NITROGEN

By Deborah A. Kramer

Domestic survey data and tables were prepared by Feri Naghdi, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Nitrogen (N) is an essential element of life and a part of all plant and animal proteins. As a part pf the DNA and RNA molecules, N is an essential constituent of each individual's genetic blueprint. As an essential element in the chlorophyll molecule, N is vital to a plant's ability to photosynthesize. Some crop plants, such as alfalfa, soybeans, garden peas, and peanuts, 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 their nitrogen in the ammonium and/or nitrate form or in a form that is quickly converted to these forms once 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 is derived from a variety of raw materials, including water and crude oil, coal, or natural gas hydrocarbons. Other nitrogen fertilizers are produced from ammonia feedstocks through a variety of chemical processes. Small quantities of nitrates are produced from mineral resources principally in Bolivia and Chile.

In 2000, U.S. ammonia production was 12.3 million metric tons (Mt) of contained N, a 5% decline from that in 1999. Although the United States produced most of its ammonia requirements, imports, mainly from Canada, Russia, and Trinidad and Tobago, supplied a portion of consumption. Apparent consumption of ammonia also decreased by 5%. About 88% of the ammonia was used in fertilizer applications.

By yearend, the skyrocketing price of natural gas in the United States resulted in the temporary closure of significant quantities of ammonia production capacity. At the end of 2000, about 5.6 Mt of annual capacity was closed (including permanent facility closures). The closure of this ammonia capacity led to closures at urea and urea ammonium nitrate solution (UAN) plants because of the lack of ammonia feedstock. Several producers were selling their natural gas futures instead of producing ammonia. Two ammonia facilities—one in Louisiana and one in Oklahoma—were permanently closed during the year, and a new plant that uses petroleum coke as a feedstock opened in Kansas.

Global ammonia production in 2000 increased by about 2% from that of 1999 to about 109 Mt of contained N. China, India, and the United States continued to be the principal producers. In 2000, world urea production increased slightly to 49.4 Mt of contained N. Urea exports increased by nearly 9% to 12.0 Mt of contained N. China and India, the two largest producing countries, accounted for 47% of world production; production in China increased by about 2% and production in India decreased by 1% compared with those of 1999. The

Ammonia in the 20th Century

Prior to the 20th century, sources of fixed nitrogen compounds were limited to natural organic materials, natural nitrates, and coke-oven byproducts. By 1910, two techniques for nitrogen fixation were commercially established but required significant quantities of energy. During the first decade of the 20th century, the worldwide demand for nitrogen-based fertilizers exceeded the existing supply. The largest source of nitrogen was found in a huge guano deposit (essentially sea bird droppings) that was 350 kilometers in length and 1.5 meters thick and was located along the coast of Chile. This natural source of ammonia and nitrogenous compounds, however, was disappearing quickly. Fritz Haber invented a large-scale catalytic synthesis of ammonia from elemental hydrogen and nitrogen gas, reactants that are abundant and inexpensive. The original laboratory-scale process was first demonstrated in 1909 and patented by Haber in 1910. Carl Bosch and Friedrich Bergius contributed the invention and development of chemical high-pressure methods of ammonia production, which allowed higher ammonia yields. [These advances in ammonia production methods were the basis for two Nobel Prizes in chemistry—Haber in 1918 and Bergius and Bosch in 1931.] Although the original process has been modified since its development, mostly to improve processing efficiencies, the Haber-Bosch process remained the basis of ammonia production facilities through the end of the 20th century. With the advent of inexpensive ammonia production, consumption of ammonia increased rapidly. Statistical data for ammonia were not available before 1942, but U.S. consumption was estimated to be about 400,000 metric tons per year in the 1940s, with 80% of that used for agriculture. During World War II, demand for ammonia escalated because of the need for ammonium-base munitions. After the end of the war, ammonia demand continued to increase because additional fertilizer was required to grow food for a growing population.

By 2000, the United States, China, and India had become the three largest producers of ammonia in the world. Of a total world production of 109 million metric tons nitrogen content, these three countries produced nearly one-half; U.S. production was about 13 million tons of nitrogen content. The principal use for ammonia remained as a fertilizer, which accounted for about 88% of the total ammonia consumption in the United States. A significant quantity of ammonia was used to produce a variety of downstream products that included urea, ammonium nitrate, ammonium sulfate, and nitric acid, which also were used mainly as fertilizers.

United States and Canada produced about 11% of the total. China continued its ban on imports of urea and supplied its needs with domestic production. With the passage of the U.S.-China Relations Act of 2000 (Public Law 106-286) and the pending membership of China in the World Trade Organization (WTO), this ban may be lifted.

Legislation and Government Programs

In October, the U.S.-China Relations Act of 2000 was enacted into law. As part of its provisions, the law normalized trade relations with China, ending the annual congressional review of China's normal-trade-relations (NTR) status, and stated that the United States should ask the WTO to monitor China's performance annually as part of China's admission to the organization (CBS News, October 10, 2000, Clinton inks China trade bill, accessed May 23, 2001, at URL http://www.cbsnews.com/now/story/0,1597,234529-412,00.shtml). As a result of granting permanent NTR status to China, the fertilizer industry can benefit from a U.S.-China market access agreement that was signed in 1999. Under the agreement, a tariff rate quota for urea and diammonium phosphate (DAP) would be established, and the importation of a certain quantity of urea and DAP through China's private sector would be allowed. The agreement set tonnage quantities that would be subject to an in-quota tariff rate of 4%. Any imported tonnage above this number would be subject to a 50% tariff rate unless the Chinese Government chooses to waive applying the higher rate. For DAP, the in-quota tonnage would begin with 5.4 Mt and increase to 6.9 Mt by the sixth year. For urea, the in-quota tonnage would start at 1.3 Mt and increase to 3.3 Mt in the sixth year (Green Markets, 2000b).

On October 13, the Committee for Fair Ammonium Nitrate Trade filed a petition with the U.S. International Trade Commission (ITC) alleging that ammonium nitrate from Ukraine was being sold in the United States at less than fair value. As a result, the ITC began an antidumping investigation of imports of ammonium nitrate from Ukraine and determined that there was a reasonable indication that the domestic industry was being injured (U.S. International Trade Commission, 2000). The International Trade Administration (ITA), U.S. Department of Commerce, began its investigation into the antidumping allegation in November and made a preliminary determination in March 2001. According to the ITA's investigation, the estimated dumping margin for J.S.C. "Concern" Stirol was 113.38% ad valorem. The Ukraine-wide rate, which was applicable to all other producers and exporters, was also 113.38%. The ITA also determined that critical circumstances existed. A final determination was set to be completed 105 days after the notice was published in the Federal Register (U.S. Department of Commerce, 2001).

In July, the U.S. Environmental Protection Agency (EPA) established a final rule on how and when States must move to limit nutrient levels and pollution in water bodies. According to the EPA rule, States, territories, and authorized tribes would be required to develop more comprehensive lists of all water bodies that do not attain and maintain water-quality standards. They also would need to establish all necessary total maximum daily loads (TMDLs) over a 10-year period, with an allowance for another 5 years where necessary. The rule also specified elements of approvable TMDLs, including implementation plans containing lists of actions and expeditious schedules to reduce pollutant loadings. The rule established specific timeframes under which the EPA would ensure that lists of waters and TMDLs are completed as scheduled and necessary National Pollutant Discharge Elimination System (NPDES) permits are issued to implement TMDLs. The final rule explained the EPA's discretionary authority to object to and reissue, if necessary, State-issued NPDES permits that have been administratively continued after expiration where there is a need for a change in the conditions of the permit to be consistent with water-quality standards and established and approved TMDLs (U.S. Environmental Protection Agency, 2000).

In June, the Governors of Maryland, Virginia, and Pennsylvania, the Mayor of Washington, DC, and the Administrator of the EPA signed the new Chesapeake Bay Agreement, which established regional standards for Bay restoration over the next 10 years. Included in these standards is a cap on nitrogen and phosphorus loading, which would remain at the existing level of 40% (Governor's Office of the State of Maryland, June 28, 2000, Governor Glendening, leaders from neighboring States sign historic agreement to preserve Chesapeake Bay, accessed June 11, 2001, at URL http://www.gov.state.md.us/gov/press/2000/jun/html/chesbao.html).

Production

Industry statistics for anhydrous ammonia and derivative products were developed by the U.S. Census Bureau. A summary of the production of principal inorganic fertilizers by quarter was reported in the series MQ325B, and industrial gases (including nitrogen) were reported in the quarterly report MQ325C. Final data for inorganic fertilizers were subsequently published in the companion annual report MA325B, and data for industrial gases were published in the annual report MA325C.

In 2000, production of anhydrous ammonia (82.2% N) decreased by 5% to 12.3 Mt of contained N compared with a revised figure of 12.9 Mt in 1999 (table 1). Of the total production, 88% was for use as a fertilizer; the remaining 12% was used in other chemical and industrial sectors (table 2). Because a significant portion of the ammonia production was estimated, production figures reported by the U.S. Census Bureau were probably high; significant declines in production occurred, especially during the fourth quarter of 2000, because of capacity reductions, which may not have been accounted for in the census figures.

The United States remained the world's second largest producer and consumer of elemental and fixed types of nitrogen following China. In declining order, urea, ammonium nitrate, ammonium phosphates (DAP, monoammonium phosphate, and other ammonium phosphates), nitric acid, and ammonium sulfate were the major downstream products produced from ammonia in the United States. Their combined production was 10.5 Mt of contained N, with urea accounting for about 30% of the production (table 3). Of the urea produced in the United States in 2000, 65% was used for UAN production, 22% was consumed in granular form, 11% was consumed in prill form, and 12% was consumed in feedstock for such other uses as melamine production.

Ammonia producers in the United States operated at about

70% of design capacity; this percentage includes capacities at plants that operated during any part of 2000. Excluding the plants that permanently closed during 2000, more than 55% of total U.S. ammonia production capacity was concentrated in the States of Louisiana (33%), Oklahoma (13%), and Texas (9%), owing to large indigenous reserves of feedstock natural gas. Farmland Industries Inc., Terra Industries Inc., PCS Nitrogen Inc., Agrium Inc., CF Industries Inc., and Mississippi Chemical Corp., in declining order, accounted for 73% of total U.S. ammonia capacity (table 4).

Skyrocketing natural gas prices in the second half of 2000 led to temporary closures of much of the U.S. nitrogen capacity. By the end of 2000, the Henry Hub spot price for natural gas had reached more than $10 per million British thermal units. Much of this rapid price increase occurred in the last 3 months of the year; at the end of October, the price was about $4.50 per million British thermal unit, and by the end of November, it was $6.50 per million British thermal unit (U.S. Energy Information Administration, February 5, 2001, Natural gas weekly market update, accessed May 14, 2001, via URL http://www.eia.doe.gov). In some instances, it became more profitable for the operating companies to sell their natural gas futures contracts than to produce and sell nitrogen products. By yearend, about one-half of the U.S. nitrogen production capacity was shut down (Green Markets, 2000i). In addition to regular maintenance turnaround closings, companies began closing capacity in June in response to higher natural gas prices.

At yearend, the following U.S. ammonia plants were closed because of market conditions: Agrium—Finley, WA; Coastal Corp.—St. Helen's, OR, and Cheyenne, WY; Farmland—Pollock, LA; Koch Nitrogen Co.—Sterlington, LA; Royster-Clark Inc.—East Dubuque, IL; and Terra Industries—Beaumont, TX. The following ammonia plants were partially closed because of market conditions: Agrium—Borger, TX [135,000 metric tons per year (t/yr)]; CF Industries—Donaldsonville, LA (762,000 t/yr); and PCS Nitrogen—Augusta, GA (195,000 t/yr), Geismar, LA (95,000 t/yr), and Lima, OH (112,000 t/yr). In addition, many associated urea and UAN production plants were closed without sufficient ammonia feedstock (Fertilizer Markets News Update, 2000).

