Industry & Trade Summary

Fertilizers

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PREFACE

In 1991 the United States International Trade Commission initiated its current *Industry and Trade Summary* series of informational reports on the thousands of products imported into and exported from the United States. Each summary addresses a different commodity/industry area and contains information on product uses, U.S. and foreign producers, and customs treatment. Also included is an analysis of the basic factors affecting trends in consumption, production, and trade of the commodity, as well as those bearing on the competitiveness of U.S. industries in domestic and foreign markets.[1]

This report on fertilizers covers the period 1992 through 1996. Listed below are the individual summary reports published to date on the energy, chemicals, and textiles sectors.

USITC publication number	***Publication date***	***Title***
Energy and Chemicals:		
2458	November 1991	Soaps, Detergents, and Surface-Active Agents
2509	May 1992	Inorganic Acids
2548	August 1992	Paints, Inks, and Related Items
2578	November 1992	Crude Petroleum
2588	December 1992	Major Primary Olefins
2590	February 1993	Polyethylene Resins in Primary Forms
2598	March 1993	Perfumes, Cosmetics, and Toiletries
2736	February 1994	Antibiotics
2739	February 1994	Pneumatic Tires and Tubes
2741	February 1994	Natural Rubber
2743	February 1994	Saturated Polyesters in Primary Forms
2747	March 1994	Fatty Chemicals
2750	March 1994	Pesticide Products and Formulations
2823	October 1994	Primary Aromatics

[1] The information and analysis provided in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under statutory authority covering the same or similar subject matter.

PREFACE—*Continued*

USITC publication number	***Publication date***	***Title***
Energy and Chemicals—Continued:		
2826	November 1994	Polypropylene Resins in Primary Forms
2845	March 1995	Polyvinyl Chloride Resins in Primary Forms
2846	December 1994	Medicinal Chemicals, except Antibiotics
2866	March 1995	Hose, Belting, and Plastic Pipe
2943	December 1995	Uranium and Nuclear Fuel
2945	January 1996	Coal, Coke, and Related Chemical Products
3014	February 1997	Synthetic Rubber
3021	February 1997	Synthetic Organic Pigments
3081	March 1988	Explosives, Propellant Powders, and Related Items
3082	March 1998	Fertilizers
3093	March 1998	Adhesives, Glues, and Gelatin
Textiles and apparel:		
2543	August 1992	Nonwoven Fabrics
2580	December 1992	Gloves
2642	June 1993	Yarn
2695	November 1993	Carpets and Rugs
2702	November 1993	Fur Goods
2703	November 1993	Coated Fabrics
2735	February 1994	Knit Fabric
2841	December 1994	Cordage
2853	January 1995	Apparel
2874	April 1995	Manmade Fibers

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ABSTRACT

This report addresses trade and industry conditions for fertilizers for the period 1992-96.

- The United States ranks among the top five world fertilizer producers for all major nutrients: nitrogen, phosphorus, potassium, and sulfur. The United States remains the primary world producer of phosphatic fertilizers and sulfur, is second only to China for nitrogenous fertilizer production, and ranks fifth in production of potassic fertilizers.

- U.S. fertilizer production is inadequate to satisfy domestic demand; therefore, imports account for a significant share of domestic consumption. On a nutrient basis, a significant portion of domestic demand for nitrogenous and potassic fertilizers is satisfied by imports. However, U.S. production of phosphatic fertilizers is both sufficient to satisfy domestic demand and to account for the majority of U.S. fertilizer exports, while U.S. sulfur imports satisfy a relatively small share of domestic demand.

- Producers of these products in the United States had annual production averaging approximately $8.8 billion during 1992-96, with employment of over 37,000 persons. Imports comprised approximately a quarter of U.S. consumption of fertilizer products with significant quantities coming from producers in Canada, Trinidad and Tobago, Russia, and Mexico. The top markets for U.S. exports were China, India, Australia, Canada, and Japan with total U.S. exports representing approximately one-third of U.S. production.

- The primary U.S. consumers of these fertilizer products include farmers, nurseries, golf courses, and landscapers. Consumer demand for these fertilizer products closely parallels the condition of the U.S. farm economy. In particular, fertilizer demand is affected from year to year by highly variable factors, such as weather conditions, grain inventories, U.S. and foreign government agricultural policies, world economic conditions, and world trade of fertilizers and agricultural products.

INTRODUCTION

This summary of industry and trade information on fertilizers is organized into four sections: U.S. industry profile, U.S. market, U.S. trade, and foreign industry profile. The U.S. industry section discusses types of fertilizers, industry structure, costs, distribution channels, and restructuring. The U.S. market section provides information on U.S. apparent consumption, production, and end-market environment. The section on U.S. trade includes information on the U.S. tariff structure and trade-related investigations as well as the tariff structures of major U.S. export markets. The foreign industry profile section examines the major world fertilizer producers and markets. Most of the information in this report is provided in the context of a 5-year (1992-96) timeframe.

Fertilizers, which supply nutrients to vegetable matter, are grouped by nutrients provided. Fixed nitrogen (N), water-soluble phosphorus (P), and water-soluble potassium (K) are the primary fertilizer nutrients. Sulfur (S) is considered the most important secondary nutrient. Information concerning additional secondary and minor plant food elements, which include calcium, magnesium, iron, manganese, copper, zinc, boron, and molybdenum, are included in aggregated trade and production data.

Of the three primary crop nutrients, nitrogen is the leading nutrient applied by farmers in the United States. Nitrogen promotes plant growth and production of chlorophyll. Natural gas and nitrogen from the atmosphere are the primary input raw materials for all nitrogenous fertilizer production.[1] There are several different nitrogenous fertilizers, such as anhydrous ammonia, urea, and ammonium nitrate, each with its own advantages and disadvantages.

Anhydrous ammonia, which is 82.2 percent nitrogen, has the highest nitrogen content of all the nitrogen fertilizers. It is produced from natural gas and nitrogen from the air, and per unit of nitrogen, is the lowest cost nitrogen fertilizer. However, ammonia application requires specialized equipment. At ambient temperature and atmospheric pressure, ammonia is a toxic gas. Consequently, storage and distribution are expensive, because ammonia must either be cooled to a liquid by refrigeration or stored and transported in high-pressure containers. Ammonia application is also expensive because special plows are required that inject the ammonia, as a gas, under the soil. In addition, soil conditions must be such that ammonia will be retained until it is nitrified by soil microorganisms. More than 90 percent of all ammonia use occurs as fertilizer or as an input to further fertilizer production, with the balance consumed as a reagent-grade chemical or as input to non-fertilizer chemical manufacturing processes.

[1] The U.S. nitrogenous fertilizer industry exhibits a high degree of vertical integration, with ammonia, urea, urea ammonium nitrate solutions (UAN), and ammonium nitrate often produced by the same company at the same production site.

Urea has the highest nitrogen content (46.6 percent) of solid nitrogen fertilizers. Most urea is produced as granules and prills[2] from ammonia and carbon dioxide, is safe to store and easy to handle, and has a transportation advantage in that it can be shipped, or back-hauled, in the same vessels used to transport bulk cargos such as grain. More than 85 percent of urea produced is used as fertilizer, including solid and nitrogen solutions of urea. The balance is primarily consumed as livestock feed and in the production of urea-formaldehyde resins and melamine.

Ammonium nitrate (35.0 percent nitrogen) is produced from ammonia and nitric acid, and is marketed as prills and granules that look very much like those of urea. However, ammonium nitrate is hygroscopic and can also present fire or explosion hazards. Ammonium nitrate's principal advantage is that part of its nitrogen content is in the form of nitrate that can be immediately utilized by crops. Other than fertilizer, the major end use of ammonium nitrate is in mixtures with fuel oil to produce explosives.

Nitrogen solutions are aqueous mixtures, usually of urea and ammonium nitrate (UAN), whose temperature-sensitive nitrogen content usually ranges from 28 to 32 percent. UAN solutions are easy to handle, can be more uniformly applied to the soil than solid fertilizers, can be metered into irrigation water to provide nitrogen to growing crops, and are less costly than ammonia to transport and store. Moreover, direct production of these solutions from urea and ammonium nitrate reactor solutions eliminates prilling or granulating costs. However, the lower UAN nitrogen content increases shipping costs per unit of nitrogen and different equipment is required for application than that used to apply dry fertilizers.

The nutrient phosphorus has often been called the master key to agriculture in that it has a marked influence on root development, plant maturation, and crop yield. Phosphorus is delivered to plants chiefly through the two-nutrient (N and P) ammonium phosphate salts that are generally derived from the reaction between ammonia and phosphoric acid. More than 95 percent of the use of ammonium phosphates is as fertilizers. Diammonium phosphate (DAP) accounts for the bulk of total reported production of all solid ammonium phosphates in the United States. Monoammonium phosphate (MAP), which gives a lower percentage of nitrogen inherent to the compound, is also chiefly used as a fertilizer.

A number of potassium salts, commonly referred to as potash, are used as fertilizers. Because the term potash can refer to any of several compounds, the potassium content of a fertilizer is usually stated in terms of the oxide, K_2O, although it is not itself a naturally occurring chemical compound. Potassium aids in the synthesis of starch and sugar, stiffens straw in cereal grains, promotes root growth, and enables plants to better withstand disease and adverse conditions of climate. Potassium chloride (KCl), also known as muriate of potash, is the chief source of fertilizer potassium applied to fields in the United States. Most potassium chloride in the United States exists in underground deposits. Approximately 80 percent of this total is exploited by conventional shaft-mining techniques. The remainder is obtained either from solution mines or recovered from surface brines.

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[2] Defined as hollow spherical or tear-shaped particles.

Sulfur is both a necessary plant nutrient and also an input for other types of fertilizer production. The largest single end use of sulfur is to produce sulfuric acid used for production of phosphatic fertilizers. Elemental sulfur may be produced by discretionary mining of native sulfur associated with the cap rock of salt domes and in sedimentary deposits by the Frasch hot-water method in which the native sulfur is melted underground and brought to the surface by compressed air. Sulfur compounds are also nondiscretionary by-products from petroleum refining, natural gas processing, and coking plants, captured primarily to comply with environmental regulations that seek to reduce the sulfur content of emissions from processing facilities. The sulfur content of fuels sold or used by such facilities is also regulated.

