	1,700	Canada, 51%; Brazil, 22%.
Sodium nitrate	67	11	33,700	95	16	26,400	Chile, 47%; Germany, 44%.
Urea	6,580	3,020	1,640,000	5,510	2,530	1,400,000	Qatar, 24%; Canada, 13%; Saudi Arabia, 12%; United Arab Emirates, 11%.
Total	16,600	8,170	4,550,000	14,800	6,900	3,980,000	

[r]Revised.
[1]Table includes data available through May 10, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Cost, insurance, and freight value.
[3]Includes industrial chemical products.
[4]Includes industrial ammonia.
[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 12

AMMONIA: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Thousand metric tons, contained nitrogen)

Country or locality[2]	2013	2014	2015	2016	2017
Afghanistan	76	60	44	48 [r]	48 [e]
Algeria	580	1,360 [r]	1,770 [r]	2,170 [r]	2,100 [e]
Argentina	600	500	500 [r]	500 [r]	500 [e]
Australia	1,250	1,250	1,300	1,300	1,300 [e]
Austria[e]	400	400	400	400	400
Bahrain	461 [r]	454	416	468 [r]	465
Bangladesh[3]	600	600	630 [r, e]	585 [r, e]	213
Belarus	967	1,019	1,060	1,040 [r]	1,050
Belgium[e]	890	820	860	760 [r]	760
Brazil	1,000	870	1,000	1,000 [e]	1,000 [e]
Bulgaria	300	313	313	313 [e]	313 [e]
Canada	3,830 [r]	3,716 [r]	4,004 [r]	4,133 [r]	3,745
China	47,175 [r]	46,850 [r]	47,603 [r]	46,922 [r]	43,600
Croatia	343	376	375	347 [r]	387
Czechia	153	175	180	180 [e]	170 [e]
Egypt	2,655	2,200	1,800	2,800 [r]	2,800 [e]
Estonia	99	30	35	35	35
Finland	78	78	78	78 [e]	78 [e]
France	810 [r]	760 [r]	1,040 [r]	1,010 [r]	1,010 [e]
Georgia	150 [e]	170 [e]	190 [e]	150 [r]	150 [e]
Germany	2,757	2,540	2,500	2,500	2,500 [e]
Greece	105	119	119	75 [r]	80 [e]
Hungary[e]	290 [r]	390 [r]	330 [r]	370 [r]	370
India[4]	10,840	10,780	10,800	10,800 [e]	10,800 [e]
Indonesia	5,000	5,000	5,000 [e]	5,000 [e]	5,000 [e]
Iran	2,404	2,446	2,642	2,640 [e]	2,640 [e]
Iraq	146	125 [r]	40 [r, e]	35 [r, e]	35 [e]
Italy[e]	570	570	570	570	570
Japan	828	787	790	725 [r]	719
Kazakhstan	95	139	140 [r]	142 [r]	142
Kuwait	552	498 [r]	535 [r]	556 [r]	562
Libya	124	208	266	219 [r]	--
Lithuania	693	815	876	753 [r]	927
Malaysia	990	980	990	990 [e]	990
Mexico	758 [r]	714 [r]	473 [r]	438 [r]	411
Netherlands	2,300	2,200	2,300	2,300	2,300 [e]
New Zealand[e]	125	125	125	125	125
Nigeria	130	90	150	340 [e]	340 [e]
Norway[e]	300	300	300	300	300
Oman[e]	1,700	1,700	1,700	1,700	1,700
Pakistan	2,700	2,700 [r]	3,100 [r]	3,300 [r]	3,300 [e]
Peru	12	13	5	5 [e]	--
Poland	2,119	2,200	2,200	2,237 [r]	2,337
Qatar	2,986	2,972	3,050 [r]	2,960 [r]	3,220 [e]
Romania	920 [r]	980 [r]	500 [r]	440 [r]	440 [e]
Russia	11,879	12,030	12,455 [r]	13,300 [r]	14,020
Saudi Arabia	3,190 [e]	3,600 [e]	3,040 [r]	3,684 [r]	3,820 [e]
Serbia	166 [r]	90 [r]	73 [r]	60 [r]	60 [e]
Slovakia	390 [r]	280 [r]	390 [r]	330 [r]	330 [e]
South Africa[e]	620	620	620	620	620
Spain	440 [r]	440 [r]	400 [r]	410 [r]	410 [e]
Switzerland	20	20	30	30 [e]	30 [e]
Syria	20 [r]	20 [r]	--	--	20 [e]
Trinidad and Tobago	3,814 [r]	3,886 [r]	4,032 [r]	4,040 [r]	4,144
Turkey	360 [r]	410 [r]	560 [r]	380 [r]	380 [e]
Turkmenistan	285	293	309	309	320 [e]
Ukraine	3,480 [r]	2,419 [r]	2,168 [r]	1,678 [r]	979
United Arab Emirates	658	995	995 [e]	995 [e]	995 [e]
United Kingdom	790 [r]	810 [r]	840 [r]	820 [r]	820 [e]

See footnotes at end of table.

TABLE 12—Continued
AMMONIA: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Thousand metric tons, contained nitrogen)

Country or locality[2]	2013	2014	2015	2016	2017
United States[5]	9,170	9,330	9,590	10,200	11,600
Uzbekistan	1,100 r	1,000 r	1,100 r	1,100 r	1,100 e
Venezuela	1,200 e	1,100 e	1,000 e	830 r	830 e
Vietnam	1,000	1,100	1,100	1,100 e	1,100 e
Zimbabwe	27	22	15	NA e	NA
Total	140,000 r	140,000 r	142,000 r	144,000	142,000

[e]Estimated. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through October 2, 2018. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]In addition to the countries and (or) localities listed, Taiwan and Tajikistan produced ammonia, but available information was inadequate to make reliable estimates of output.

[3]May include nitrogen content of urea.

[4]Production is based on fiscal year, with a starting date of April 1.

[5]Synthetic anhydrous ammonia; excludes coke oven byproduct ammonia.