In January, Agrium signed an agreement with Unocal Corp. to purchase its nitrogen-based production and distribution businesses for an estimated $398 million. Because of market concentration concerns, the U.S. Federal Trade Commission (FTC) investigated the purchase. As a result, the FTC required Agrium to divest the Unocal deepwater terminal near Portland, OR, part of its upriver terminal in central Washington (Hedges), which contains urea storage capacity, and the leases on three UAN terminals, including one with deepwater access. These assets were sold to J.R. Simplot Co. (U.S. Federal Trade Commission, September 29, 2000, FTC clears Agrium, Inc.'s acquisition of Unocal, accessed May 14, 2001, via URL http://www.ftc.gov). The acquisition was finalized in October and included an ammonia-urea complex in Kenai, AK; an ammonia complex in Finley (Kennewick), WA, which also produced ammonium nitrate, nitric acid, and UAN solutions; and storage facilities and terminals in Kennewick and West Sacramento, CA (Green Markets, 2000a).

Also in January, Coastal announced that it would be acquired by El Paso Energy Corp. The total value of the transaction was approximately $16 billion, including $6 billion of assumed debt and preferred equity. The merger was not completed until January 2001, after FTC approval. As part of the FTC approval, the company agreed to divest its ownership in five pipeline systems and certain offshore assets. The revenue from these sales was expected to be used to pay down some debt (El Paso Corp., January 29, 2001, El Paso Energy completes merger with Coastal, creating the world's leading natural gas company, accessed May 14, 2001, via URL http://www.epenergy.com). Coastal, through its subsidiaries, owned three ammonia plants in Cheyenne, WY, Freeport, TX, and St. Helens, OR, with a total capacity of 471,000 t/yr; the ammonia and nitrogen fertilizer assets were only a small portion of Coastal's holdings.

Farmland announced that it would sell its Coffeyville, KS, oil refinery but retain ownership of the adjacent ammonia and UAN plants. The company opened its nitrogen complex, which uses petroleum coke as a raw material, in September and was running the operation in a start-up mode for the remainder of the year (Green Markets, 2000d).

In April, Mississippi Chemical announced it had signed a letter of intent to purchase a 227,000-t/yr granular urea production facility in Faustina, LA, from IMC-Agrico Co. No purchase price was disclosed. Mississippi Chemical planned to operate the plant in conjunction with its ammonia/urea complex located approximately 1.6 kilometers (km) away in Donaldsonville, LA. IMC Global Inc., one of the partners in IMC-Agrico, previously had announced plans to exit the urea business and other noncore product lines as part of its restructuring program launched in December 1998. IMC had stopped production of urea at its Faustina facility in the summer of 1999, but the 508,000-t/yr ammonia plant would continue to supply ammonia as a raw material for use in IMC-Agrico's production of concentrated phosphate products at the same location (Green Markets, 2000g).

Two separate explosions idled parts of two plants for nearly one-half of 2000. On May 24, an explosion at CF Industries' Donaldsonville, LA, ammonia plant killed two workers and hospitalized nine others (ABC News, May 25, 2000, Plant explosion, accessed May 25, 2000, at URL http://abcnews.go.com/sections/us/DailyNews/ammoniaplant000525.html). Because of this, the company's #3 unit was closed for the remainder of 2000, and portions of other units also were closed for most of the remainder of the year because of collateral damage. A July 14 explosion in the ammonia unit at Farmland's Lawrence, KS, ammonia-UAN complex that caused minor damage shut down the plant for a short period. Because of the fire, the company performed a complete turnaround on the plant, and it was brought back on-stream in November (Green Markets, 2000c).

Willard Grain & Feed Inc., operating as Wil-Grow Fertilizer Co., announced that it would liquidate all of the company assets and cease business in February. The company operated ammonia, ammonium nitrate, and UAN production facilities at Pryor, OK; these facilities had been idle since the end of 1999 (Green Markets, 2000k).

In June, Borden Chemical & Plastics L.P. announced that it would close and scrap its ammonia and granular urea complex in Geismar, LA. The company cited a decline in nitrogen values and increasing cost of natural gas feedstock as part of its reason to close the operation (Fertilizer Markets, 2000b).

LaRoche Industries Inc. filed for chapter 11 bankruptcy in May. At the time of the filing, LaRoche estimated that it had more than 1,000 creditors, with Cytec Industries Inc., its equal partner in the Avondale Ammonia Co. joint venture, as the fourth largest. In August, LaRoche announced the sale of its ammonium nitrate facilities in Alabama, Missouri, Illinois, and Utah to Orica LLC, a unit of Orica Ltd., an international manufacturer and distributor of explosives. After the U.S. Bankruptcy Court in Delaware approved the sales, Orica then sold the Cherokee, AL, and Crystal City, MO, facilities to LSB Industries Inc., which planned to operate these facilities under its El Dorado Chemical Co. subsidiary; these facilities included a 159,000-t/yr ammonia plant in Cherokee (Green Markets, 2000f). In April 2001, the Court approved LaRoche's settlement with Cytec in which Cytec will take over total ownership of the Avondale Ammonia plant for $800,000 (Green Markets, 2001).

Environment

The ammonium and nitrate forms of N are highly soluble in water and are readily available for crop plant uptake. Ammonium is held by soil particles and, therefore, is not subject to movement down through the soil during periods of rainfall or irrigation. Nitrates, however, do move downward with soil water. This leaching process can lead to nitrate accumulation in ground water. As soils are warmed during the growing season, the ammonium form of nitrogen is subject to conversion to nitrate in a process called nitrification. Most of the ammonium not used by the crop is eventually converted to nitrate. Nitrogen stabilizers and nitrification inhibitors can slow the conversion of soil ammonium to nitrate. Best management practices to increase nitrogen use efficiency and to reduce nitrate leaching include application of fertilizer close to the time of actual crop use, multiple applications, terracing, grass waterways, and strip cropping.

Hypoxia in the Gulf of Mexico recently has become a controversial environmental concern for the fertilizer industry and an issue that spawned significant research efforts to determine its cause. "Hypoxia in the Gulf of Mexico" refers to an area along the Louisiana-Texas coast in which water near the bottom of the gulf contains less than 2 parts per million of dissolved oxygen. Hypoxia can cause stress or death in bottom-dwelling organisms that cannot move out of the hypoxic zone. Some studies postulated that nitrate runoff from fertilizers is the principal cause of hypoxia, while others cited other causes for the hypoxic zone.

U.S. Geological Survey (USGS) study results published in 2000 supported previous findings that most of the nitrogen pollution delivered to the Gulf of Mexico by the Mississippi River originates far upstream in the upper Midwest and Ohio Valley States. But this study also found that within these regions there were large differences in the percentage of nitrogen reaching the gulf, depending on the relation of the location of nitrogen sources to streams of different sizes in the watershed. The study found that the rates of nitrogen reaching the gulf from upstream areas near large rivers in such States as Ohio and Minnesota were much higher than those in neighboring areas near small streams. Moreover, areas near large rivers in these same States, located more than 2,400 km from the gulf, also deliver more nitrogen to the Gulf than areas near small streams in the states of Mississippi and Arkansas, located only a few hundred kilometers from the Gulf. This study found that nitrogen pollution was naturally removed from water much more rapidly in small streams than in large rivers. As a result, nitrogen delivery from point and nonpoint sources in a stream drainage basin was not simply a function of the distance between the gulf and the nitrogen source, but a function of the amount of time the nitrogen traveled through small streams (U.S. Geological Survey, 2000, Percentage of stream nitrogen reaching the Gulf of Mexico, accessed May 15, 2001, at URL http://www.usgs.gov/themes/nature.html). The data supporting these conclusions also has been published as a map. Information on additional USGS involvement in hypoxia research is available at URL http://toxics.usgs.gov/highlights/hypoxia.html.

A group of scientists from Federal agencies and academic institutions completed its report "Hypoxia in the Northern Gulf of Mexico," which was released in May 2000. In this assessment, a national model of the agriculture sector was used to examine many of the economic effects and the changes in nitrogen loading under various scenarios. Reducing nitrogen loss at the edge of the field by 20% through a combination of economically optimal improvements in farming practices would be expected to cost producers and consumers about $0.40 per pound of nitrogen reduction. Other measures to reduce nitrogen loads to rivers and streams, such as reducing urban point and nonpoint sources and atmospheric deposition, could provide important contributions in some instances; average costs of reducing point sources and atmospheric deposition were estimated to be between $5 and $50 per pound. Increasing the acreage of wetlands and vegetated riparian buffers within the basin would enhance denitrification (a process that removes nitrogen from the system), increase nitrogen retention, and decrease the amount of nitrogen entering streams and rivers. Model analyses demonstrated that the most effective use of restored and created wetlands would be in watersheds that discharge high quantities of nitrogen. At typical denitrification rates for flow-through wetlands, more than 2 million hectares of wetlands would reduce nitrogen load to the gulf by 20% and would cost an estimated $4.05 per pound of nitrogen denitrified. An estimated 7.7 million hectares of additional riparian buffers would be needed to reduce nitrogen load to the gulf by the same amount (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, May 2000, Hypoxia in the northern Gulf of Mexico, accessed November 7, 2000, at URL http://www.nos.noaa.gov/products/pubs_hypox.html).

On October 11, Federal and State officials agreed on a $1 billion per year plan to revive as much as 30% of the hypoxic zone in the Gulf of Mexico by 2015. Under the plan, more money would go to programs that reduce excess nutrients in streams and rivers feeding into the Mississippi, which drains 40% of the continental United States. These programs would cut fertilizer use on farms, establish wetlands and buffer strips near streams to soak up excess nitrogen, and reduce discharges from sewage treatment plants. The plan also called for funding scientific efforts to track the flow of nitrogen (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, October 12, 2000, Agreement to shrink dead zone, accessed May 17, 2001, at URL http://www.nos.noaa.gov/products/pubs_hypox.html#update).

A report prepared by the National Research Council of the National Academy of Sciences stated that the Federal Government—along with State and local agencies—should develop a comprehensive regulatory solution to combat nitrogen and phosphorous runoff from agricultural fields, which was causing serious environmental damage along the Atlantic and Pacific coastlines. The committee that prepared the reports said that a national strategy should strive to reduce the number of severely damaged coastal areas by 25% by 2020 and to ensure that no other areas become affected. Initiatives that were identified by the committee to address the problem included expanding monitoring and assessment programs, exerting Federal leadership on issues spanning multiple jurisdictions or threatening federally protected natural resources, eliminating overlap and gaps among existing and proposed Federal legislation, providing data and technical assistance to local coastal authorities, and developing a classification scheme to provide better information on the likelihood that excess nutrients will damage coastal areas (Green Markets, 2000h).

Nutrient runoff also was hypothesized to cause deterioration of the coral reefs in the Florida Keys. According to a report prepared by scientists from the University of Miami, nutrients in runoff from the Everglades agricultural area were generating algal blooms, which in turn have killed sponges, increased turbidity, reduced the light available to seagrasses, and altered the entire food web of Florida Bay. The research also has shown that this nutrient- and algae-rich water was transported into the Florida Keys coral reef tract, where water quality has declined (Larry Brand, 2000, An evaluation of the scientific basis for "restoring" Florida Bay by increasing freshwater runoff from the Everglades, accessed May 17, 2001, via URL http://www.reefrelief.org/main.html).

Economic and environmental effects of alternative environmental policies were analyzed using the U.S. Regional Agricultural Sector Model developed by the U.S. Department of Agriculture's (USDA) Economic Research Service. The analysis covered policy effects on most major agricultural commodities. A goal of 10% reduction in nitrogen releases from agriculture was used to illustrate the effects of a small change in nitrogen releases on production and trade. To reduce nitrogen releases by 10%, four alternative generic policy approaches were evaluated: (1) a "green payment" that producers would receive from the Government to compensate for lower returns resulting from lower crop yields caused by reduced fertilizer use; (2) regulations to reduce per-acre nitrogen use; (3) a tax on nitrogen fertilizer; and (4) buffer strips and other land retirement to intercept field runoff and reduce nitrogen fertilizer use. Among the first three policies, a green payment policy would achieve the environmental goal with the least market-price escalation. A green payment approach also would generate the smallest consumer costs and the greatest producer benefits, but it also would involve the greatest Government cost and would result in the largest increase in soil erosion. In contrast, a land retirement policy to achieve the same nitrogen loss reduction would have export-reducing effects almost six times that of a green payment policy, with the largest costs to consumers. Producer benefits in the land retirement scenario were second only to green payments, and the reduction in soil erosion was the greatest of any scenario. (Agricultural Outlook, 2000).

Consumption

In 2000, apparent consumption of ammonia decreased by 5% to 15.4 Mt of contained N. Apparent consumption is calculated as the production plus imports minus exports, adjusted to reflect any changes in stocks.