Overall, U.S. fertilizer production is inadequate to satisfy domestic demand; therefore, imports account for a significant share of domestic consumption. On a nutrient basis, a significant portion of domestic demand for nitrogenous and potassic fertilizers is satisfied by imports. However, U.S. production of phosphatic fertilizers is both sufficient to satisfy domestic demand and to account for the majority of U.S. fertilizer exports, while U.S. sulfur imports satisfy a relatively small share of domestic demand.

U.S. INDUSTRY PROFILE

Industry Structure

The U.S. industry is composed of establishments primarily engaged in (1) manufacturing nitrogenous fertilizer materials or mixed fertilizers from nitrogenous materials produced in the same establishment, as classified in Standard Industrial Classification (SIC) Industry No. 2873; (2) manufacturing phosphatic fertilizer materials, or mixed fertilizers, from phosphatic materials, produced in the same establishment, as classified in SIC Industry No. 2874; (3) mixing fertilizers from purchased fertilizer materials, as classified in SIC Industry No. 2875; (4) manufacturing industrial inorganic chemicals, such as calcium phosphates, phosphorous, and potassium nitrates, classified as part of SIC Industry No. 2819; (5) mining, milling, or otherwise preparing natural potash and potassium compounds, classified as part of SIC Industry No. 1474; and (6) mining, milling, or otherwise preparing sulfur and guano, classified as part of SIC Industry No. 1479.

The aggregated U.S. fertilizer industry was composed of about 350 establishments, with approximately 37,400 total employees during 1996.[3] Changes in size and number of firms during 1992-96 have primarily occurred in response to such factors as price changes for natural gas, grain surpluses, natural resource depletion, and environmental constraints on

[3] Estimated by USITC staff from statistics compiled by the U.S. Department of Commerce, Bureau of the Census, *1992 Census of Manufactures: Agricultural Chemicals*, MC92-1-28G Industry Series, (Washington, DC), p. 28G-7.

production and consumption. In general, the geographic distribution of the U.S. fertilizer industry is dictated by proximity to its natural resources, primary inputs, or end-use markets and is clustered by nutrient along the gulf coast (N and S), Florida and North Carolina (P), and New Mexico (K). Fertilizer production may be characterized overall as moderately labor intensive.

Nitrogenous fertilizer and sulfur production processes are computer controlled; however, the mining components of phosphatic and potassic fertilizer production require significant manual labor input. When feasible, vertical integration is used as a logical strategic cost control measure. Frequently, the U.S. nitrogenous fertilizer industry exhibits a high degree of vertical integration with ammonia, urea, UAN, and ammonium nitrate often produced at the same production site. Figure 1 shows the interrelated nature of stages of fertilizer product manufacture from raw material inputs to finished fertilizer product. In general, fertilizers are marketed through long-term agreements by corporate sales forces, with prices reflecting supply-demand situations. Because the fertilizer industry is considered to be a mature industry, research and development expenditures are concentrated on increasing process yield and efficiency and compliance with environmental production constraints.

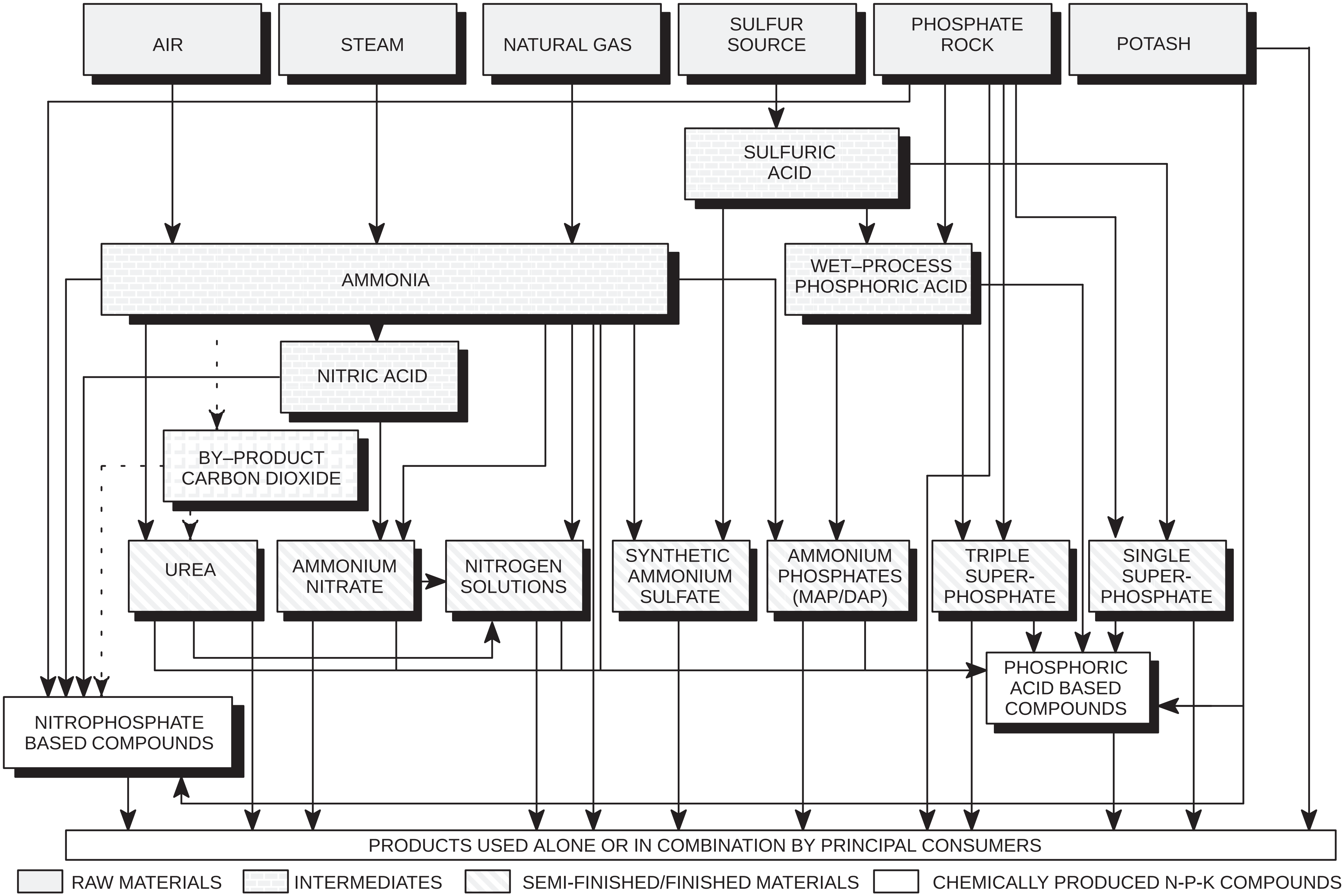
Several regulatory issues affect the fertilizer industry, including Superfund,[4] the General Agreement on Tariffs and Trade (GATT),[5] and the Farm Bill. Superfund required EPA to establish a national inventory of toxic chemical emissions called the Toxics Release Inventory (TRI).[6] As this legislation affects production of each major fertilizer nutrient product group, the impact will be addressed separately for each nutrient, as appropriate.

[4] Section 313 of the Environmental Protection Agency's (EPA) Emergency Planning and Community Right-to-Know Act of the Superfund Amendments and Reauthorization Act (SARA) of 1986 (Public Law 99-499).

[5] Now the World Trade Organization (WTO).

[6] U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, *Toxics Release Inventory 1992*, Public Data Release, EPA 745-R-94-001, (Washington, DC), Apr. 1994.

Figure 1
U.S. fertilizer industry: Principal raw materials, intermediates, and products



Source: Adapted from “Principal Fertilizer Raw Materials, Intermediates, and Products,” © 1986 The British Sulphur Corporation Ltd., 31 Mount Pleasant, London WC1X OAD, England. Reproduced with permission of British Sulphur.

The President signed the Uruguay Round Agreements Act[7] on December 8, 1994. By this act, the new multilateral GATT (now WTO), implemented on January 1, 1995, is expected to gradually result in the lowering of global tariff barriers, thus improving the prospects for improved access of U.S. agricultural exports to major countries around the globe.[8] The "Freedom to Farm" U.S. Farm Bill was enacted on April 4, 1996. This legislation withdraws the Acreage Reduction Plan restrictions on planted acreage of grains, oilseeds and fibers. While the exact implementation mechanism is unclear at this time, there will be no governmental restrictions on planted acreage.[9]

The U.S. fertilizer industry is part of a global industry and it ranks among the top five world producers for N, P, K, and S nutrients. Detailed nutrient-specific industry discussions follow.

Nitrogenous Fertilizers

There were 152 establishments, with 7,400 employees, producing nitrogenous fertilizers in the United States during 1992.[10] Since 1987, both the number of establishments and workers employed in the nitrogenous fertilizer industry increased from 117 establishments with 7,000 employees.[11] Nitrogenous fertilizer production is not considered labor intensive because most production processes are computer controlled.

Changes in size and number of firms comprising the U.S. nitrogenous fertilizer industry have primarily occurred to capitalize on economies of scale and to respond to such events as price changes for natural gas and ammonia inputs, increases in world nitrogenous fertilizer trade, and changes in environmental protection regulations. In the 1980s, industry analysts predicted that several ammonia plants would close as a result of significant increases in the U.S. price of natural gas. Several U.S. ammonia plants did close during the mid-1980s, since which time U.S. production has been inadequate to satisfy demand, and current predictions are that U.S. ammonia capacity will increase during 1998-2000. The U.S. nitrogenous fertilizer industry has also become more concentrated. In 1992, the six largest companies accounted for 56 percent of total U.S. ammonia production capacity; in 1996, the six largest companies accounted for 68 percent. The U.S. nitrogenous fertilizer industry is predominantly controlled by domestic companies, with significant foreign direct investment interests. Currently the top four nitrogenous fertilizer producing companies are Farmland Industries, Inc., The Potash Corporation of Saskatchewan (PCS), Terra International, Inc., and CF Industries.[12]

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[7] H.R. 5110 - Public Law No. 103-465.

[8] U.S. President, *Presidential Documents*, V. 30, No. 49, Dec. 12, 1994. Office of the Federal Register, (Washington, DC), pp. 2478-2480.

[9] John Douglas, "Outlook 1996: An Excellent Picture," *Fertilizer International*, No. 352 (May/June 1996), British Sulphur Publishing, p. 93.

[10] U.S. Department of Commerce, *1992 Census of Manufactures: Agricultural Chemicals*, p. 28G-7.

[11] Ibid.