Consumption of nitrogen fertilizers in the United States for the 2000 crop year (ending June 30, 2000) is listed in table 5. Consumption of 11.2 Mt of contained N was about 2% less than that in 1999. Anhydrous ammonia was the principal fertilizer product, representing 30% of fertilizer consumption. Of the single-nutrient fertilizers, only consumption of urea and ammonium sulfates increased from that in the 1999 crop year.

Other uses of ammonia are in the production of amines, cyanides, and methyl methacrylate polymers (plexiglass); in liquid household and industrial cleaners; in industrial stack-gas scrubbing; in pulp and paper products; in industrial refrigeration; in metallurgy; and as a propellant in vehicular air bags (Nitrogen & Methanol, 2000b).

Urea and UAN solutions constituted 42% of fertilizer consumption during the 2000 crop season. Urea is typically 45.9% N, and UAN solutions are typically 29.8% to 29.9% N. In the industrial sector, urea is used extensively as a protein supplement in ruminant animal feeds, in the production of urea-formaldehyde adhesives, and in the synthesis of plastics and resins.

Ammonium nitrate was used primarily in solid and liquid fertilizers, in industrial explosives, and as blasting agents. After World War II, ammonium nitrate became the leading solid nitrogen fertilizer in the United States and worldwide and remained so until about 1975 when its use was surpassed by synthetic urea. Ammonium nitrate containing 33.9% N constituted 5% of 2000 nitrogen fertilizer consumption.

Ammonium sulfate was used mostly as a fertilizer material, valued for its nitrogen content (21.2% N) and its readily available sulfur content (24.3% sulfur). It is commonly produced as a byproduct of caprolactam production, an intermediate in nylon manufacture. Since the introduction of ammonium nitrate and urea as fertilizer materials, the relative importance of ammonium sulfate worldwide has steadily decreased. In the 2000 crop year, fertilizer consumption of ammonium sulfate, based on nitrogen content, was 2% of the total nitrogen-based fertilizer market. Nonfertilizer uses of ammonium sulfate include food processing, fire control, tanning, and cattle feed.

Nitric acid production is listed in table 3. Nitric acid is used in salt formation reactions to produce metal nitrates and in metal degreasing, treating, and pickling for the graphic and galvanic industries. Nitration reactions with benzene, phenol, and toluene produce dyestuffs, pharmaceutical products, trinitrotoluene explosives, and disinfectants. Esterification reactions with glycol, glycerol, and cellulose produce nitroglycerine explosives (dynamite), celluloid, and nitrocellulose lacquers. Oxidation reactions with toluene, p-xylene, and cyclohexanone produce polyurethanes and polyester fibers (nylon).

Elemental nitrogen is used extensively by the electronics, metals, food, and aerospace industries because of its inert and cryogenic properties. Nitrogen can be used to prevent fires and explosions, as a purging agent for cleaning and processing equipment, and as a controlling atmosphere for annealing and heat treating and other metal preparation processes where oxygenation is a concern.

Stocks

Stocks of ammonia in 2000 were 1.12 Mt, an increase of 12% from those at the end of 1999, according to data published by The Fertilizer Institute (table 6). The U.S. Census Bureau reported ending stocks of ammonia to be 420,000 metric tons (t), which was a significant difference from The Fertilizer Institute data. In addition, there were no reported census data for 1999 with which to compare this figure because the 1999 data were withheld. Although the USGS traditionally has used census data in calculating apparent consumption, the calculation was computed using The Fertilizer Institute data to minimize irregularities caused by continually switching data series.

Transportation

Ammonia was transported by refrigerated barge, rail, pipeline, and truck. Three companies serve 11 States with 4,900 km of pipelines, with 4,800 km of river barge transport, and by rail and truck used primarily for interstate or local delivery.

Koch Industries Inc. operated the Gulf-Central ammonia pipeline from the Gulf of Mexico (Louisiana) to the Midwest as far north as Iowa, spanning 3,070 km, and to the east to Huntington, OH. The annual capacity of this pipeline was about 2 Mt, with a storage capacity of more than 1 Mt.

CF Industries and Cargill Fertilizer Inc. jointly operated the 135-km long Tampa Bay pipeline (TBP) system. TBP moved nitrogen compounds and ammonium phosphate for fertilizer producers in Hillsborough and Polk Counties, FL.

The pipelines of Williams Companies Inc. and its subsidiary Mid-America Pipeline System extend from Borger in northern Texas to Mankato in southern Minnesota, covering 1,700 km. The pipelines have an annual capacity of more than 1 Mt and about 500,000 t of ammonia storage capacity. In 2000, Williams formed a wholly owned subsidiary, Williams Energy Partners L.P., to acquire, own, and operate a diversified portfolio of energy assets. This partnership includes Williams' ammonia pipeline and distribution facilities. In October, Williams Energy Partners filed with the Securities and Exchange Commission to register for an initial public offering of stock, which was begun in February 2001 (The Williams Companies Inc., October 30, 2000, Williams Energy Partners L.P. files S-1, accessed November 8, 2000, at URL http://www.williams.com/news/newsreleases/rel618.html).

Capacities for trucks and railcars are usually 20 t and 100 t, respectively. Depending on the product loaded and the volume of the container, barges can accommodate from 400 t to 2,000 t.

Ammonium nitrate is transported by rail, road, and water, but its transportation on U.S. navigable waterways is restricted. Urea is shipped either in bulk or as bagged material.

Prices

Although the individual price curves were slightly different, all the nitrogen prices (ammonia, ammonium nitrate, ammonium sulfate, and urea) reached their highest price of the year at yearend (table 7). Ammonia prices climbed throughout most of the year (figure 1). After a steep climb during the spring planting season to $176 per short ton from $117 per short ton, the price stabilized, then reacted to the escalation in natural gas prices to increase to $230 per short ton by yearend. Granular urea prices rose early in the year to $148 per short ton from $110 per short ton (figure 2), then dropped slightly. After a price spike at midyear, the price leveled off until the very end of 2000 when it, too, reacted to the increased natural gas price. At yearend, the granular urea price was $160 per short ton. The average granular Gulf Coast urea price for the year was about $143 per short ton, more than 50% higher than the 1999 average price. The average ammonia price was $169 per short ton.

Ammonium nitrate prices (figure 3) showed a similar trend to that of urea, rising early in the year, declining, rising again at midyear, then leveling off until the very end of 2000 when they reached their high for the year at $145 per short ton. Ammonium sulfate prices also rose at the beginning of 2000, leveled off at about $122 per short ton, then rose to reach $133 per short ton at yearend (figure 4).

Foreign Trade

Ammonia exports increased by about 18% from those in 1999 (table 8); much of this increase was reflected in increased exports to the Republic of Korea, which remained the principal destination, accounting for 80% of total U.S. exports of ammonia. Most of the material shipped to the Republic of Korea was produced at the Agrium plant in Alaska.

Imports of anhydrous ammonia were essentially the same as those in 1999 (table 9). Trinidad and Tobago (51%), Canada (22%), and Russia (19%) were the primary sources. Tables 10 and 11 list trade of other nitrogen materials and include information on principal source or destination countries.

World Review

Anhydrous ammonia and other nitrogen materials were produced in more than 80 countries. Global ammonia production in 2000 increased by about 2% from that of 1999 (table 12). In 2000, total ammonia production was 109 Mt contained N, according to data reported to the USGS. China, with 26% of this total, was the largest world producer of ammonia. Asia contributed 44% of total world ammonia production, and the United States and Canada represented 15% of the global total. Countries in the former U.S.S.R. produced 13% of the total; Western Europe, 10%; the Middle East, 7%; Latin America, 5%; and Africa, Eastern Europe, and Oceania contributed the remaining 6%.

In 2000, world ammonia exports increased by 6% to 12.7 Mt of contained N compared with those of 1999. Russia (19%), Trinidad and Tobago (19%), Ukraine (10%), and Canada (7%) accounted for 55% of the world total. The United States imported 33% of global ammonia trade, followed by Western Europe (27%) and Asia (20%) (International Fertilizer Industry Association, 2001a, p. 1-11).

In 2000, world urea production increased slightly to 49.4 Mt of contained N. Urea exports increased by nearly 9% to 12.0 Mt of contained N. China and India, the two largest producing countries, accounted for 47% of world production; production in China increased by about 2% and production in India decreased by 1% compared with those of 1999. The United States and Canada produced about 11% of the total. Exports from most geographic areas increased, with the exception of an 8% decrease from North America and a 27% decrease from Latin America. The Middle East exported the largest quantity of urea with 26% of the total. Russia and Ukraine together also accounted for 26% of total exports, Asia for 13%, Canada and the United States for 10%, Western Europe for 8%, Eastern Europe for 7%, and China and Latin America for 4% each. Latin America accounted for 21% of global urea imports, Western Europe for 18%, North America for 17%, and Asia for 16% (International Fertilizer Industry Association, 2001b, p. 1-

14).

***Algeria.*—**ASMIDAL Group, its trading partner Transammonia Inc., and the German engineering firm Ferrostaal AG signed a memorandum of understanding (MOU) to build a 600,000-t/yr joint-venture ammonia plant. The new facility was expected to be sited in Arzew near two existing ammonia units with a combined capacity of about 550,000 t/yr. Estimated project cost was $370 million, and the product would likely be exported to nearby fertilizer and caprolactam producers on the Spanish Mediterranean coast. The joint-venture partners did not disclose how the equity would be divided or the potential timetable for plant construction (Fertilizer Week, 2000a).

***Argentina.*—** In May, Profertil S.A., the joint venture between Agrium and Repsol YPF S.A., began ammonia trials at its new 1.1-million-metric-ton-per-year (Mt/yr) ammonia-urea complex in Bahia Blanca. A fire at the ammonia plant in July delayed full commissioning of the ammonia section until October, which in turn delayed the start-up of the urea section. The commissioning of the granular urea section, originally scheduled for the second half of 2000, was delayed further because of ammonia leaks and vents that occurred during start-up. By yearend, Profertil decided to install ammonia flare stacks at the complex as protection against future ammonia leaks or vents (Fertilizer Week, 2000v). The urea plant began production in January 2001.

***Australia.*—**Wesfarmers CSBP began commissioning its new $90 million, 650-metric-ton-per-day (t/d) ammonia plant in April. The plant was scheduled to be commissioned in September 1999, but building delays postponed the start-up. The new plant uses Haldor-Topsøe technology and replaced a 300-t/d unit that was closed in August 1999. The additional production from the new plant would also replace ammonia that had been imported from Qatar (Fertilizer Week, 2000c). Wesfarmers used the ammonia as feedstock for ammonium nitrate production, gold extraction, and nickel refining.

Queensland Fertilizer Assets Ltd., Krupp Uhde, a unit of ThyssenKrupp AG of Germany, and Devco International Co. of the United States, signed an MOU to develop a nitrogen fertilizer complex near Pickanjinnie, Queensland. The proposed plant, which was scheduled to be completed by 2003, was expected to have the capacity to produce 330,000 t/yr of ammonia, 330,000 t/yr of urea, and 150,000 t/yr of low-density ammonium nitrate. Krupp Uhde will use its own licensed technology for the production units (Fertilizer Week, 2000z).

Plenty River Corp. and India's Chambal Fertilizers and Chemicals Ltd. terminated the MOU that they signed in 1999 relating to Plenty River's proposed ammonia-urea complex in Western Australia. As part of the MOU, Chambal Fertilizers and Chemicals would be brought into the project as a 50%-equity participant upon completion of a positive feasibility study (Fertilizer Markets, 2000f). Plenty River was seeking a new participant to take Chambal Fertilizers and Chemicals' 50% share. The other equity partners in the project were Snamprogetti S.p.A. of Italy (15%) and Theiss Pty. Ltd. (5%); Plenty River maintains a 30% equity. Right after the MOU was dissolved, Queensland Fertilizer Assets signed a 15-year offtake contract with Helm Düngemittel of Germany GmbH, an international marketing company. Under this agreement, total production of ammonia and urea would be sold to Helm Düngemittel under a 15-year take-or-pay contract. The plant was expected to produce approximately 760,000 t/yr of granular urea with 190,000 t/yr of excess salable ammonia. Construction was scheduled to begin in 2001 with commissioning of the plant in 2004 (Fertilizer Week, 2000u).

***Bangladesh.*—**In May, Bangladesh Chemical Industries Corp. and China's Huanqui Chemical Engineering Co. signed an MOU to conduct a feasibility study for a 560,000-t/yr urea plant in northwestern Bangladesh. Although several sites were under consideration, the most probable site was Sirajganj (Nitrogen & Methanol, 2000a).

***Brazil.*—**After a 3-month shutdown beginning in September, Petróleo Brasileiro S.A. (Petrobras) increased capacity at its ammonia-urea complex in Camacari by about 50%. Total production capacity after the revamp was 495,000 t/yr of ammonia and 500,000 t/yr of urea. Petrobras exported most of its surplus ammonia through a term contract with Transammonia (Fertilizer Week, 2000s).

***Bulgaria.*—**In June, a consortium of a management buyout team and one of its marketing partners purchased 51% of Neochim S.A. for $100,000. After the buyout, the ownership of the plant was shared among the Bulgarian company Evrofert S.A. (the buyout team) (39%), the Lebanese company Karimex Chemicals International S.A. (the marketing partner) (12%), and the Bulgarian Government (24%). Small portions were owned by various funds and private individuals. The new owners planned to invest $5.5 million over 5 years to improve the plant. Production capacity at the plant was estimated to be 410,000 t/yr of ammonia and 630,000 t/yr of ammonium nitrate, but the plant had been operating at only about 40% of the total (Fertilizer Week, 2000o). As part of the buyout, the company reached an agreement with the country's natural gas supplier to extend Neochim's debt repayment period until April 30, 2001.

In November, Bulgaria's Council of Ministers announced an increase in the duty on ammonium nitrate to 40% from 25%; this duty increase was aimed at protecting domestic producers from imports of ammonium nitrate from Georgia, Romania, Russia, and Ukraine. The duty increase was requested by producers in June when gas prices began to climb. The Government started an antidumping duty investigation to parallel the increase in import duties (Fertilizer Week, 2000b.).

***Canada.*—**The sharp increase in natural gas prices that resulted in closures at many U.S. ammonia facilities also had the same effect on many plants in Canada. At yearend, Agrium had closed about 651,000 t/yr of its ammonia capacity in Alberta because of market conditions. This represented about 27% of the company's total production capacity in Alberta (Fertilizer Markets News Update, 2000).

***Chile.*—**After Potash Corp. of Saskatchewan (PCS) purchased the Yumbes nitrate operation in 1999, it renamed the operation PCS Yumbes, and the company began producing nitrates from the deposit in August 2000. The first material to be produced was potassium nitrate. Eventually, the company planned to produce about 300,000 t/yr of nitrates, of which about 265,000 t/yr was expected to be potassium nitrate, and the remaining 35,000 t/yr would be sodium nitrate. For domestic sales, PCS has entered into a marketing agreement with Cargill Inc. to serve Chilean fertilizer and industrial-grade nitrates markets (Fertilizer Week, 2000r).

Sociedad Quimica y Minera de Chile S.A. (SQM) brought its new 160,000-t/yr potassium nitrate plant on-stream at the end of August. As part of the joint-venture agreement that was signed in 1998 between SQM and Norsk Hydro A/S, SQM retained the majority stake in the plant, and by selling nitrates, Norsk Hydro had the opportunity to increase its product range in Europe

(Fertilizer Week, 2000aa).

A third potassium nitrate plant in Chile was scheduled to begin production by yearend. Compania de Salitre y Yodo S.A. (Cosayach) expected to begin production at its 200,000-t/yr operation near Pozo Almonte. Although potassium nitrate would be the principal product, Cosayach also planned to produce sodium nitrate and iodine (Fertilizer Markets, 2000e).

China.—Yunnan Yuntianhua Co. and its trading partner China National Chemical Construction Co. signed a licensing contract with the Dutch firm Stamicarbon bv to debottleneck and upgrade its urea plant in Shuifu, Yunnan Province. The upgrade was expected to be completed in 2002 and would increase the plant's capacity to about 860,000 t/yr from 535,000 t/yr. In addition to increasing capacity, the revamp was expected to help improve energy consumption (Fertilizer International, 2000c).

China National Offshore Oil Corp. announced that it would construct an ammonia-granular urea plant in Dongfang City, Hainan Province. Proposed plant capacity was 450,000 t/yr of ammonia and 800,000 t/yr of urea. Construction of the $362 million plant was scheduled to begin in 2001, with completion scheduled for 2003 (Fertilizer International, 2000c).

Egypt.—By September, Egyptian Fertilizer Co. completed the start-up of its ammonia-urea complex in Ain Sukhna. The new plant could produce 635,000 t/yr of granular urea and an additional 50,000 t/yr of excess ammonia. Egyptian Fertilizer has long-term contracts for 100,000 t/yr of urea each with four international trading firms and two local firms. Although the material would initially be shipped from existing ports to its principal markets in Israel, Jordan, Mauritius, and South Africa, Egyptian Fertilizer planned to construct a bulk handling terminal by the second quarter of 2001 that would be Egypt's only terminal capable of handling panamax and cape-sized vessels (Fertilizer Week, 2000h).

European Union.—The European Commission (EC) enacted a significant number of antidumping decisions during 2000. In September, the EC established definitive antidumping duties on UAN from Algeria, Belarus, Lithuania, Russia, and Ukraine; these duties will last for 5 years. The duties (in euros per metric ton) were as follows: Algeria, 6.88; Belarus, 17.86; Lithuania, 3.98; Russia, 17.80 to 20.11, depending on the company; and Ukraine, 26.17. The original complaint, filed by the European Fertilizer Manufacturers Association (EFMA) included UAN from Slovakia, but imports from this country were still being investigated (Fertilizer Markets, 2000d).

In July, the EC imposed 6-month provisional antidumping duties on imports of ammonium nitrate from Poland and Ukraine. For Poland, the duty ranged from 22.61 euros per metric ton to 29.91 euros per metric ton, depending on the producer. For Ukraine, the country-wide duty was 33.25 euros per metric ton. The original investigation included imports from Lithuania; however, the EC found the dumping margin from this country to be minimal and did not establish any provisional duties (Fertilizer Week, 2000k).

In September, the EC also began an interim review of current antidumping duties on imports of ammonium nitrate from Russia. The existing duty of 26.3 euros per metric ton expired in August, and EFMA asked for a review in March (Fertilizer Week, 2000j). In October, the EC began an antidumping investigation into imports of urea from Belarus, Bulgaria, Croatia, Egypt, Estonia, Libya, Lithuania, Poland, Romania, and Ukraine. The EFMA lodged a complaint in September alleging that volumes and prices of urea from these countries had a damaging effect on the sales and markets shares of its members (Fertilizer Week, 2000g).

India.—In February, the Indian Government announced a 3-year moratorium on all domestic greenfield urea projects and that it could not guarantee that proposals to expand existing units would be protected under the country's retention pricing scheme (RPS). [The RPS ensured project feasibility by allowing an automatic 12% after-tax return on capital investment as soon as new units are commissioned.] This new policy eliminated proposals for new projects that were recently approved—Indian Farmers Fertiliser Cooperative Ltd.'s (IFFCO) 768,000-t/yr new plant at Nellore, Krishak Bharati Co-operative's (Kribhco) 768,000-t/yr expansions at Hazira and Gorakhpur, and Rashtriya Chemicals & Fertilizers Ltd.'s 726,000-t/yr expansion at its Thal complex (Fertilizer Week, 2000e).

Indonesia.—PT Kaltim Parna Industri, a joint venture between Japanese firms Mitsubishi Corp. (55%) and Asahi Chemical Industry Co. Ltd. (10%) and the Indonesian companies PT Parna Raja (25%) and PT Pupuk Kalimantan Timur (Kaltim) (10%), started construction of a $240 million ammonia plant in Bontang, East Kalimantan. The project, which had been postponed since 1997, was scheduled for completion in 2002. Capacity at the plant was projected to be 495,000 t/yr. Natural gas for the plant will be supplied by the State-owned natural gas company under a 20-year contract. Output from the plant was expected to be exported primarily to China, Japan, the Philippines, and Thailand (Fertilizer Week, 2000n). Kaltim Pasifik Amoniak began production at its 660,000-t/yr ammonia plant in Bontang in March, and its first export sales were completed in April.

PT Pupuk Sriwidjaja, the holding company for Indonesia's State-owned fertilizer producers Kaltim, PT Petrokimia Gresik, PT Pupuk Kujang, and PT Pupuk Iskandar Muda (PIM), delayed three fertilizer projects pending clarification of the Government's privatization plans. The three projects were Kujang's 570,000-t/yr urea plant at Cikampek, Java; Kaltim's 570,000-t/yr urea plant at Bontang, East Kalimantan; and PIM's ammonia-urea complex at Lhokseumawe, Aceh (Fertilizer International, 2000a).

Israel.—Haifa Chemicals Ltd. completed a debottlenecking and expansion project that doubled the company's potassium nitrate production capacity to 100,000 t/yr. Haifa Chemicals marketed the potassium nitrate for agricultural and industrial applications (Fertilizer International, 2000b).

Malaysia.—Production at Petronas Ammonia Sdn. Bhd.'s new 450,000-t/yr ammonia plant at Kerteh began in October. Most of the production was destined for export. Mitsubishi and Mitsui & Co. Ltd. signed MOU's with Petronas for the offtake of the ammonia, but final agreements were not completed by yearend (Fertilizer Week, 2000t).

Mexico.—In May 1999, Agro Nitrogenados de Mexico S.A. de C.V. (Agromex) had stopped production of urea because Petroquimica Cosoleacaque S.A. de C.V. stopped supplying ammonia to the plant when Agromex's parent company filed for bankruptcy. Although press reports indicated that there was an agreement on feedstock supplies among the Energy Ministry, Pemex, and domestic fertilizer producers that would allow the restart of Agromex's 1.1 Mt/yr urea production capacity in February, the agreement fell through (Fertilizer Week, 2000p).

Because of the stoppage in domestic production, imports of urea into Mexico increased significantly in the past 2 years. Compared to imports of 340,000 t in 1998, urea imports increased to 495,000 t in 1999 and to 561,000 t in 2000. Much of these imports were supplied by Russia (55% in 2000) (International Fertilizer Industry Association, 2001b, p. 7L-7R). Because of the increased imports from Russia, Agromex had petitioned Mexico's customs agency to investigate dumping of imports from Russia and the United States. The investigation began in 1999, and in April 2000, the authorities determined that Mexican urea production was not harmed by imports of Russian and United States urea. The Government determined that Agromex could not start its urea plants, because the high cost of domestically produced ammonia did not allow domestic urea to compete with cheaper imports. As a result of this determination, Agromex decided to sue the Government claiming that imports improperly lowered urea values. Agromex wanted Mexican authorities to convene a trilateral commission under the auspices of the North American Free Trade Agreement to examine the determination (Fertilizer Markets, 2000a).

***Netherlands.*—**Kemira Agro Oy announced that it would close its nitrogen operations in Rozenberg as part of its restructuring program. The Roenberg operations included capacities of 550,000 t/yr of ammonia and 230,000 t/yr of urea, as well as production capacity of UAN and calcium ammonium nitrate. High natural gas prices and persistent oversupply in the European nitrogen fertilizer markets were cited as additional reasons for closure (Fertilizer Week, 2000m).

***Oman.*—**In June, the Indian Government signed an offtake agreement for the production from the proposed Oman-India Fertilizer Co. ammonia-urea joint venture. Under the terms of the agreement, the Government would honor a 25-year take-or-pay contract for 1.6 Mt/yr of urea from the plant. Any surplus ammonia that would be generated was expected to be taken by IFFCO, one of the joint-venture partners (25%), under a 15-year agreement (Fertilizer Week, 2000d). The new plant was expected to be completed in 2003, with a capacity of 1.67 Mt/yr of granular urea and 1.2 Mt/yr of ammonia. Kribhco (25%) and Oman Oil Co.(50%) were the other partners in the joint venture.

Suhail Bahwan Group announced that it would construct an ammonia-urea complex in the Sohar industrial area. The new plant would have a design capacity of 2,000 t/d of ammonia and 2,600 t/d of granular urea. The estimated cost of the plant was between $450 million and $500 million; 30% of this cost was expected to be funded by Sheikh Suhail Salem Bahwan and the remaining 70% was expected to be financed. Construction was scheduled to begin by mid-2001, after a contractor is selected, and would be completed by 2004 (Fertilizer Week, 2000x).