[12] U.S. Department of the Interior, Bureau of Mines, *Nitrogen*, (1992 Annual Report) by Raymond L. Cantrell, (Washington, DC), Aug. 1993, p. 2, and U.S. Department of the Interior,

(continued...)

Nitrogenous fertilizers are most frequently produced near the site of their primary input, natural gas. U.S. nitrogenous fertilizer production capacity is primarily concentrated in the States of Louisiana (40 percent), Oklahoma (14 percent), and Texas (6 percent), owing to large indigenous reserves of natural gas feedstock. Plants in several Midwestern States also account for significant capacity (16 percent) with the remainder equally divided between the Southern and Southeastern States, and Western States (12 percent each).[13]

Since ammonia is required for all downstream nitrogenous fertilizer production, vertical integration is viewed as a logical economic move to exert some control over costs.[14] Nitric acid, urea, ammonium nitrate, and urea ammonium nitrate solutions are often produced at a single highly-integrated production location.

In general, nitrogenous fertilizer prices reflect the supply situation for ammonia. Approximately 7 percent of total annual industrial natural gas use in the United States goes to nitrogenous fertilizer production as both fuel and feedstock. The primary nitrogenous fertilizer product produced from natural gas is ammonia, which, in turn, is both an end-use nitrogenous fertilizer product and a primary input for all other nitrogenous fertilizer production.

Firms that must purchase ammonia on the open market typically obtain long-term contracts with suppliers to secure a steady supply and to hedge against price volatility. U.S. ammonia capacity, overbuilt in the 1970s and rationalized in the late 1980s-early 1990s, is currently inadequate to meet demand;[15] therefore, U.S. demand is satisfied by ammonia imports.

The primary market for nitrogenous fertilizers is in agriculture, mainly for the nitrogen-intensive crops of corn, wheat, cotton, and rice. Because three of these crops are planted only in the spring, demand for nitrogenous fertilizers tends to be seasonal. Producers typically sell under contract to distributors and dealers who, in turn, supply farmers. An exception is the farmer-owned co-operative, CF Industries, whose ownership structure both eliminates distribution channel intermediates and assures an adequate captive supply to its members.

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[12] (...continued)
U.S. Geological Survey (formerly Bureau of Mines), *Nitrogen*, (Annual Review - 1996) by Jim F. Lemons, Jr., (Washington, DC), Aug. 1997, p. 2.

[13] U.S. Department of the Interior, *Nitrogen*, (Annual Review - 1996), Aug. 1997, p. 2.

[14] The cost of producing ammonia is largely determined by the price of natural gas, which accounts for approximately 75 percent of total ammonia production cost. In 1991, the cost of producing ammonia at the large U.S. plants averaged about $87 per ton. At a natural gas cost of $1.80 per million cubic feet (MMCF), gas constituted 72 percent of the total cost to produce ammonia. However, many overseas competitors enjoyed lower gas costs. If gas is priced at a collection value of about $1 per MMCF (which is commonly done in countries where gas is readily available), the cost of ammonia production drops from $87 to $59 per ton and gas constitutes 59 percent of the total cost of production. The ability to compete in world nitrogenous fertilizer markets, therefore, depends mainly on the relative price of natural gas.

[15] Karen Chasez, "Effect of Ammonia Expansions on the Latin American Nitrogen Industry," (paper presented at the British Sulphur 7th Fertilizer Latin America Conference, Tampa, FL, Mar. 4, 1996), p. 1.

Soils do not retain nitrogen from year to year; therefore, nitrogen fertilizer must be added during each planting season to ensure optimum growth and yield conditions. There is a close relationship between relative nitrogenous fertilizer prices and nutrient source product selection. For example, if solid urea prices in the United States fell more rapidly than those of anhydrous ammonia, this might lead to increased consumption of solid urea at the expense of decreased consumption of anhydrous ammonia. However, concerns regarding the safety and environmental effects of anhydrous ammonia and ammonium nitrate may also affect nitrogen source choice. Differences in weather, temperature, and soil conditions can also result in switching from one type of nitrogenous fertilizer to another.

The U.S. nitrogenous fertilizer industry is considered to be a mature industry with minimal research and development expenditures. Research and development funds are spent on process automation and control upgrades, improving energy efficiency, de-bottlenecking, and environmental compliance. However, research was recently undertaken by the U.S. Bureau of Mines Pittsburgh Research Center on methods of desensitizing ammonium nitrate to detonation while retaining its benefit as a fertilizer. The Bureau found that ammonium nitrate containing 20 percent urea diluent will not detonate based on the customary simple addition of fuel oil.[16] The primary use for ammonium nitrate mixed with fuel oil is in explosives.

In regard to environmental concerns, EPA's 1992 TRI revealed that ammonia ranked high both in terms of total releases and in terms of direct releases to the air, water, and land. Ammonia ranked first in terms of underground injection, second in discharges to surface water, and third in terms of the largest emissions to the air. Ammonium nitrate solution, nitric acid, and ammonium sulfate solution were also listed among the top 50 releases, in order of importance.[17]

The U.S. nitrogenous fertilizer industry is part of a global industry and ranked second among the top five world ammonia producers during 1996: China (20.7 percent), United States (14.6 percent), Russia (8.2 percent), India (8.1 percent), and Canada (3.8 percent).[18] Canada and Trinidad and Tobago are the two largest sources of overall U.S. nitrogenous fertilizer imports.

Significant industry acquisitions, expansions, consolidation, and joint ventures occurred during 1992-96. In 1996, nitrogen producer Arcadian Corp.[19] was acquired by The Potash

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[16] "House Explores Ammonium Nitrate Issue," *Green Markets, Fertilizer Market Intelligence Weekly*, June 19, 1995, pp. 8-9.

[17] U.S. Environmental Protection Agency, *Toxics Release Inventory 1992*.

[18] Based on data reported to the International Fertilizer Industry Association (IFA), Paris, France.

[19] In 1993, Arcadian Corp., one of the largest U.S. producers of nitrogenous fertilizers, purchased two adjacent fertilizer plants in the Republic of Trinidad and Tobago, an island country in the Caribbean Sea off the coast of Venezuela, rich in natural gas reserves. This move enhanced Arcadian's strategy of improving competitiveness through the acquisition of production capacity in close proximity to key market areas. The ammonia units purchased had been jointly owned by Amoco Corp. of the United States and Fertilizers of Trinidad and Tobago, Ltd. (FERTRIN), while the urea plant purchased -- Trinidad and Tobago Urea Co., Ltd. -- was wholly owned by Trinidad and Tobago. (U.S. Department of the Interior, *Nitrogen*, (1993 Annual

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Corp. of Saskatchewan (PCS), a major North American potash and phosphate fertilizer manufacturer; Mississippi Chemical Corp. acquired the nitrogen facilities of First Mississippi Fertilizer Inc. (Ampro) and of Triad Chemical Co. PCS initiated production of a 255-ton-per-year ammonia plant at Point Lisas, Trinidad, in April 1996. Farmland Industries, Inc. and Mississippi Chemical Corp. contracted to construct the largest ammonia plant in the world, due on-stream by early 1998, in Trinidad and Tobago.[20] Saskferco, an ammonia and urea production joint-venture between Cargill Fertilizer of Minneapolis, MN, the Crown Corp. of Saskatchewan, and Citibank Canada, came on-stream in the fall of 1992 at Belle Plaine, Saskatchewan.[21]

Phosphatic Fertilizers

There were 75 establishments, with 9,500 employees, producing phosphatic fertilizers in the United States during 1992.[22] As discussed below, however, the number of firms in the market decreased considerably during 1992-96. Phosphatic fertilizer production is considered moderately labor intensive, since mined phosphate rock must be washed, crushed, and classified before digestion by acid. However, further downstream production processes of finished phosphates are computer-controlled. Since the late 1980s, the number of workers employed in the phosphatic fertilizer industry has increased slightly from 9,300 employees, while the number of establishments producing phosphatic fertilizers has decreased slightly from 77.[23] Phosphatic fertilizer production processes require significant electrical energy inputs; therefore, energy costs play a major role in determining commodity prices and competitive advantage. Higher energy costs in industrialized countries are a factor in the emergence of the phosphatic fertilizer industry in some less developed countries.[24]

The United States is the world's leading producer and consumer of phosphatic fertilizers. Currently the top three domestic phosphatic fertilizer-producing companies are IMC-Agrico Co.[25] (36 percent), Cargill Fertilizer, Inc. (15 percent), and CF Industries, Inc. (12 percent). In 1990, the top three companies accounted for 42 percent of total U.S. phosphatic fertilizer production capacity; in 1996, the top three companies accounted for 63 percent.[26] The changes in the size and number of firms comprising the U.S. phosphatic fertilizer industry,

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[19] (...continued)
Report), Aug. 1994, p. 6, and U.S. Department of the Interior, *Nitrogen*, (Annual Review - 1996), Aug. 1997, p. 1.)

[20] U.S. Department of the Interior, Bureau of Mines, *Nitrogen*, (Annual 1994), by Raymond Cantrell (Washington, DC), Aug. 1995, p. 5.

[21] U.S. Department of the Interior, Bureau of Mines, *Nitrogen*, (Annual 1993), by Raymond Cantrell (Washington, DC), Aug. 1994, p. 6.

[22] U.S. Department of Commerce, *1992 Census of Manufactures: Agricultural Chemicals,* p. 28G-7.

[23] Ibid., p. 28G-5.

[24] As noted later in the report, energy resources in such countries are often state-owned and provided to domestic industrial users at prices below the world market value of the product.

[25] A joint-venture partnership between IMC Fertilizer Group, Inc. and Freeport-McMoRan Resource Partners, L.P.

[26] U.S. Department of the Interior, *Nitrogen*, (Annual 1992 and 1996).

and their degree of concentration, were due to major industry consolidation and restructuring in Florida and the Western States during the past few years. A protracted period of global phosphate fertilizer oversupply, grain surpluses, and depressed prices between 1981 and 1986 were factors in the U.S. industry consolidation, as well as its incorporation of advanced technologies in the wet-process phosphoric acid (WPPA) manufacturing process, including wet rock grinding, and the cogeneration of electrical power from by-product steam. The net result was that, by 1994, a few major firms, operating under vastly improved economies of scale, dominated the industry. An added benefit was more effective vertical integration between phosphate rock mining, finished phosphate manufacture, and marketing. No new U.S.-owned capacity is anticipated; rather, existing plants may be debottlenecked and idle plants may be recommissioned. However, a new monoammonium phosphate plant is under construction at Bartow, FL, by the Chinese Government-owned Sinochem USA.