***Pakistan.*—**In June, Pakistan's Privatisation Commission invited bids for a controlling stake in the country's largest nitrogen fertilizer producer, Pak-Saudi Fertilizers Ltd. The local government expected to sell its majority holding by early 2001. The plant, in Mairpur Mathelo, could produce 557,000 t/yr of urea and 320,000 t/yr of ammonia. This was the second attempt to privatize the plant. Although the deadline to submit bids originally was in October, the committee extended the deadline by 3 months because of a lack of interest from foreign buyers (Nitrogen & Methanol, 2000c).

Engro Pakistan Chemical Ltd. announced that it would add 100,000 t/yr of capacity to its urea plant in Daharki by 2002. This would bring the total capacity at the plant to 950,000 t/yr. The new capacity was being added to provide material for the company's 100,000-t/yr nitrogen-phosphorus-potassium (NPK) granulation unit under construction at Port Qusim in 2001 (Fertilizer Week, 2000i).

***Qatar.*—**Qatar Fertiliser Co. (Qafco) received approval for its Qafco IV expansion in October. The expansion would increase total capacity at the Umm Said complex to 2.8 Mt/yr of urea, making it one of the largest urea plants in the world. The cost of the expansion was estimated to be $500 million, and bids for plant construction were expected to be finalized by the third quarter of 2001. The expansion was scheduled to be on-stream by mid-2004 and primarily would supply the nearby Indian market (Fertilizer Week, 2000y). Qafco is a 75%-25% joint venture between Qatar General Petroleum Corp. and Norsk Hydro.

***Russia.*—**TogliottiAzot, Russia's largest ammonia and urea producer, announced a plan to build an ammonia terminal that would give it direct access to the Black Sea. The company had been exporting its ammonia via a 2,250-km pipeline that runs to the Ukranian port of Yuzhnyy. Because one-third of the pipeline runs through Ukraine, the Russian ammonia had been subject to tariffs ($23 per metric ton) and restrictions on throughput (1.25 Mt/yr). The proposed ammonia terminal would consist of the construction of ammonia handling facilities near Temryuk, on the Russian coast of the Azov Sea, which flows directly into the Black Sea. This terminal could handle large ammonia vessels and panamax-size ships. The project also would involve transporting ammonia by rail 350 km south from a point on the existing pipeline close to the Russia-Ukraine border and include a new 35-km section of rail line. The project was estimated to cost $200 million, some of which would be offset against the cost of the Ukrainian tariffs and some of which may be financed by the European Bank for Reconstruction and Development (Fertilizer International, 2000d).

***Saudi Arabia.*—**The National Chemical Fertilizer Co., a joint venture between Saudi Arabia Basic Industries Co. (Sabic) and Saudi Arabian Fertilizer Co., announced that it would debottleneck its ammonia plant at ibn al-Baytar to increase capacity to 583,000 t/yr from 500,000 t/yr. The expansion, which was to be completed by Japan's Toyo Engineering Corp. by the first quarter of 2002, would supply some of the feed requirements for Sabic's increase in urea production capacity (Fertilizer Week, 2000w).

***South Africa.*—**Norway's Norsk Hydro acquired 51% of Kynoch Fertilizer Ltd. and, as a result, owned the company in a joint-venture agreement with its former parent AECI Ltd. Through the agreement, Kynoch would produce and market NPK and liquid fertilizers in the South African market. As part of the agreement, Norsk Hydro would supply 250,000 t/yr of plant nutrients, and Kynoch would close its nitrate production plants in South Africa (Industrial Minerals, 2000).

***Trinidad and Tobago.*—**On December 31, 1999, PCS shut two of its four ammonia plants in Point Lisas because of a disagreement with its natural gas supplier, National Gas Co. of Trinidad and Tobago Ltd. A 15-year supply contract expired at the end of 1999, and contract terms suitable to both parties were not agreed upon, which resulted in the closure of 930,000 t/yr of capacity. PCS's two other ammonia plants and its urea plant at the same location, however, were not affected. It was not until the middle of June that the two companies negotiated a gas-supply contract and production at the plants restarted (Fertilizer Week, 2000q).

Construction of the $268 million 645,000-t/yr Caribbean Nitrogen Co. Ltd. ammonia plant in Point Lisas began early in 2000. Ferrostaal is responsible for construction of the facility using technology supplied by M.W. Kellogg Corp. The construction time was estimated to be 28 months, and start-up of the facility was scheduled for the last quarter 2002. Debt financing was expected to be provided by Kreditanstalt für Wiederaufbau backed by the German credit insurance agency Hermes. The shareholders of the project were Clico Energy Co. Ltd., U.S.-based Duke Energy Corp., EOG Resources Trinidad Ltd., KBR Development Corp., and Ferrostaal. Even before this plant is completed, Duke Energy was seeking financing for a second 650,000-t/yr plant at the same location. The $300 million to finance the second plant was expected to come from the same companies that financed the first plant. If financing is completed by early 2001, the new plant could be operational by 2004 (Fertilizer Markets, 2000c).

Turkey.**—**In June, the Turkish Privatisation Administration announced that it would accept bids for the privatization of fertilizer producers Istanbul Gübre Sanayii (Igsas) and Türkiye Gübre Sanayii (Tügsas). Igsas was the country's sole urea producer with four plants totaling 560,000 t/yr of capacity, and Tügsas produced ammonium nitrate, DAP, and compound fertilizers at a number of plants. Although Toros Fertilizer and Chemical Co.'s bid for two of the Igsas units, its port installations, and its distribution network was accepted by the Privatisation Administration, it was rejected by the country's competition authorities in November. Toros was one of the country's largest urea importers, and it was determined that this purchase would limit competition in the urea market. Bids for the Tügsas plants were rejected by the Privatisation Administration (Fertilizer Week, 2000bb).

Ukraine.**—**Because of its failure to pay an estimated $21.6 million in taxes since it was founded in 1997, Ukrzovnishkhimprom, which controlled the Togliatti-Yuzhnyy ammonia pipeline, would be broken into independent regional companies. The companies would be subsidiaries of newly formed Ukykhimtransammiak and would charge ammonia shippers for transportation and pay taxes to local authorities (Fertilizer Week, 2000cc). The Government also withdrew approval to nitrogen fertilizer producer DneproAzot to build an ammonia pipeline from its plants in Dneprodzerzhinsk to connect to the Togliatti-Yuzhnyy pipeline. The Government said that the funds for the project, which were to be partially supplied by duties from transporting Russian ammonia, should not be used to support a project promoted by a company that belongs to offshore shareholders (Fertilizer Week, 2000f).

United Arab Emirates.**—**By October, Southern Petrochemical Industries Corp. was approximately 50% finished with its conversion of an ammonia-urea unit to use natural gas rather than naphtha as a feedstock. Projected start-up of the 400,000-t/yr urea plant in Jebel Ali was late 2001, which is almost 3 years later than originally planned. Prolonged negotiations for gas supply agreements and low urea prices were cited as the reasons for the delay (Nitrogen & Methanol, 2000d).

Venezuela.**—** Fertilizantes Nitrogenados de Venezuela (FertNitro) completed construction of its ammonia-urea complex in Jose in the fourth quarter. The plant was jointly owned by Petroquimica de Venezuela S.A., Koch Nitrogen, Snamprogetti, and Empresas Polar. After start-up in early 2001, FertiNitro will produce over 1.2 Mt of ammonia and 1.5 Mt of urea annually. Much of the plant's output was expected to be destined for North American markets (Fertilizer Week, 2000l).

Current Research and Technology

The Iowa State University extension developed a web page featuring a soil temperature map for each county and the statistical probability of temperatures over a period of time. The goal of this project was for producers, agricultural businesses, and fertilizer dealers to apply anhydrous ammonia when soil temperatures are 50º F and trending lower; applying ammonia below this temperature reduces nitrate leaching, which leads to lower nitrogen losses. The web site would use soil temperature data from weather stations around Iowa. The observed soil temperature data would be placed on the World Wide Web and used with air temperature readings to compute soil temperatures for counties without actual observations (Green Markets, 2000e).

Perdue-AgriRecycle introduced a new product called MicroStart60™, the brand name for a fertilizer made from pelletized chicken litter. The company was constructing a $10 million facility in Sussex, DE, that, when completed in early 2001, would be able to process 80,000 t/yr of chicken litter. The company contracted with producers on the Delmarva peninsula to provide the raw material. According to Perdue-AgriRecycle, the nutrient content of the pelletized material is 3% nitrogen, 3% phosphorus, 3% potassium, and 60% organic matter. The company also claimed that the product provides micronutrients such as calcium, copper, iron, magnesium, manganese, sulfur, and zinc, and provides water-insoluble nitrogen that is released slowly over a long period of time, which prevents runoff and resultant nutrient loss (Green Markets, 2000j).

Outlook

According to the USDA, farmers' planting intentions for the eight major field crops (corn, soybeans, wheat, barley, sorghum, oats, cotton, and rice) total 101.8 million hectares in the 2000-2001 crop year, a drop of 1.3% from the last year's planted area. Farmers intend to plant a record 31.0 million hectares of soybeans, 3% more than in 2000 and the 10th straight increase. Corn plantings are expected to be down 4%, wheat plantings are expected to be down by 4%, and projected cotton area, 6.3 million hectares, is the largest since 1995. With adverse weather or significant changes in crop prices, actual plantings could vary from intentions. For example, persistent wet conditions this spring could delay corn plantings and cause an even greater switch from corn to soybeans. Higher fertilizer and fuel costs, reflecting the effect of higher natural gas prices, represent another important factor in the expansion of soybean plantings this year, because corn production uses significantly more nitrogen fertilizer relative to soybeans. According to a cost budget prepared by the University of Illinois extension service, nitrogen costs in corn production will increase by $17 per hectare in the 2000-2001 crop year because of higher nitrogen fertilizer prices (Agricultural Outlook, 2001). Based on these planting projections, U.S. nitrogen consumption is expected to decrease in 2001.

In the longer term, the USDA projects that after a decline in planted acres in the beginning of the decade, corn plantings will increase slightly by 2011, projecting a planted acreage of 32.8

million hectares compared with 31.3 million hectares in 2000 (figure 5). Wheat and soybeans follow a similar pattern, with wheat plantings projected to grow to 26.7 million hectares from 25.4 million hectares, and soybean plantings projected to grow to 30.3 million hectares from 29.8 million hectares (U.S. Department of Agriculture, Economic Research Service, February 2001, Agricultural baseline projections, accessed June 12, 2001, at URL http://www.ers.usda.gov/Briefing/baseline). If these projections are correct, U.S. consumption of nitrogen for fertilizer applications is likely to increase.

If natural gas costs remain high, some U.S. production capacity can be expected to close for extended periods or to shut permanently. The New York Mercantile Exchange Henry Hub natural gas futures contract prices are not projected to increase to much more than $4.00 per million British thermal unit through mid-2004, but these costs are generally higher than they had been before the price spike (New York Mercantile Exchange, [undated], Henry Hub natural gas, accessed June 28, 2001, at http://www.nymex.com/markets/quotes.cfm?showAll=on&contract=NG#NG). High natural gas costs in the United States, coupled with projected ammonia and urea capacity increases in South America, could lead to a higher level of imports. Material from this region potentially could be brought into the United States at a significantly lower cost than U.S.-produced material, which could put further pressure on U.S. ammonia and urea producers to close facilities.

References Cited

Agricultural Outlook, 2000, Curbing nitrogen runoff—Effects on production and trade: Agricultural Outlook, AGO-271, May, p. 19-21.

———2001, Soybean plantings to expand, corn to recede in 2001: Agricultural Outlook, AGO-281, May, p. 5-9.

Fertilizer International, 2000a, Indonesian projects on hold: Fertilizer International, no. 377, July-August, p. 16.

———2000b, KNO_3 expansion nears completion: Fertilizer International, no. 374, January-February, p. 16.

———2000c, Stamicarbon debottlenecking success: Fertilizer International, no. 377, July-August, p. 14.

———2000d, Togliatti seeks Black Sea outlet: Fertilizer International, no. 376, May-June, p. 23.

Fertilizer Markets, 2000a, Agromex wants NAFTA panel to review urea imports: Fertilizer Markets, v. 10, no. 46, June 5, p. 2.