Most (about 85 percent) U.S. phosphatic fertilizer production capacity is concentrated near phosphate rock mineral deposits in Florida and North Carolina. The United States produces approximately one-third of the world's phosphate rock. Two new U.S. phosphate rock mines, owned by Cargill and CF Industries, were commissioned during 1995, yet industry sources expect U.S. phosphate rock exports to decline as export emphasis is placed on downstream higher-value-added phosphatic fertilizers. Phosphate rock imports are expected to increase to feed plants in the Mississippi River area,[27] whose location and cost-effective production facilities make them highly competitive in the global marketplace. Phosphatic fertilizers are also produced near rock deposits in the Western States of Idaho, Wyoming, and Utah. These latter production facilities provide fertilizer to consuming States in a vast region extending from the Midwest to the Pacific Coast and into Canada.[28] Because transportation costs are an important factor for fertilizer distribution, the primary channels of distribution require access to deep water ports, inland waterways, and proximity to world trade routes.

Vertical integration of phosphatic fertilizer production is viewed as a logical strategic move to exert control over input costs. Required sulfuric and phosphoric acid input plants are generally at the integrated phosphate rock mine site. Firms that must purchase phosphate rock on the open market typically obtain long-term contracts with suppliers to secure a steady supply and to hedge against price volatility.

Because product differentiation and quality differences are almost nonexistent, individual phosphatic fertilizer products are generally, with few exceptions, marketed on the basis of price by the private companies' marketing and sales forces. However, some international marketing arrangements are handled through international traders and collaborative industry organizations have been organized for such purposes. Phosphate finished products are exported through the Phosphate Chemicals Export Association (PhosChem), a group of producers formed under provisions of the Webb-Pomerene Act. Beyond pricing policies, marketing methods may also depend on extension of credit.

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[27] Pierre L. Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (paper presented at the 64th Annual Conference of the International Fertilizer Industry Association (IFA), in Berlin, Germany, May 20-23, 1996), pp. 19-20.

[28] U.S. Department of the Interior, Bureau of Mines, *Phosphate Rock*, (Annual 1994), by Raymond Cantrell (Washington, DC), Sept. 1995, p. 3.

In general, heavy demand for downstream phosphate fertilizer products is reflected in rising prices. Industry consolidation and restructuring resulted in improved operating efficiencies and lower raw materials costs. The price of domestic phosphate rock raw material is an indicator of finished phosphatic fertilizer product merchant market prices because of the high degree of vertical integration between captive phosphate rock production and upgraded phosphate manufacture.

There is a relatively low level of research and development expenditure in the phosphatic fertilizer industry, probably because of the relatively mature technology used worldwide to produce these commodity products. Phosphatic fertilizer research and development expenditures generally focus on chemical process upgrades or modifications, mining and beneficiation improvements, reclamation, and environmental compliance in the areas of process emission, effluent, and phosphogypsum tailings disposal and handling. Much of phosphatic fertilizer production occurs in or close by the nature preserves and wetlands of Florida; therefore, a significant portion of research expenditures is allocated to restore and preserve these areas.

As phosphoric acid is produced through the digestion of phosphate rock by sulfuric acid, and a further wide range of high-grade downstream phosphatic fertilizers is derived from the reaction between ammonia and phosphoric acid, process emissions are closely regulated. EPA's 1992 TRI revealed that phosphoric acid emissions ranked fourth in terms of total releases by the top 50 TRI chemicals, and accounted for about 7 percent of the total.[29]

The U.S. phosphatic fertilizer industry is part of a global industry, and has the largest phosphate rock capacity and production in the world. Ownership of the U.S. phosphatic fertilizer industry is predominantly private and domestic with foreign direct investment in certain U.S. companies. To minimize capital outlay, commitment, and risk, the preferred market entry strategy for foreign suppliers appears to be the export of raw material or intermediate inputs to the United States to companies producing phosphatic fertilizers in geographic regions without close-by phosphate rock natural resources. As the industry consolidates, the degree of integration with foreign investors, producers, and suppliers appears to be on the increase. During 1995, PCS (Canada) acquired Texasgulf's[30] ammonium phosphates business and Occidental's White Springs Agricultural Chemicals business, thus becoming the second largest U.S. ammonium phosphate producer. In late 1995, Agrium Inc. (Canada) acquired Nu-West Industries, Inc. Nu-West now operates as a manufacturing subsidiary of Agrium, with sales handled through Agrium.[31] U.S. Agri-Chemicals Corporation's central Florida phosphate rock mining and processing facilities operate as a wholly-owned subsidiary of China's Sinochem; wet process phosphoric acid (WPPA) and ammonium phosphate plants at Green Bay, Florida, operate as a joint venture between Farmland Industries, Inc. and Norsk Hydro, L.P.; a purified WPPA plant in North Carolina is cooperatively operated by Texasgulf Chemicals Co. and Albright and Wilson, Ltd. of the

[29] U.S. Environmental Protection Agency, *Toxics Release Inventory 1992*.

[30] Texasgulf is owned principally by Elf Aquitaine S.A. of France; the Williams Companies, Inc., of the United States holds a minority interest.

[31] U.S. Department of the Interior, U.S. Geological Survey (formerly Bureau of Mines), *Phosphate Rock*, (Annual Report--1996), by Joyce Ober (Washington, DC), July 1997, p. 2.

United Kingdom; and Rhone Poulenc of France supplies, under the terms of a 7-year contract negotiated in November 1993, phosphate rock ore to Agrium (formerly Nu-West Industries, Inc.) at Conda, ID, for processing and upgrading to WPPA, SPA, and ammonium phosphates.[32]

Potassic Fertilizers

There were 33 establishments, with 5,500 employees, producing the potash, soda, and borate minerals of SIC industry 1474 in the United States during 1992.[33] Certain potassium salts primarily used as fertilizers, and collectively referred to as potash, comprise a portion of SIC industry 1474. In 1996, there were 10 establishments, with 1,690 employees producing potash in the United States.[34] Since 1992, the number of workers employed in the potassic fertilizer industry decreased irregularly from 2,180 while the number of establishments producing potassic fertilizers decreased from 12 to 10.[35] Three potash mines have closed since 1978, and a fourth will probably close before 2010. However, if the price for KCl stays relatively steady, one closed mine may reopen as a result of mining technology improvements and the use of a different mill.[36] Employment in the U.S. industry declined steadily between 1981 and 1987[37] as a result of the depletion of the U.S. reserve base, mine closures, and increased import reliance. Then, as a result of a re-opened mine, employment subsequently increased through 1992 before decreasing irregularly through 1996.

The number of U.S. establishments producing potassic fertilizers decreased from 12 to 10 during 1992-96.[38] The changes in the size and number of firms comprising the U.S. potassic fertilizer industry were due to natural resource reserve depletion, environmental constraints, industry consolidation, and industry restructuring of firms in New Mexico and Michigan during the past few years. Industry sources report that conventional mining producers in the United States have experienced relatively high production costs and aggressive competition from Canadian and other imported potash, while brine[39] producers have had the advantage of low-cost raw materials, but must abide by environmental impact constraints. Such cost, competition, and constraint factors contributed to the closures of the Horizon potash mine at

[32] U.S. Department of the Interior, *Phosphate Rock*, (Annual 1994), Sept. 1995, pp. 2-3.

[33] U.S. Department of Commerce, Bureau of the Census, *1992 Census of Mineral Industries: Chemical and Fertilizer Mineral Mining*, MIC92-1-14D Industry Series, p. 14D-5.

[34] U.S. Department of the Interior, Bureau of Mines, "Potash," by James P. Searls, *Mineral Commodity Summaries 1995*, (Washington, DC), Jan. 1995, p. 128.

[35] U.S. Department of the Interior, U.S. Geological Survey (formerly Bureau of Mines), *Potash*, by James P. Searls, (Annual Review - 1996), July 1997, (Washington, DC), p. 1.

[36] Ibid.

[37] Year of suspension agreement of Canadian antidumping investigation, and following 1985 ITC potash antidumping investigations with regard to the Former Soviet Union, East Germany, and Israel.

[38] U.S. Department of the Interior, Bureau of Mines, *Potash*, by James P. Searls, (Annual Report - 1992), (Washington, DC), Sept. 1993, pp. 4-5, and U.S. Department of the Interior, *Potash*, (Annual Review - 1996), July 1996, p. 1.

[39] The water of a salt lake or water saturated or strongly impregnated with potassium salts.

Carlsbad, NM, during 1994,[40] and the North American Chemical (Harris & Associates) brine facility at Trona, CA, in March 1996.[41]

The U.S. potash industry consists of companies operating underground mines (3), companies recovering potash from brines (2), and companies operating solution mines (2). Underground mined potash production is centered in Southeastern New Mexico where three companies operate five mine establishments by conventional mining of bedded deposits. These establishments produce about 85 percent of domestic potash. The ore is mined, hoisted to the surface, ground, and screened. The chloride components are separated by crystallization or froth flotation. Three companies in Utah produced potash through recovery from solution mining of underground deposits, from subsurface brines, or from surface brines by solar evaporation and flotation. In Michigan, a pilot-plant development of a deep ore body by solution mining technology continues.[42]

Potassic fertilizer production is considered moderately labor intensive. Conventionally mined potash rock must be beneficiated[43] by flotation, heavy media separation, dissolution-recrystallization, and washing. Brine or solution mine recovery requires evaporation, concentration, and/or flotation. These processes require personnel to run and monitor necessary process equipment.

U.S. potash production will likely continue to decrease as reserves are exhausted. According to the Bureau of Mines, certain New Mexico mined deposits are expected to be depleted in the 1990s, while others appear to be sufficient to sustain mining operations past the year 2000.[44]

Potassic fertilizers are often produced at the site of the primary input mined ore as a logical strategic cost control. Vertical integration is confined to processes which upgrade mined ore to end-use fertilizer product. Potash refers to a number of potassium salts derived from soluble subsurface deposits of potassium minerals, and product diversity is determined by the nature of the mineral deposit mined. For example, sylvanite, the highest grade potash ore, is a mixture of potassium chloride and sodium chloride; through processing it yields potassium chloride product. Langbeinite, a rare form of chloride-free potassium sulfate ore that also contains magnesium sulfate, yields potassium magnesium sulfate (K_2MgSO_4). Kainite ore contains potassium chloride and magnesium sulfate. Evaporation of Great Salt Lake brines yields sulfate of potash.[45]

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[40] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 41.

[41] Pierre L. Louis, "The Outlook for Phosphates and Potash, with Special Reference to Latin America," (IFA paper presented at the British Sulphur 7th Fertilizer Latin America International Conference, Tampa, FL, Mar. 3-5, 1996), p. 6.

[42] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 41.

[43] Treatment methods used on raw materials to improve properties.

[44] U.S. Department of the Interior, Bureau of Mines, "Potash," by James P. Searls, *Mineral Facts and Problems*, (1985 edition), p. 14.

[45] U.S. Department of the Interior, Bureau of Mines, *Potash 1992*, by James P. Searls, (Annual Report), (Washington, DC), Sept. 1993, p. 1.

Potash is marketed through several channels of distribution. In general, potash is transported by train, truck, and barges to warehouses, wholesalers, and retailers. Some potash is sold directly from barges used as temporary warehouses. Retailers sell potash and potash blended with other fertilizers in dry or liquid form for distribution over fields in both spring and fall.[46] In addition, PCS markets potash exports for three New Mexico operations, now in a single company owned by Mississippi Chemical, as a cost-cutting measure.[47]

A protracted period of global potash fertilizer overcapacity has resulted in producers around the world operating at partial capacities to maintain prices. This situation is the result of a decline in demand among the developed market countries since 1979 (i.e., the second oil shock) and in many of the former centrally planned economies since 1988.[48] Developed economy demand dropped as subsidies for agriculture declined; demand in the former Soviet Union (FSU)[49] and other centrally planned economies fell in response to declining state assistance and changing market and political conditions.[50] Historically, in times of economic downturn, potassium is the first nutrient deleted in crop production.[51] During 1992-96, the average annual value of U.S. potash product sales of all types and grades increased irregularly from $96.45 to $101.08 per metric ton f.o.b. mine.[52]

Although domestic production of potash continues to decline, certain specific research and development continues. For example, in the State of Michigan, IMC-Kalium developed an experimental pilot-plant to extract KCl from a deep ore body through solution mine technology. As this facility is close to a main consumption area, production at this mine is likely to continue.[53]

Potash from Canada is the subject of a suspension agreement between the International Trade Administration of the U.S. Department of Commerce and the Canadian Potash producers. The agreement resulted from a 1987 antidumping investigation.[54] The action is slated to be reviewed beginning in March 1999 under the sunset provision of the antidumping law. In recent years, U.S. pricing practices of U.S. and Canadian producers have been the subject of

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[46] U.S. Department of the Interior, Bureau of Mines, "Potash," by James P. Searls, *Mineral Commodity Summaries 1995*, (Washington, DC), Jan. 1995, p. 128.

[47] U.S. Department of the Interior, *Potash*, (Annual Review - 1996), July 1996, p. 2.

[48] U.S. Department of the Interior, *Potash 1992*, (Annual Report), Sept. 1993, p. 9.

[49] For this report, FSU is used to refer to the nations that once comprised the Soviet Union because historical data needed to provide a baseline analysis were, and in some cases continue to be, compiled under the name Soviet Union.

[50] Louis, "The Outlook for Phosphates and Potash, with Special Reference to Latin America," Mar. 1996, p. 5.

[51] Potassium use yields hidden benefits, such as withstanding disease and adverse climate conditions, promotion of root growth, and strong stalks, whereas the benefits of nitrogen and phosphorus use, such as plant growth, chlorophyll production (greening), plant maturation, and crop yield, are clearly visible to the farmer.

[52] U.S. Department of the Interior, *Potash*, (Annual Review - 1996), July 1996, p. 6.

[53] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 41.

[54] USITC, *Potassium Chloride from Canada*, (investigation No. 731-TA-374 (preliminary)), USITC publication 1963, Mar. 1987; for further information, see section entitled, "U.S. government trade-related investigations."

a Justice Department investigation and at least two lawsuits. In June 1996, the Antitrust Division of the U.S. Department of Justice concluded an investigation, begun in 1993, into allegations that North American potash producers acted together to fix the price of potash sold in the United States between 1987 and 1994. The companies under investigation were advised that no action would be taken. In September 1996, a U.S. Federal District Court in St. Paul, MN, dismissed civil antitrust lawsuits alleging that Canadian and some U.S. potash producers were engaging in collusive pricing. Indirect purchasers residing in California filed similar collusive pricing allegations in California State courts. As of the end of 1996, the California suits were still pending, with no discovery proceedings having occurred.[55]

The U.S. potassic fertilizer industry is part of a global industry, and is the fifth-largest potash producer in the world. The degree of integration with foreign investors, producers, and suppliers is shown by such examples as International Minerals and Chemicals Corp.'s (IMC) direct ownership investment in potash mines in both the United States and Canada and by the PCS export marketing agreement for Mississippi Chemicals' consolidated production.[56] Advantages of these arrangements center on supply availability to primary use markets, source-dependent pricing flexibility,[57] and cost-effective marketing.

Sulfur

There were 99 establishments, with 4,100 employees, producing the mined chemical and fertilizer minerals, not elsewhere classified, of SIC industry 1479 in the United States during 1992.[58] By 1996, the number of establishments producing sulfur had increased to 2 establishments producing mined native sulfur and 137 establishments that recovered elemental sulfur as a nondiscretionary by-product from petroleum refining, natural gas processing, and coking plants, primarily to comply with environmental regulations directly applicable to the processing facility or indirectly through restrictions on sulfur content of fuels sold or used by the facility.[59] Total employment, in sulfur mines and/or plants, has been relatively stable at approximately 3,100 employees for the period 1992-96.[60]

Although elemental sulfur and by-product sulfuric acid are produced in 26 States, Texas and Louisiana accounted for 50 percent of domestic production during 1996.[61] Recovered sulfur represented 73 percent of elemental sulfur production with the balance consisting of

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[55] U.S. Department of the Interior, *Potash*, (Annual Review - 1996), July 1996, p. 1.

[56] Ibid., p. 2.

[57] When one producer owns manufacturing establishments in two different geographical locations or countries, with different grade ore beds, different mining processes, and different available modes of transportation, product price may depend upon product source facility.

[58] U.S. Department of Commerce, *1992 Census of Mineral Industries: Chemical and Fertilizer Mineral Mining*, p. 14D-5.

[59] U.S. Department of the Interior, Bureau of Mines, *Sulfur*, (Annual Review - 1994), by Joyce A. Ober, (Washington, DC), Nov. 1995, pp. 1-2.

[60] U.S. Department of the Interior, Bureau of Mines, "Sulfur," by Joyce A. Ober, *Mineral Commodity Summaries 1996*, (Washington, DC), Jan. 1997, p. 166.

[61] Ibid.

discretionary Frasch mined production. In addition, by-product sulfuric acid was recovered at 16 nonferrous smelters in 10 States by 11 companies.[62]

Domestic production of recovered sulfur continued to grow, as mine production decreased with the closure of an older Freeport Sulfur Frasch operation in the Gulf of Mexico early in 1994. Soon after the newest Freeport Sulfur Frasch mine attained design capacity at the end of 1993, the company made the decision to close the older mine to take full advantage of the lower cost and higher efficiency at the newer facility.[63] The two remaining Frasch producers, both also controlled by Freeport Sulfur, are located (one each) in Texas and off-shore Louisiana. Pennzoil announced an agreement to sell virtually all of its sulfur assets to Freeport in a sale that was officially effective January 3, 1995.[64]

Frasch mined sulfur production is considered moderately labor intensive in that native sulfur is melted underground and brought to the surface by compressed air. Recovered sulfur is not considered labor intensive in that it is produced by on-site computer-controlled processes to comply with environmental regulations, regardless of demand.

Vertical integration in the sulfur industry is dictated by use. The largest use of sulfur in all forms is in agriculture, often as a process intermediate input in the form of sulfuric acid.[65] In particular, processing phosphate rock to higher-value-added fertilizer products often requires investment in a sulfuric acid plant as part of integrated phosphatic fertilizer production. In the absence of such a plant, sulfuric acid must be purchased. Product diversity is limited by the intermediate input usage of the sulfuric acid primary product.

In general, sulfur is sold directly by producers' sales forces to chemical and fertilizer producers. It is transported by train, truck, or barge directly to the production site where it is then converted to sulfuric acid to be used as a process intermediate input.

The posted price for Frasch sulfur ranged from $65 to $70 per metric ton during the first quarter of 1994, then reached and maintained $77 per metric ton through fourth quarter 1994.[66] Following the January 1995 consolidation of Frasch sulfur production under sole control of Freeport Sulfur, average price values are unpublishable to protect business-confidential information. However, industry sources reported that Frasch prices increased during 1996 and recovered prices decreased. Sulfur prices, reported as average value in dollars per ton of elemental sulfur, f.o.b. mine and/or plant, decreased irregularly during 1992-96, from $48.14 to $38.00 (estimated).[67] The price decline reflects the increased production and reliance on by-product recovered, rather than mined, sulfur as dictated by the early 1994 Frasch mine closure discussed previously. Freeport Sulphur announced plans early in 1996

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[62] Ibid.

[63] "Freeport-McMoRan to Idle Caminada Sulfur Mine," *Green Markets*, v. 17, No. 42, pp. 1 and 10.

[64] "Freeport to Buy Most of Pennzoil Sulphur," *Fertilizer Markets*, v. 5, No. 14, p. 1.

[65] According to the U.S. Geological Survey, agricultural chemicals (primarily fertilizers) comprised approximately 67 percent of sulfur demand; about 90 percent of sulfur was consumed in the form of sulfuric acid.

[66] U.S. Department of the Interior, *Sulfur*, (Annual Review - 1995), Mar. 1997, pp. 2-3.