———2000b, Borden to close, scrap nitrogen facilities: Fertilizer Markets, v. 10, no. 50, July 3, p. 2-3.

———2000c, Duke Energy expansion moves ahead on Trinidad: Fertilizer Markets, v. 11, no. 10, October 2, p. 1-2.

———2000d, EC slaps duties on UAN from FSU and Algeria; Fertilizer Markets, v. 11, no. 10, October 2, p. 2.

———2000e, Third potassium nitrate plant begins production in Chile: Fertilizer Markets, v. 11, no. 17, November 13, p. 2.

———2000f, [Untitled]: Fertilizer Markets, v. 11, no. 20, December 4, p. 4.

Fertilizer Markets News Update, 2000, Production changes affecting North American market: Fertilizer Markets News Update, December 12, unpaginated.

Fertilizer Week, 2000a, Asmidal, Trammo, Ferrostaal in NH_3 MoU: Fertilizer Week, v. 14, no. 12, July 31, p. 1-2.

———2000b, Bulgaria increases AN import duties: Fertilizer Week, v. 14, no. 29, November 27, p. 3.

———2000c, CSBP starts NH_3 commissioning: Fertilizer Week, v. 13, no. 48, April 17, p. 3.

———2000d, Delhi backs off-take deal for Oman-India: Fertilizer Week, v. 14, no. 7, June 26, p. 1.

———2000e, Delhi details urea project moratorium: Fertilizer Week, v. 13, no. 39, February 14, p. 1.

———2000f, DneproAzot NH_3 pipeline plans turned down: Fertilizer Week, v. 13, no. 48, April 17, p. 2.

———2000g, EC urea dumping case official; angry response: Fertilizer Week, v. 14, no. 25, October 30, p. 1, 3.

———2000h, Egyptian Fertilizer Co[.] lines up urea exports: Fertilizer Week, v. 14, no. 22, October 9, p. 3.

———2000i, Engro plans new NPK unit; urea upgrade seen: Fertilizer Week, v. 13, no. 47, April 10, p. 2.

———2000j, EU launches dumping review on Russian AN: Fertilizer Week, v. 14, no. 17, September 4, p. 1-2.

———2000k, EU slaps import duties on Polish, Ukranian AN: Fertilizer Week, v. 14, no. 12, July 31, p. 1.

———2000l, Fertnitro mechanical completion imminent: Fertilizer Week, v. 14, no. 9, July 10, p. 1, 3.

———2000m, Kemira to close Rozenberg N plant: Fertilizer Week, v. 14, no. 1, May 15, p. 1-2.

———2000n, KPI starts construction of ammonia plant: Fertilizer Week, v. 13, no. 41, February 28, p. 3.

———2000o, Management buy-out takes 51% of Neochim: Fertilizer Week, v. 14, no. 6, June 19, p. 2.

———2000p, Mexico in 11th hour urea output deal: Fertilizer Week, v. 13, no. 40, February 21, p. 1.

———2000q, PCS announces NH_3 restart in Trinidad: Fertilizer Week, v. 14, no. 5, June 12, p. 1, 4.

———2000r, PCS Yumbes starts KNO_3 output in Chile: Fertilizer Week, v. 14, no. 14, August 14, p. 2.

———2000s, Petrobras N unit ready; merchant NH_3 to rise: Fertilizer Week, v. 14, no. 31, December 11, p. 2.

———2000t, Petronas begins ammonia commissioning at Kerteh: Fertilizer Week, v. 14, no. 22, October 9, p. 1-2.

———2000u, Plenty River strikes 15-year offtake contracts: Fertilizer Week, v. 14, no. 32, December 18, p. 1-2.

———2000v, Profertil to install NH3 flare stacks: Fertilizer Week, v. 14, no. 30, December 4, p. 1-2.

———2000w, Saudi ibn al-Baytar set for ammonia debottleneck: Fertilizer Week, v. 14, no. 15, August 21, p. 1-2.

———2000x, Sohar NH_3/urea project seen complete by 2004: Fertilizer Week, v. 14, no. 13, August 7, p. 3.

———2000y, Qafco IV approved; output seen mid[-]2004: Fertilizer Week, v. 14, no. 23, October 16, p. 3.

———2000z, QFAL, Uhde, Devco sign MoU on new N complex: Fertilizer Week, v. 13, no. 50, May 8, p. 3.

———2000aa, SQM eyes late-August to start Chile KNO_3 unit: Fertilizer Week, v. 14, no. 8, July 3, p. 1.

———2000bb, Turkish regulator blocks Toros bid for Igsas: Fertilizer Week, v. 14, no. 29, November 27, p. 3.

———2000cc, Ukraine reorganises NH_3 pipeline control: Fertilizer Week, v. 14, no. 25, October 30, p. 3.

Green Markets, 2000a, Agrium-Unocal deal completed; J.R. Simplot buys divested terminal: Green Markets, v. 24, no. 41, October 9, p. 1, 11-12.

———2000b, China trade bill passes Senate 83-15; "new gateways" to fertilizer trade expected: Green Markets, v. 24, no. 39, September 25, p. 1, 12.

———2000c, Explosion idles Farmland's Lawrence plant: Green Markets, v. 24, no. 30, July 24, p. 1.

———2000d, Farmland to sell Coffeyville refinery; keep fert assets: Green Markets, v. 24, no. 50, December 11, p. 10.

———2000e, ISU Extension maps soil temperatures for timely fall fertilizer application: Green Markets, v. 24, no. 39, September 25, p. 9.

———2000f, LaRoche-Orica-Eldorado deal closes; Dyno Orica forge jv on Geneva AN plant: Green Markets, v. 24, no. 45, November 6, p. 1, 12.

———2000g, MissChem to buy IMC-Agrico urea plant: Green Markets, v. 24, no. 14, April 3, p. 8.

———2000h, National Research Council report proposes a reduction in N and P levels: Green Markets, v. 24, no. 15, April 10, p. 1, 12.

———2000i, Nitrogen producers close plants as gas soars: Green Markets, v. 24, no. 51, December 18, p. 1, 11-12.

———2000j, Perdue Agri-Recycle to make chicken-litter fertilizer: Green Markets, v. 24, no. 32, August 7, p. 11.

———2000k, Wil-Gro Fertilizer to liquidate: Green Markets, v. 24, no. 6, February 7, p. 1, 11.

———2001, LaRoche reorganization on track: Green Markets, v. 25, no. 15, April 9, p. 11.

Industrial Minerals, 2000, Norsk/AECI fertiliser j-v: Industrial Minerals, no. 389, February, p. 65.

International Fertilizer Industry Association, 2001a, Ammonia statistics 2000: International Fertilizer Industry Association, A/01/61, May, 12 p.

———2001b, Urea statistics 2000: International Fertilizer Industry Association, A/01/60, May, 22 p.

Nitrogen & Methanol, 2000a, Bangladesh—New urea capacity moving ahead: Nitrogen & Methanol, no. 247, September-October, p. 8.

———2000b, Non-fertilizer uses of ammonia: Nitrogen & Methanol, no. 244, March-April, p. 15-18.

———2000c, Pakistan—Pak-Saudi sale put back: Nitrogen & Methanol, no. 248, November-December, p. 7.

———2000d, United Arab Emirates—SPIC plant "to start up in 2001":

Nitrogen & Methanol, no. 247, September-October, p. 8.
U.S. Department of Commerce, International Trade Administration, 2001, Notice of preliminary determination of sales at less than fair value and postponement of final determination—Solid agricultural grade ammonium nitrate from Ukraine: Federal Register, v. 66, no. 43, March 5, p. 13286-13292.
U.S. Environmental Protection Agency, 2000, Revisions to the water quality planning and management regulation and revisions to the national pollutant discharge elimination system program in support of revisions to the water quality planning and management regulation: Federal Register, v. 65, no. 135, July 13, p. 43586-43670.
U.S. International Trade Commission, 2000, Certain ammonium nitrate from Ukraine—Investigation no. 731-TA-894 (preliminary): U.S. International Trade Commission, USITC publication no. 3374, December, 19 p.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

A National Look at Nitrate Contamination of Ground Water, URL http://water.usgs.gov/nawqa/wcp/index.html.
Evaporites and Brines. Ch. in United States Mineral Resources, Professional Paper 820, 1973.
Fertilizers—Sustaining Global Food Supplies. Fact Sheet 155-99, 1999.
Nitrogen. Ch. in Mineral Commodity Summaries, annual.
Nitrogen in the Mississippi Basin—Estimating Sources and Predicting Flux to the Gulf of Mexico. Fact Sheet 135-00, 2000.
Nonpoint and Point Sources of Nitrogen in Major Watersheds of the United States. Water-Resources Investigations Report 94-4001, 1994.
Nutrients in the Nation's Waters—Too Much of a Good Thing?. Circular 1136, 1996.

Other

Agricultural Outlook. U.S. Department of Agriculture.
Chemical Market Reporter, weekly.
International Fertilizer Development Center, Muscle Shoals, AL.
International Fertilizer Industry Association, Paris, France.
Nitrogen. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
Nitrogen & Methanol. CRU Publishing Ltd., bimonthly.
The Fertilizer Institute, Washington, DC.

TABLE 1
SALIENT AMMONIA STATISTICS 1/ 2/

(Thousand metric tons of contained nitrogen, unless otherwise specified)

	1996	1997	1998	1999	2000 p/
United States:					
Production	13,400	13,300	13,800	12,900 r/	12,300
Exports	435	395	614	562	662
Imports for consumption	3,390	3,530	3,460	3,890	3,880
Consumption, apparent 3/	16,400	15,800	17,100	16,300 r/	15,400
Stocks, December 31; producers'	881	1,530	1,050	996 4/	1,120 4/
Average annual price per ton product, f.o.b. Gulf Coast 5/	$190	$173	$121	$109	$169
Net import reliance as a percentage of percent of apparent consumption 6/	19	16	19	21 r/	20
Natural gas price, wellhead 7/	$2.17	$2.32	$1.94	$2.17 r/	$3.60 e/
World:					
Production	105,000 r/	103,000 r/	105,000	107,000 r/	109,000 e/
Trade 8/	10,900	11,300	11,300	12,000	12,600

e/ Estimated. p/ Preliminary. r/ Revised.
1/ Data are rounded to no more than three significant digits, except prices.
2/ Synthetic anhydrous ammonia, calendar year data, the U.S. Census Bureau; excludes coke oven byproduct.
3/ Calculated from production, plus imports minus exports, and industry stock changes.
4/ Source: The Fertilizer Institute.
5/ Source: Green Markets.
6/ Net import reliance is defined as imports minus exports, adjusted for industry stock changes.
7/ Monthly Energy Review, U.S. Department of Energy. Average annual cost at wellhead in dollars per thousand cubic feet.
8/ Source: International Fertilizer Industry Association Statistics, World Anhydrous Ammonia Trade.

TABLE 2
FIXED NITROGEN PRODUCTION IN THE UNITED STATES 1/

(Thousand metric tons of contained nitrogen)

	1999 r/	2000 p/
Anhydrous ammonia, synthetic:		
Fertilizer	11,400	10,900
Nonfertilizer	1,550	1,490
Total	12,900	12,300

p/ Preliminary. r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Sources: U.S. Census Bureau, Current Industrial Reports MA325B and MQ325B.

TABLE 3
MAJOR DOWNSTREAM NITROGEN COMPOUNDS PRODUCED IN THE UNITED STATES 1/ 2/

(Thousand metric tons)

Compound	1999 r/	2000 p/
Urea:		
Gross weight	8,080	6,950
Nitrogen content	3,710	3,190
Ammonium phosphates: e/ 3/		
Gross weight	16,700	15,800
Nitrogen content	2,820	2,510
Ammonium nitrate:		
Gross weight	7,230	7,480
Nitrogen content	2,450	2,540
Nitric acid:		
Gross weight	8,120	7,980
Nitrogen content	1,790	1,760
Ammonium sulfate: 4/		
Gross weight	2,610	2,600
Nitrogen content	533	552

See footnotes at end of table.

TABLE 3--Continued
MAJOR DOWNSTREAM NITROGEN COMPOUNDS PRODUCED IN THE UNITED STATES 1/ 2/

e/ Estimated. p/ Preliminary. r/ Revised.
1/ Data are rounded to no more than three significant digits.
2/ Ranked in relative order of importance by nitrogen content.
3/ Diammonium phosphate (DAP), monoammonium phosphate (MAP), and other ammonium phosphates.
4/ Excludes coke plant ammonium sulfate.