[67] U.S. Department of the Interior, “Sulfur,” 1997 Summary, Jan. 1997, p. 166.

to cut production at both of its Frasch mines to better balance supply and demand to maintain prices.[68]

R & D expenditures focus on the low-cost removal of sulfur from petroleum products. Energy Biosystems Corp. (EBC) of Houston, TX, has developed a unique process for this purpose which is being tested in a pilot plant. Genetically engineered microorganisms remove sulfur from petroleum products by biocatalytic desulfurization, or by virtually eating the sulfur, without consuming carbon and wasting valuable fuel. Construction and operating costs of biological desulfurization units are projected to be significantly less than those of more traditional systems.[69]

Sulfur is also subject to several EPA requirements. The first stage of Clean Air Act Amendments (CAAA) of 1990 required electric utilities, in particular coal-fired power plants, to reduce sulfur dioxide emissions significantly in 1995, and all power companies to limit sulfur dioxide emissions to 1990 levels by the year 2000. As a result companies are implementing developed research processes to recover saleable by-products such as commercial grade elemental sulfur, sulfuric acid, and liquid sulfur dioxide rather than invest in costly disposal of these environmental pollutants.[70]

The U.S. sulfur industry is part of a global industry, and the United States is the largest sulfur producer in the world. Examples of the degree of integration with foreign investors, producers, and suppliers are shown through foreign parentage of certain U.S. refinery or natural gas producers, such as Shell Oil (Anglo-Dutch) and BP Oil (British). Advantages of these arrangements center on supply availability to primary use markets, source dependent pricing flexibility, and cost-effective marketing.

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[68] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 32.

[69] A.K. Rhodes, "Enzymes Desulfurizing Diesel Fuel in Pilot Plant Tests," *Oil & Gas Journal*, v. 93, No. 20, (1995), p. 33.

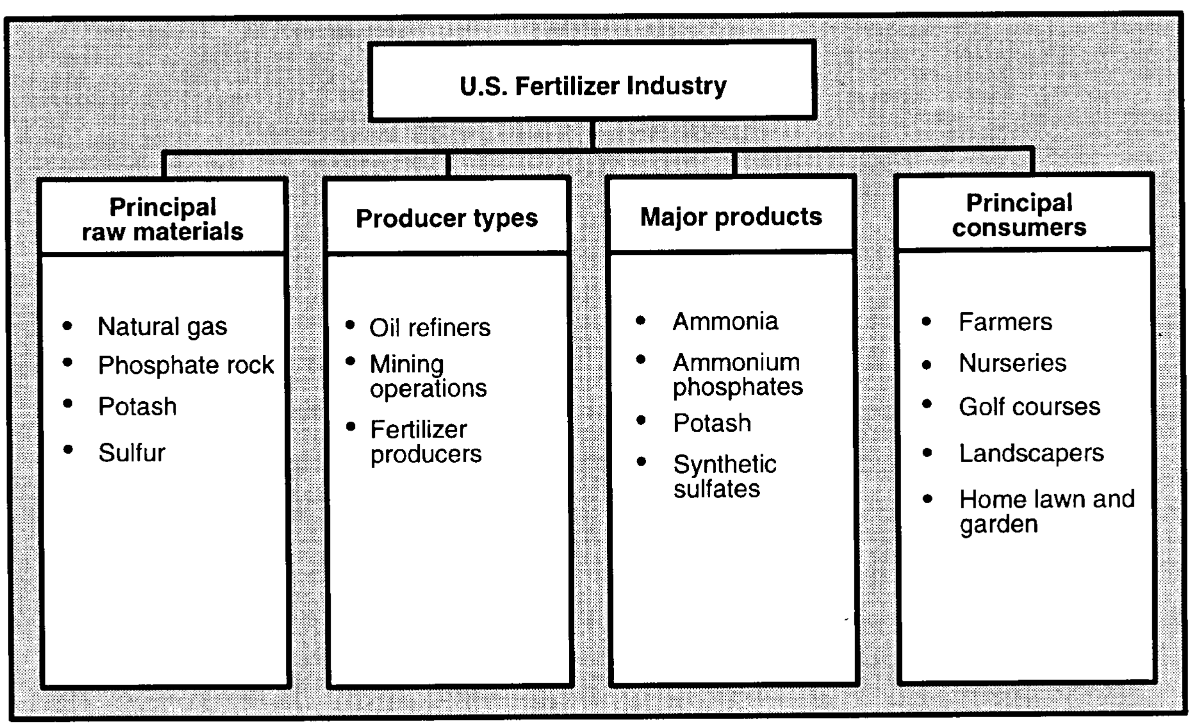
[70] U.S. Department of the Interior, *Sulfur*, (Annual Review - 1994), Nov. 1995, p. 4.

U.S. MARKET

Consumer Characteristics and Factors Affecting Demand

U.S. agriculture is by far the major consumer of fertilizers (figure 2). More than 85 percent of fertilizers consumed in the United States is by farmers in crop production. Specific fertilizer concentration and nutrient mix applied is dictated by soil conditions and crop needs. For example, four crops together account for the majority of nitrogenous fertilizer use: corn, wheat, cotton, and rice; more than one-half of potash consumed is for corn and soybeans; and more than one-half of phosphatic fertilizers consumed are used in the production of corn and wheat. Golf courses, landscapers, and nurseries together account for approximately 10 percent of domestic fertilizer use, with strong demand for nitrogenous fertilizers to ensure greening and quick growth. The home lawn and garden market accounts for the remaining 5 percent of domestic fertilizer consumption with specific usage determined by climate, soil, and plant need.

Figure 2
U.S. fertilizer industry: Principal raw materials, producer types, major products, and principal consumers



Source: U.S. International Trade Commission.

Fertilizer demand may be influenced by weather conditions, trade disputes, political unrest, general economic agricultural conditions, crop prices, and product supply. There are no substitutes for fertilizers in plant growth. However, within each necessary nutrient group, each nutrient may be supplied through a variety of products. Within crop and soil requirements, farmers often select the nutrient vehicle used by price and product supply. Demand is typically the greatest during the spring planting season and in the fall for winter top dressing of soil after crop harvest.

Consumption

Fertilizers are consumed in all 50 States and the District of Columbia. Illinois, Iowa, and Texas consumed the largest amounts of fertilizers, with a combined share of about 25 percent of total U.S. production during 1992-96.[71] Fertilizer use has fluctuated since the early 1980s, affected by the world economic recession, problems specific to the U.S. agricultural economy, and government acreage reduction programs. Total consumption of fertilizers increased irregularly from $7.5 billion in 1992 to $9.0 billion in 1996 (table 1 and figure 3). Imports supplemented U.S. production and import share increased consistently, from 19.6 percent to 27.7 percent of U.S. fertilizer consumption, during 1992-96.

The primary use for fertilizers is in the production of agricultural crops. U.S.-produced fertilizers are considered to be of high quality, and to exhibit stable handling, good storage, and long shelf life characteristics. U.S. producers are considered to be the most secure source of supply in the world. To illustrate the importance of security of supply, one of the most highly integrated U.S. fertilizer production facilities is owned by a farmers' co-operative, which also eliminates markup on distribution.

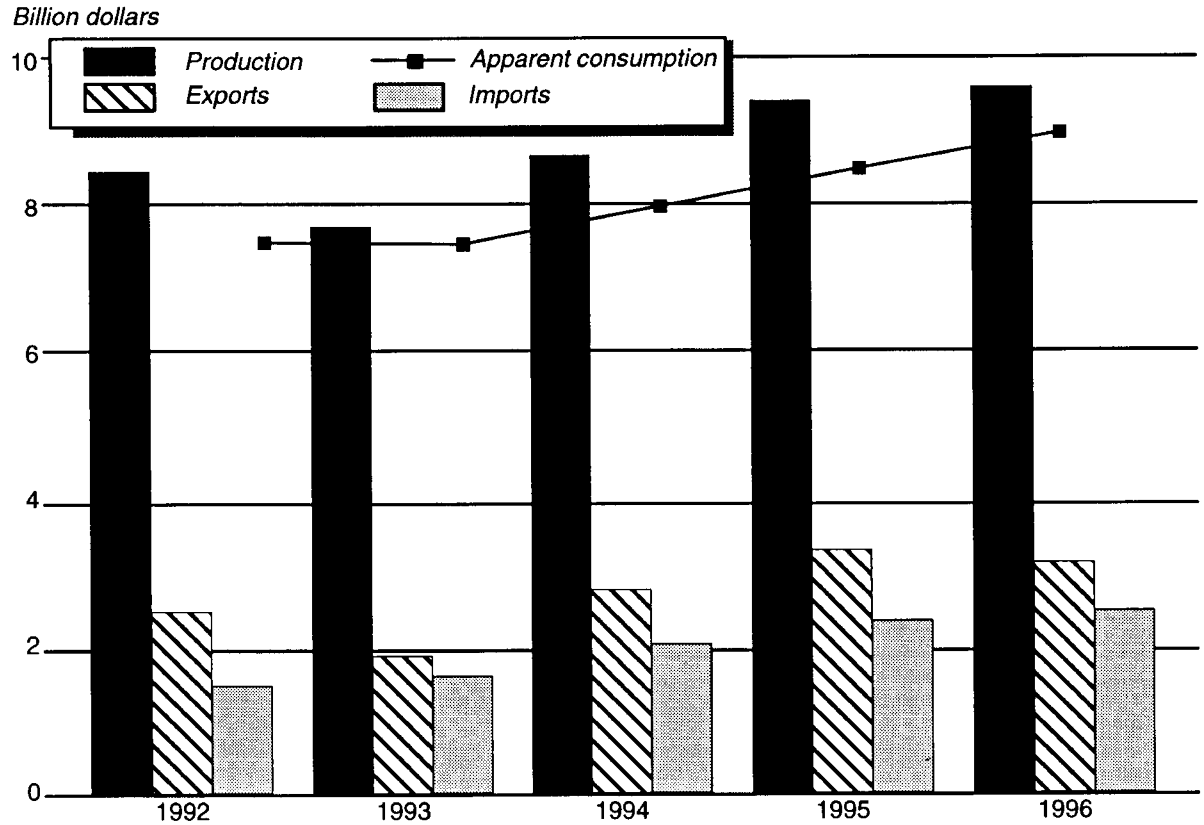
Table 1
Fertilizers: U.S. production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1992-96

Year	U.S. production	U.S. exports	U.S. imports	Apparent U.S. consumption	Ratio of imports to consumption
	Million dollars				*Percent*
1992	8,515	2,483	1,471	7,503	19.6
1993	7,758	1,877	1,600	7,481	21.4
1994	8,737	2,780	2,040	7,997	25.5
1995	9,480	3,319	2,357	8,518	27.7
1996	9,670	3,151	2,489	9,008	27.6

Source: Compiled from official statistics of the U.S. Department of Commerce.

[71] The Association of American Plant Food Control Officials and The Fertilizer Institute, *Commercial Fertilizers 1996*, p. 6.

Figure 3
Fertilizers: U.S. production, exports, imports, and apparent consumption, 1992-96



Source: Compiled from official statistics of the U.S. Department of Commerce.

Production

Much U.S. fertilizer production occurs near raw materials sources. During 1992-96, the value of U.S. production of fertilizers increased irregularly by approximately 3 percent per year, from $8.5 billion in 1992 to approximately $9.7 billion in 1996. The major fertilizer products shipped were ammonium phosphates, urea, and ammonium nitrate, with an estimated 26, 20, and 13 percent, respectively, of the total value of U.S. production of fertilizers in 1996. In general, inventories of dry, storable fertilizers such as DAP, urea, and potash are built up over the winter months for late winter/early spring deliveries targeted for use during the spring planting season. These inventories are often held in storage facilities along traditional delivery routes, such as along the Mississippi River.

U.S. TRADE

Overview

During 1992-96, the United States maintained a positive balance of trade in fertilizers (table 2). The positive trade balance has, however, deteriorated irregularly from $1.0 billion in 1992 to $662 million in 1996. This decline may be primarily attributed to irregular ammonium phosphate exports to China and India and significant increases in imports of nitrogenous fertilizers from Trinidad and Tobago, Russia, Ukraine, and Saudi Arabia.

Table 2
Fertilizers: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country groups, 1992-96[1]

(Million dollars)

Item	1992	1993	1994	1995	1996
U.S. exports of domestic merchandise:					
Canada	204	216	207	261	276
China	630	293	944	1,204	893
Trinidad and Tobago	([2])	([2])	1	([2])	1
Australia	130	131	162	207	295
Japan	166	165	186	218	186
Russia	1	([2])	([2])	([2])	2
Mexico	95	133	160	83	168
Saudi Arabia	1	6	1	1	1
Brazil	124	92	179	113	137
Argentina	35	26	38	59	134
Ukraine	0	0	0	0	2
India	263	173	134	284	81
All other	834	642	768	889	975
Total	2,483	1,877	2,780	3,319	3,151
EU-15	145	71	113	100	68
OPEC	104	41	58	80	37
Latin America	495	439	623	524	784
CBERA	91	64	89	108	118
Asian Pacific Rim	1,128	798	1,518	1,937	1,724
ASEAN	81	64	97	116	174
Central and Eastern Europe	6	1	([2])	([2])	([2])

See footnotes at end of table.

Table 2—*Continued*
Fertilizers: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country groups, 1992-96[1]
(*Million dollars*)

Item	1992	1993	1994	1995	1996
U.S. imports for consumption:					
Canada	928	943	1,067	1,111	1,097
China	([2])	1	1	2	3
Trinidad and Tobago	101	138	238	330	327
Australia	1	([2])	([2])	([2])	([2])
Japan	7	9	11	13	13
Russia	42	47	98	208	170
Mexico	130	69	145	163	165
Saudi Arabia	0	9	40	59	141
Brazil	2	14	9	([2])	5
Argentina	0	([2])	([2])	0	([2])
Ukraine	26	37	57	61	133
India	([2])	([2])	1	1	1
All other	234	333	373	409	435
Total	1,471	1,600	2,040	2,357	2,489
EU-15	60	86	71	73	98
OPEC	3	59	76	104	237
Latin America	276	279	436	552	598
CBERA	101	138	238	330	328
Asian Pacific Rim	11	16	22	24	28
ASEAN	([2])	6	9	9	10
Central and Eastern Europe	6	43	92	105	48
U.S. merchandise trade balance:					
Canada	-725	-728	-860	-850	-822
China	629	292	943	1,203	890
Trinidad and Tobago	-101	-137	-238	-330	-326
Australia	129	131	162	207	295
Japan	159	156	175	205	174
Russia	-41	-47	-98	-208	-168
Mexico	-35	64	14	-81	3
Saudi Arabia	1	-4	-39	-58	-140
Brazil	122	78	170	112	132
Argentina	35	26	38	59	134
Ukraine	-26	-37	-57	-61	-131
India	263	173	133	283	80
All other	602	309	395	481	541
Total	1,012	277	740	962	662
EU-15	85	-15	42	27	-30
OPEC	101	-18	-18	-23	-200
Latin America	219	160	186	-28	186
CBERA	-11	-74	-149	-222	-210
Asian Pacific Rim	1,117	782	1,496	1,913	1,696
ASEAN	81	58	87	107	163
Central and Eastern Europe	([2])	-42	-92	-105	-48

[1] Import values are based on Customs value; export values are based on f.a.s. value, U.S. port of export.
[2] Less than $500,000.

Source: Compiled from official statistics of the U.S. Department of Commerce.

U.S. Imports

Principal Suppliers and Import Levels

U.S. imports of fertilizers increased from approximately $1.5 billion in 1992 to $2.5 billion in 1996 (table 3). U.S. fertilizer imports are chiefly composed of potash and nitrogenous fertilizers. Although Canada remained the primary U.S. fertilizer import source during 1992-96, by 1993 Trinidad and Tobago emerged as the second largest source and remained so through 1996. U.S. fertilizer imports from Canada are predominately potash, which account for approximately 80 percent of domestic annual potash consumption. U.S. potash supply capacity is both inadequate to satisfy domestic demand and geographically remote from areas of highest domestic consumption. Further, U.S. potash production locations are landlocked, which necessitates expensive overland transport of this high-weight and low-value commodity to reach primary midwest consumption areas. Canada also exports approximately 25 percent of its domestic ammonia production and about 50 percent of its domestic urea production to the United States. The Canadian agricultural sector is about one-tenth that of the United States. In 1996, the United States was the sole market for Canadian exports of ammonia and accounted for approximately 72 percent of the Canadian export market for urea.[72]

Table 3
Fertilizers: U.S. imports for consumption, by principal sources, 1992-96
(*1,000 dollars*)

Source	1992	1993	1994	1995	1996
Canada	928,332	943,226	1,067,480	1,110,961	1,097,384
Trinidad & Tobago	101,226	137,761	238,022	330,228	326,571
Russia	41,657	47,389	98,199	208,080	169,609
Mexico	130,325	68,870	145,193	163,366	165,216
Saudi Arabia	0	9,402	39,635	58,932	141,176
Ukraine	26,263	37,294	57,187	61,296	133,106
Venezuela	2,868	25,224	17,989	23,345	55,378
Norway	31,734	31,010	36,119	45,133	54,130
Netherlands	9,888	23,315	25,515	26,823	34,557
Morocco	45,370	27,866	27,226	30,058	33,810
All other	153,289	248,200	287,342	298,584	277,865
Total	1,470,952	1,599,557	2,039,907	2,356,806	2,488,803

Source: Compiled from official statistics of the U.S. Department of Commerce.

[72] International Fertilizer Industry Association (IFA), *Ammonia Statistics 1996*, (Paris, France, May 1997) and *Urea Statistics 1996*, (Paris, France, May 1997).

The agricultural sector of Trinidad and Tobago is very small relative to that of the United States; however, Trinidadian natural gas prices for ammonia production include a relatively low floor price and an escalator clause tied to the price of ammonia.[73] Trinidad and Tobago exports approximately 70 percent of its indigenous ammonia production and about 40 percent of its indigenous urea production to the United States, primarily from U.S.-Trinidadian joint-venture plants at Point Lisas. In 1996, the U. S. market accounted for 86 percent of Trinidadian ammonia exports and approximately 42 percent of the Trinidadian urea exports.[74]

U.S. Trade Measures

Tariff measures

Table 4 shows the rates of duty for U.S. imports of the products covered in this summary under the *Harmonized Tariff Schedule of the United States (HTS)*. The column 1 rates of duty for countries considered for general or most-favored-nation (MFN) treatment, as well as duty rates under column 1 for countries qualifying for special tariff programs, are free unless subject to special duty provisions.[75]

U.S. government trade-related investigations

The Commission has conducted several investigations in recent years with respect to products covered in this summary (table 5). As a result of final affirmative Commission determinations under U.S. antidumping (AD) and countervailing duty (CVD) laws,[76] the U.S. Department of Commerce has issued AD orders with respect to urea from the former German Democratic Republic, Romania, and the former Soviet Union, and elemental sulfur from Canada; and AD and CVD orders with respect to phosphoric acid from Belgium and Israel. In addition, potassium chloride from Canada is subject to terms of a suspension agreement. Beginning in mid-1998, outstanding AD and CVD orders will become subject to sunset reviews by Commerce and the Commission.

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[73] As the price of ammonia goes up, the price of input gas goes up also; Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 5.

[74] IFA 1996 Ammonia and Urea Statistics.

[75] See app. A for an explanation of rate of duty columns.

[76] 19 U.S.C. 1671 et seq.

Table 4

Fertilizers: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1997; U.S. exports, 1996; and U.S. imports, 1996

HTS heading or subheading	Description	Col. 1 rate as of Jan. 1, 1997 General	Col. 1 rate as of Jan. 1, 1997 Special	U.S. exports[1] 1996	U.S. imports 1996
				Million dollars	
2503.00.00	Sulfur of all kinds, other than sublimed sulfur, precipitated sulfur and colloidal sulfur	Free		35.0	94.1
2510	Natural calcium phosphates, natural aluminum calcium phosphates and phosphatic chalk:				
2510.10.00	Unground	Free		0	29.6
2510.20.00	Ground	Free		0	0.1
2802.00.00	Sulfur, sublimed or precipitated; colloidal sulfur	Free		9.8	232.4
2804.70.00	Phosphorus	Free		25.5	3.1
2814	Ammonia, anhydrous or in aqueous solution:				
2814.10.00	Anhydrous ammonia	Free		0	688.9
2814.20.00	Ammonia in aqueous solution	Free		3.3	1.3
2834	Nitrites; nitrates:				
	Nitrates:				
2834.21.00	Of potassium	Free		6.5	8.7
2834.29	Other:				
2834.29.10	Of calcium	Free		0.8	7.8
3101.00.00	Animal or vegetable fertilizers, whether or not mixed together or chemically treated; fertilizers produced by the mixing or chemical treatment of animal or vegetable products	Free		([2])	3.2
3102	Mineral or chemical fertilizers, nitrogenous:				
3102.10.00	Urea, whether or not in aqueous solution	Free		([2])	415.6
	Ammonium sulfate; double salts and mixtures of ammonium sulfate and ammonium nitrate:				
3102.21.00	Ammonium sulfate	Free		([2])	35.4
3102.29.00	Other	Free		([2])	0.1
3102.30.00	Ammonium nitrate, whether or not in aqueous solution	Free		([2])	101.5

See footnotes at end of table.