Source: U.S. Census Bureau, Current Industrial Reports MQ325B.

TABLE 4
DOMESTIC PRODUCERS OF ANHYDROUS AMMONIA IN 2000 1/

(Thousand metric tons per year of ammonia)

Company	Location	Capacity 2/
Agrium Inc.	Borger, TX	490
Do.	Finley, WA 3/	180
Do.	Kenai, AK 3/	1,210
Air Products and Chemicals Inc.	Pace Junction, FL	71
Avondale Ammonia Co.	Fortier, LA	399
Borden Chemicals Inc.	Geismar, LA 4/	364
CF Industries Inc.	Donaldsonville, LA	1,730
Coastal Chem Inc. 5/	Cheyenne, WY	174
Coastal Refining and Marketing Inc. 5/	Freeport, TX	204
Coastal St. Helens Chemical 5/	St. Helens, OR	93
Dakota Gasification Co.	Beulah, ND	363
E.I. du Pont de Nemours & Co. Inc.	Beaumont, TX	451
El Dorado Chemical Co. 6/	Cherokee, AL	159
Farmland Industries Inc.	Beatrice, NE	272
Do.	Coffeyville, KS 7/	349
Do.	Dodge City, KS	281
Do.	Enid, OK	907
Do.	Fort Dodge, IA	339
Do.	Lawrence, KS	409
Do.	Pollock, LA	459
Green Valley Chemical Corp.	Creston, IA	32
Honeywell International Inc. 8/	Hopewell, VA	409
IMC-Agrico Co.	Faustina (Donaldsonville), LA	508
J.R. Simplot Co.	Pocatello, ID	93
Koch Nitrogen Co.	Sterlington, LA	1,110
MissChem Nitrogen LLC 9/	Yazoo City, MS	621
Nitromite Fertilizer	Dumas, TX	128
PCS Nitrogen Inc.	Augusta, GA	653
Do.	Geismar, LA	483
Do.	Lima, OH	542
Do.	Woodstock, TN	371
Royster-Clark Inc.	East Dubuque, IL	292
Shoreline Chemical	Gordon, GA	31
Terra Industries Inc.	Beaumont, TX 10/	231
Do.	Blytheville, AR	381
Do.	Port Neal, IA	336
Do.	Verdigris, OK	953
Do.	Woodward, OK	399
Triad Nitrogen LLC 9/	Donaldsonville (Ampro), LA	509
Do.	Donaldsonville (Triad), LA	417
Wil-Grow Fertilizer Co.	Pryor, OK 11/	86
Do.	do. 11/	247
Total		17,700

1/ 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/ Purchased from Unocal Corp.
4/ Closed in July 2000.
5/ Wholly owned subsidiary of Coastal Corp.

TABLE 4--Continued
DOMESTIC PRODUCERS OF ANHYDROUS AMMONIA IN 2000 1/

6/ Purchased from Orica LLC, which had purchased plant from LaRoche Industries Inc. in 2000. El Dorado Chemical Co. is a wholly owned subsidiary of LSB Industries Inc.
7/ Opened in September 2000.
8/ AlliedSignal Inc. merged with Honeywell Inc. and company was renamed Honeywell International Inc. in 2000.
9/ Wholly owned subsidiary of Mississippi Chemical Corp.
10/ The Beaumont, TX, facility began producing ammonia in January 2000.
11/ Closed in February 2000.

Sources: International Fertilizer Development Center (IFDC) and company web sites.

TABLE 5
U.S. NITROGEN FERTILIZER CONSUMPTION, BY PRODUCT TYPE 1/ 2/

(Thousand metric tons nitrogen)

Fertilizer material 3/	1999	2000 p/
Single nutrient:		
Anhydrous ammonia	3,470 r/	3,310
Nitrogen solutions 4/	2,830 r/	2,720
Urea	1,930 r/	1,960
Ammonium nitrate	578 r/	523
Ammonium sulfate	206 r/	213
Aqua ammonia	66 r/	64
Other 5/	287	285
Total	9,370 r/	9,070
Multiple nutrient 6/	2,090 r/	2,110
Grand total	11,500 r/	11,200

p/ Preliminary. r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Fertilizer years ending June 30.
3/ Ranked in relative order of importance by product type.
4/ Principally urea-ammonium nitrate (UAN) solutions, 29.9% nitrogen (N).
5/ Includes other single-nutrient nitrogen materials, all natural organics, and statistical discrepancies.
6/ Various combinations of N, phosphate (P), and potassium (K): N-P-K, N-P, and N-K.

Source: Commercial Fertilizers 2000. Prepared as a cooperative effort by The Fertilizer Institute and the Association of American Plant Food Control Officials.

TABLE 6
U.S. PRODUCER STOCKS OF FIXED NITROGEN COMPOUNDS AT YEAREND 1/ 2/

(Thousand metric tons nitrogen)

Material 3/	1999	2000 p/
Ammonia 4/	996	1,120
Nitrogen solutions 5/	W	W
Urea	125	54
Ammonium phosphates 6/	66 r/	83
Ammonium nitrate	W	35
Ammonium sulfate	48	25
Total	1,240	1,310

p/ Preliminary. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in total.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Calendar year ending December 31.
3/ Ranked in relative order of importance.
4/ Source: The Fertilizer Institute.
5/ Urea-ammonium nitrate and ammoniacal solutions.
6/ Diammonium and monoammonium phosphates.

Source: U.S. Census Bureau, Current Industrial Reports MQ325B, except where noted.

TABLE 7
PRICE QUOTATIONS FOR MAJOR NITROGEN COMPOUNDS AT YEAREND

(Dollars per short ton)

Compound	1999	2000
Ammonium nitrate; f.o.b. Corn Belt 1/	110-115	140-150
Ammonium sulfate; f.o.b. Corn Belt 1/	109-112	130-135
Anhydrous ammonia:		
F.o.b. Corn Belt	157-165	280-300
F.o.b. Gulf Coast 2/	109	230
Diammonium phosphate; f.o.b. central Florida	138-140	137-142
Urea:		
F.o.b. Corn Belt, prilled and granular	115-125	175-180
F.o.b. Gulf Coast, granular 2/	107-110	158-161
F.o.b. Gulf Coast, prilled 2/	102	150-155

1/ Illinois, Indiana, Iowa, Missouri, Nebraska, and Ohio.
2/ Barge, New Orleans.

Source: Green Markets.

TABLE 8
U.S. EXPORTS OF ANHYDROUS AMMONIA, BY COUNTRY 1/

(Thousand metric tons ammonia)

Country	1999	2000
Brazil	--	17
Canada	27	18
Japan	3	18
Korea, Republic of	547	645
Mexico	21	67
South Africa	--	18
Taiwan	80	2
Other	6 r/	20
Total	684	805

r/ Revised. -- Zero.
1/ Value data supressed by U.S. Census Bureau.

Source: U.S. Census Bureau.

TABLE 9
U.S. IMPORTS OF ANHYDROUS AMMONIA, BY COUNTRY 1/

(Thousand metric tons ammonia and thousand dollars)

	1999		2000	
Country	Gross weight	Value 2/	Gross weight	Value 2/
Belgium	3	686	--	--
Canada	1,110	190,000	1,050	201,000
Colombia	25	2,850	46	6,340
France	3	326	--	--
Japan	(3/)	74	2	175
Indonesia	--	--	97	14,900
Lithuania	--	--	21	1,790
Mexico	19	2,100	148	21,900
Netherlands	--	--	11	1,820
Peru	(3/)	66	--	--
Russia 4/	1,010	12,300	908	48,500
Switzerland	80	8,200	--	--
Trinidad and Tobago	2,480	276,000	2,430	384,000
Ukraine	NA	55,000	NA	85,600
Venezuela	(3/)	29	9	1,430
Total	4,730	548,000	4,720	768,000

See footnotes at end of table.

TABLE 9--Continued
U.S. IMPORTS OF ANHYDROUS AMMONIA, BY COUNTRY 1/

NA Not available. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ C.i.f. value.
3/ Less than 1/2 unit.
4/ Quantity data from the Journal of Commerce Port Import/Export Reporting Service; may include imports from Ukraine.

Sources: U.S. Census Bureau, Journal of Commerce Port Import/Export Reporting Service.

TABLE 10
U.S. EXPORTS OF MAJOR NITROGEN COMPOUNDS 1/

(Thousand metric tons)

Compound	1999 Gross weight	1999 Nitrogen content	2000 Gross weight	2000 Nitrogen content	Principal destinations, 2000
Ammonium nitrate 2/	28	9	22	7	Mexico, 62%; Canada, 18%.
Ammonium sulfate 2/	1,070	288	983	265	Brazil, 61%.
Anhydrous ammonia	684	562	805	662	Republic of Korea, 80%.
Diammonium phosphate	10,500	1,890	7,620	1,370	China, 58%.
Monoammonium phosphate	1,790	197	2,300	253	Canada, 38%; Australia, 21%; Brazil, 12%.
Urea	890	409	663	304	Mexico, 24%; Thailand, 21%; Republic of Korea, 12%.
Mixed chemical fertilizers 3/	268	32	273	33	Colombia, 30%; Mexico, 27%.
Other nitrogenous fertilizers 4/	204	60	207	61	Mexico, 37%; Canada, 11%.
Total	15,400	3,450	12,900	2,960	

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes industrial chemical products.
3/ Harmonized Tariff Schedule codes 3105.10.0000, 3105.20.0000, and 3105.51.0000.
4/ Harmonized Tariff Schedule codes 3101.00.0000, 3102.29.0000, 3102.60.0000, and 3102.90.0000.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS OF MAJOR NITROGEN COMPOUNDS 1/

(Thousand metric tons and thousand dollars)

Compound	1999 Gross weight	1999 Nitrogen content	1999 Value 2/	2000 Gross weight	2000 Nitrogen content	2000 Value 2/	Principal sources, 2000
Ammonium nitrate 3/	935	317	111,000	818	277	93,700	Canada, 57%; Ukraine, 34%.
Ammonium nitrate-limestone mixtures	10	3	1,970	1	(5/)	173	Canada, 81%.
Ammonium sulfate 3/	342	73	34,500	347	74	32,400	Canada, 79%; Belgium, 10%.
Anhydrous ammonia 4/	4,730	3,890	548,000	4,720	3,880	768,000	Trinidad and Tobago, 51%; Canada, 22%; Russia and Ukraine, 19%.
Calcium nitrate	(5/)	(5/)	12,500	(5/)	(5/)	9,890	Norway, 88%.
Diammonium phosphate	36	6	8,360	123	22	21,900	Russia, 90%.
Monoammonium phosphate	47	5	18,800	188	21	40,700	Russia, 88%.
Nitrogen solutions	614	184	54,600	1,310	390	129,000	Russia, 34%; Canada, 22%; Ukraine, 20%.
Potassium nitrate	21	3	6,980	41	6	13,700	Chile, 85%.
Potassium nitrate-sodium nitrate mixtures	16	2	2,970	9	1	1,660	Chile, 98%.
Sodium nitrate	105	17	22,900	98	16	20,100	Chile, 96%.
Urea	3,260	1,500	486,000	3,900	1,790	621,000	Canada, 46%; Saudi Arabia, 12%.
Mixed chemical fertilizers 6/	262	31	60,900	257	31	61,500	Canada, 18%; Norway, 17%; Ukraine, 17%; Morocco, 16%.
Other nitrogenous fertilizers 7/	202	60	40,200	207	61	39,500	Norway, 71%.
Total	10,600	6,090	1,410,000	12,000	6,570	1,850,000	

See footnotes at end of table.

TABLE 11--Continued
U.S. IMPORTS OF MAJOR NITROGEN COMPOUNDS 1/

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ C.i.f. value
3/ Includes industrial chemical products.
4/ Includes industrial ammonia.
5/ Less than 1/2 unit.
6/ Harmonized Tariff Schedule codes 3105.10.0000, 3105.20.0000, 3105.51.0000, and 3105.90.0050.
7/ Harmonized Tariff Schedule codes 3101.00.0000, 3102.29.0000, 3102.60.0000, and 3102.90.0000.

Source: U.S. Census Bureau.

TABLE 12
AMMONIA: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons of contained nitrogen)

Country	1996	1997	1998	1999	2000
Afghanistan e/	5	5	5	5	5
Albania e/	15	10	10	10	10
Algeria	150	380 e/	350	455	458
Argentina	80	107	86	88	199
Australia	446	432 e/	435 r/	431	576
Austria e/	450	450	450	450	500
Bahrain	323	356	336	370	350
Bangladesh 3/	1,233	1,080	1,129 r/	1,240	1,255
Belarus	678	590 e/	685	765 r/	730
Belgium	750	760	756	840	863
Bosnia and Herzegovina e/	1	1	1	1	1
Brazil	977	1,019	949	1,084	925 e/
Bulgaria	1,194	808	448	315 e/	533
Burma	57	62	52	66 r/	78
Canada	3,840	4,081	3,900	4,135	4,130
China e/	25,200 r/	24,800 r/	26,100 r/	27,800 r/	28,000
Colombia	102	81	100	75	93 e/
Croatia	307	331	248	318	325
Cuba e/	135	135	135	135	135
Czech Republic	304	251	258	223	246
Denmark e/	2	2	2	2	2
Egypt	1,126	1,061	1,141	1,407	1,511
Estonia	137 r/	153 r/	175 r/	146 r/	128
Finland e/	5 r/ 4/	6	6	6	6
France e/	1,570	1,757 4/	1,570	1,570	1,700
Germany	2,485	2,470	2,512	2,406	2,473
Georgia	77	84	64	104 e/	1 e/
Greece	90	83 e/	178	160	121
Hungary	347	339	288	261	352
Iceland	7	7	6	7 e/	7 e/
India 5/	8,549	9,328	10,240 r/	10,376	10,148
Indonesia	3,647	3,769	3,600	3,450 r/	4,000 e/
Iran	882	880	1,034	865 e/	965
Iraq e/	220	220	220	220	220
Ireland	377	465	458	405	410
Israel 3/	65	57	1	-- e/	-- e/
Italy	397	446	409	367	408
Japan	1,490 r/	1,509 r/	1,389 r/	1,385 r/	1,405
Kazakhstan	75	75 e/	--	-- e/	-- e/
Korea, North e/	600	600	600	500	450
Korea, Republic of	611 r/	526 r/	496 r/	489 r/	400 e/
Kuwait	412	432 e/	452	397	410
Libya	546	537	545	552	552 e/
Lithuania	461	467 r/	407 r/	401 r/	420
Malaysia	329	243	351	432 e/	605
Mexico	2,054	1,448	1,449 r/	1,003	701

See footnotes at end of table.

TABLE 12--Continued
AMMONIA: WORLD PRODUCTION, BY COUNTRY 1/ 2/

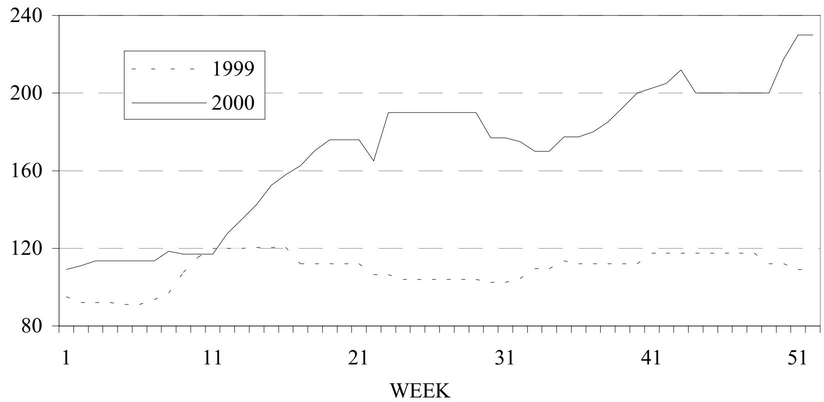
(Thousand metric tons of contained nitrogen)

Country	1996	1997	1998	1999	2000
Netherlands	2,652	2,478 r/	2,350 e/	2,430 e/	2,543
New Zealand	68	80	94	110	105
Nigeria e/	164	134	168	148	--
Norway	295	279	245	122 r/	334
Pakistan	1,606	1,549	1,797	1,999	1,884
Peru	18	15	15	-- e/	-- e/
Poland	1,713	1,824	1,683	1,474	1,862
Portugal	198	196	204	223	246 e/
Qatar	635 r/	943	1,127	1,130	1,097
Romania	1,513	781	378	686	1,016
Russia	7,900	7,150	6,500	7,633	8,735
Saudi Arabia	1,386	1,405	1,418	1,402	1,743
Serbia and Montenegro	235 r/	235 r/	172 r/	57 r/	100 e/
Slovakia	197	229	234 r/	246 r/	271
South Africa	770	752	723	785	560
Spain	466	497	460	437	442 e/
Switzerland e/	32	32	31	32	33
Syria	80	84	129	112	91
Taiwan	252	289	231	146	11 e/
Tajikistan e/	10	10	10	10	1
Trinidad and Tobago	1,801	1,772	2,271	2,720	2,686
Turkey	519	558	560	82	53
Turkmenistan	70	61	75 e/	75 e/	75 e/
Ukraine	3,300	3,400 e/	3,300	3,711	3,577
United Arab Emirates	331	373	331	380	348
United Kingdom	850	642	871	902	814 e/
United States 6/	13,400	13,300	13,800	12,900 r/	12,300
Uzbekistan	950	950	875	790 e/	810 e/
Venezuela	605	612	522	522 r/ e/	377 e/
Vietnam	54	54 e/	33	33 e/	42
Zambia	2	1 e/	--	-- e/	-- e/
Zimbabwe e/	61	64	57	61	58
Total	105,000 r/	103,000 r/	105,000	107,000 r/	109,000

e/ Estimated. r/ Revised. -- Zero.
1/ World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.
2/ Table includes data available through June 18, 2001.
3/ May include nitrogen content of urea.
4/ Reported figure.
5/ Data are for years beginning April 1 of that stated.
6/ Synthetic anhydrous ammonia; excludes coke oven byproduct ammonia.

FIGURE 1
AVERAGE GULF COAST AMMONIA PRICES

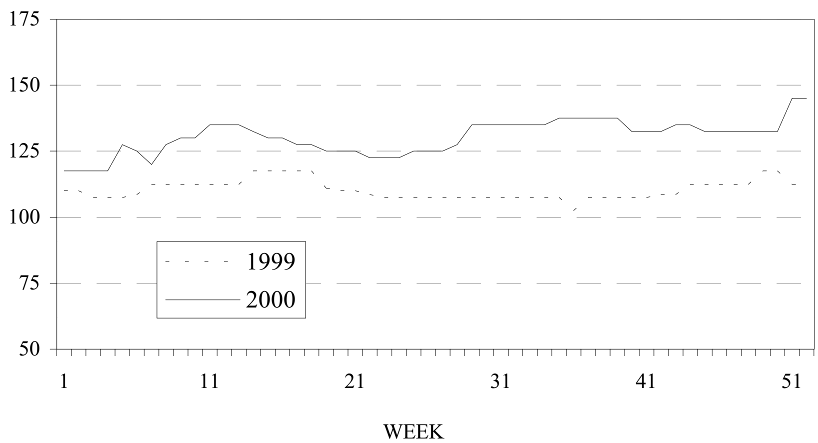
(Dollars per short ton)



Source: Green Markets.

FIGURE 2
AVERAGE GULF COAST GRANULAR UREA PRICES

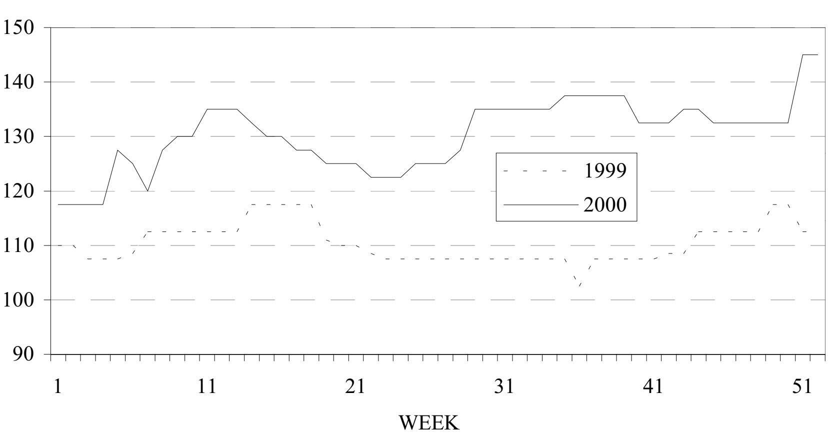
(Dollars per short ton)



Source: Green Markets.

FIGURE 3
AVERAGE AMMONIUM NITRATE PRICES

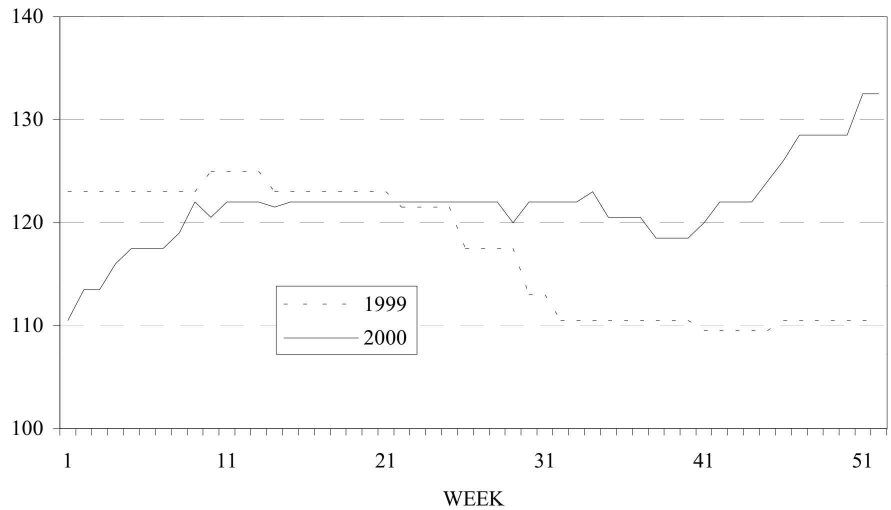
(Dollars per short ton)



Source: Green Markets.

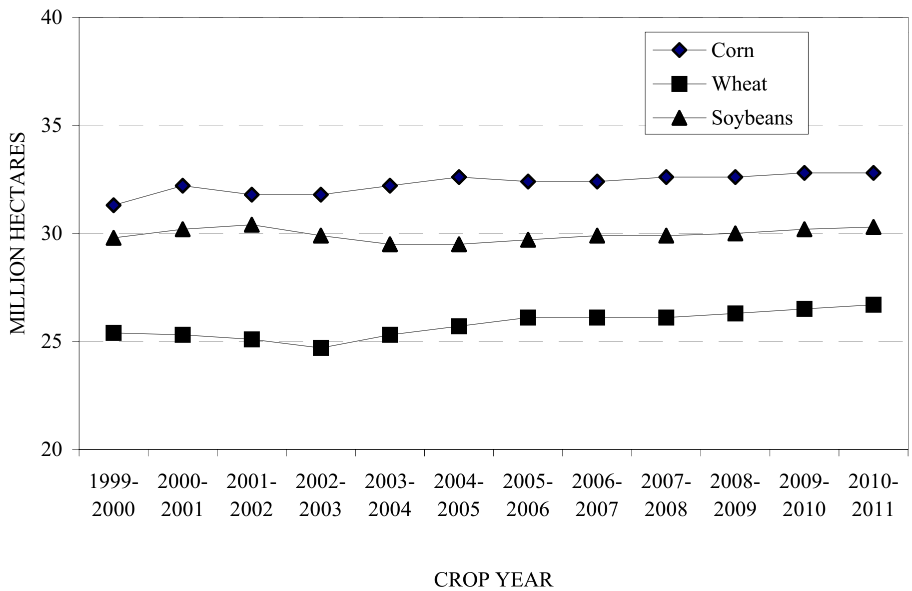
FIGURE 4
AVERAGE AMMONIUM SULFATE PRICES

(Dollars per short ton)



Source: Green Markets.

FIGURE 5
PROJECTED PLANTED ACREAGE



Source: U.S. Department of Agriculture.