Table 4—*Continued*
Fertilizers: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1997; U.S. exports, 1996; and U.S. imports, 1996

HTS heading or subheading	Description	Col. 1 rate as of Jan. 1, 1997 General	Col. 1 rate as of Jan. 1, 1997 Special	U.S. exports[1] 1996	U.S. imports 1996
				))) Million dollars	*))))*
3102.40.00	Mixtures of ammonium nitrate with calcium carbonate or other inorganic nonfertilizing substances	Free		([2])	9.7
3102.50.00	Sodium nitrate	Free		([2])	16.6
3102.60.00	Double salts and mixtures of calcium nitrate and ammonium nitrate	Free		([2])	10.0
3102.70.00	Calcium cyanamide	Free		([2])	0.2
3102.80.00	Mixtures of urea and ammonium nitrate in aqueous or ammoniacal solution	Free		([2])	107.7
3102.90.00	Other, including mixtures not specified in the foregoing subheadings	Free		([2])	14.8
3103	Mineral or chemical fertilizers, phosphatic:				
3103.10.00	Superphosphates	Free		([2])	6.2
3103.20.00	Basic slag	Free		([2])	1.1
3103.90.00	Other	Free		([2])	2.4
3104	Mineral or chemical fertilizers, potassic:				
3104.10.00	Carnallite, sylvite and other crude natural potassium salts	Free		([2])	3.1
3104.20.00	Potassium chloride	Free		([2])	544.5
3104.30.00	Potassium sulfate	Free		([2])	11.3
3104.90.00	Other	Free		([2])	5.9
3105	Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilizers; goods of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg:				
3105.10.00	Products of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg	Free		([2])	0.1
3105.20.00	Mineral or chemical fertilizers containing the three fertilizing elements nitrogen, phosphorus and potassium	Free		([2])	24.5
3105.30.00	Diammonium hydrogenorthophosphate (Diammonium phosphate)	Free		([2])	16.8
3105.40.00	Ammonium dihydrogenorthophosphate (Monoammonium phosphate) and mixtures thereof with diammonium hydrogen-orthophosphate (Diammonium phosphate)	Free		([2])	49.1

See footnotes at end of table.

Table 4—*Continued*
Fertilizers: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1997; U.S. exports, 1996; and U.S. imports, 1996

HTS heading or subheading	Description	Col. 1 rate as of Jan. 1, 1997 General	Col. 1 rate as of Jan. 1, 1997 Special	U.S. exports[1] 1996	U.S. imports 1996
				Million dollars	
	Other mineral or chemical fertilizers containing the two fertilizing elements nitrogen and phosphorus:				
3105.51.00	Containing nitrates and phosphates	Free		([2])	10.7
3105.59.00	Other	Free		([2])	0.4
3105.60.00	Mineral or chemical fertilizers containing the two fertilizing elements phosphorus and potassium	Free		([2])	1.4
3105.90.00	Other	Free		([2])	30.6

[1] Effective July 1985, the U.S. Department of Commerce discontinued publishing export statistics for fertilizers by individual Schedule B item classifications to protect confidential business information. U.S. export data reported under individual Chapter 31 HTS subheadings are collected and the aggregate statistics are published under the "dummy" subheading 3100.00.00. U.S. fertilizer exports aggregated under HTS "dummy" subheading 3100.00.00 are equivalent to $3.1 billion during 1996.

[2] Data suppressed.

Source: U.S. exports and imports compiled from official statistics of the U.S. Department of Commerce, and tariff information was obtained from the *Harmonized Tariff Schedule of the United States (1997)*, supplement 1.

Table 5
Certain U.S. International Trade Commission investigations related to trade in fertilizers, 1973-96

Nutrient	Date	Type of investigation	Product	Petitioner	Respondent/ source country	Final outcome
Nitrogen (N)	1979	Market disruption (406-TA-5)	Anhydrous ammonia	Ad Hoc Committee of Domestic Nitrogen Producers[1]	Occidental Petroleum Corp./U.S.S.R.	Affirmative ITC determination;[2] quotas recommended; President took no action
	1980	Market disruption (406-TA-6)	Anhydrous ammonia	Presidential request	Occidental Petroleum Corp./U.S.S.R.	Negative ITC determination[3]
	1987	Antidumping (731-TA-338)	Urea	Ad Hoc Committee of Domestic Nitrogen Producers[4]	Soyuzpromexport, U.S.S.R.; Philipp Brothers, U.S.S.R.; ICEC, Romania; East Germany	Affirmative ITC and Commerce determination;[5] AD order issued by Commerce
Phosphorus (P)	1987	Countervailing duty (701-TA-286) and Antidumping (731-TA-365 and 366)	Industrial phosphoric acid	FMC Corp., Chicago, IL; and Monsanto Co., St. Louis, MO	Negev Phosphates, Israel; Haifa Chemicals Ltd., Israel; Societe Chemique Prayon-Rupel, Belgium	Affirmative ITC and Commerce determination;[6] AD and CVD orders issued by Commerce
Potassium (K)	1984	Countervailing duty (303-TA-15 and 701-TA-213)	Potassium chloride	Amax Chemical Inc., Lakeland, FL; Kerr-McGee Chemical Corp., Oklahoma City, OK	Israel and Spain	Negative ITC determination[7]
	1984	Antidumping (731-TA-184-186)(Final)	Potassium chloride	Amax Chemical Inc., Lakeland, FL; Kerr-McGee Chemical Corp., Oklahoma City, OK	East Germany, Israel, and Spain determination	Negative Commerce East Germany and Israel; petition re Spain withdrawn

See footnotes at end of table.

Table 5—*Continued*
Certain U.S. International Trade Commission investigations related to trade in fertilizers, 1973-96

Nutrient	Date	Type of investigation	Product	Petitioner	Respondent/ source country	Final outcome
Potassium (K)—Cont.:						
	1985	Antidumping (731-TA-187) (Final)	Potassium chloride	Amax Chemical Inc., Lakeland, FL; Kerr-McGee Chemical Corp., Oklahoma City, OK	U.S.S.R.	Negative ITC determination[8]
	1987	Antidumping (731-TA-374)	Potassium chloride	New Mexico Potash, Carlsbad, NM and Lundberg Industries, Carlsbad, NM	Canada	Suspension agreement[9]
Sulfur (S)	1973	Antidumping (AD-127)	Elemental sulfur	Pennzoil United Inc., Houston, TX	Canada	Affirmative ITC and Commerce determination;[10] AD order issued by Commerce

[1] The Ad Hoc Committee of Domestic Nitrogen Producers was composed of the following firms: Agrico Chemicals Co.; CF Industries Inc.; Felmont Oil Corp.; First Mississippi Corp.; W.R. Grace Co.; International Minerals & Chemical Co.; Mississippi Chemical Corp.; Olin Corp.; Terra Chemicals International, Inc.; Union Oil of California; Vistron Corp., and Wycon Chemical Co.

[2] USITC, *Anhydrous Ammonia from the U.S.S.R.*, (investigation No. TA-406-5), USITC publication 1006, Oct. 1979.

[3] USITC, *Anhydrous Ammonia from the U.S.S.R.*, (investigation No. TA-406-6), USITC publication 1051, Apr. 1980.

[4] The Ad Hoc Committee of Domestic Nitrogen Producers was composed of the following firms: Agrico Chemical Co.; American Cyanamid Co.; CF Industries; First Mississippi Corp.; Mississippi Chemical Corp.; Terra International, Inc.; and W.R. Grace & Co.

[5] USITC, *Urea from the German Democratic Republic, Romania, and the Union of Soviet Socialist Republics*, (investigations Nos. 731-TA-338- 340 (final)), USITC publication 1891, July 1987.

[6] USITC, *Industrial Phosphoric Acid from Belgium and Israel*, (investigation Nos. 701-TA-286 (final) and 731-TA-365 and 366 (final)), USITC publication 2000, Aug. 1987.

[7] USITC, *Potassium Chloride from Israel and Spain*, (investigation Nos. 303-TA-15 and 701-TA-213 (final)), USITC publication 1596, Nov. 1984.

[8] USITC, *Potassium Chloride from the U.S.S.R.*, (investigation No. 731-TA-187 (final)), USITC publication 1985, Mar. 1985. See Commerce notice published in the *Federal Register* of Jan. 31,1985 (50 F.R. 4559).

[9] Commerce investigation suspended on the basis of an agreement by Canadian producers/exporters to revise their U.S. prices to eliminate the injurious effects of exports of potassium chloride to the United States. See Commerce notice published in the *Federal Register* of Jan. 19, 1988 (53 F.R. 1393).

[10] USITC, *Elemental Sulfur from Canada*, (investigation No. AD-127), TC publication 617, Oct. 1973. Elemental sulfur from Canada is still subject to antidumping orders; however, the antidumping duties imposed have fluctuated based on Commerce annual review determinations.

U.S. Exports

Principal Markets and Export Levels

The United States is considered to be the most secure source of nitrogenous and phosphatic fertilizers in the world. These fertilizers are of a high quality in terms of nutrient content, handling, storage, and use characteristics. Despite slightly higher prices, U.S. fertilizers are highly demanded on the world market. Prices of U.S. fertilizers vary by product within specific nutrient selected, geographic production and shipping locations, and quality. For example, recovered sulfur is generally lower priced than Frasch mined sulfur. Dual nutrient, more highly processed and value-added, fertilizers such as DAP are generally higher priced than single nutrient fertilizers such as potash. Because fertilizers are high-weight/low-value commodities, transportation costs add significantly to the delivered price of fertilizers.

U.S. fertilizer exports comprise a significant market for U.S. fertilizer production. The level of fertilizer exports, consisting primarily of phosphatic and nitrogenous fertilizers, is influenced by a number of factors, such as changes in the political or economic conditions in the fertilizer-importing nations, price competition, weather, transportation infrastructure, and agricultural policies. U.S. fertilizers are currently exported to more than 100 countries. U.S. fertilizer exports increased irregularly from $2.5 billion in 1992 to approximately $3.2 billion in 1996 (table 6), largely because of the purchasing policies of the Government of China, the sole importer of fertilizers into China.

Table 6
Fertilizers: U.S. exports of domestic merchandise, by principal markets, 1992-96
(*1,000 dollars*)

Market	1992	1993	1994	1995	1996
China	629,649	292,819	944,340	1,204,472	893,149
Australia	130,190	130,866	162,478	207,491	295,380
Canada	203,809	215,599	207,310	261,238	275,843
Japan	166,090	164,913	186,105	217,734	186,477
Mexico	94,571	133,167	159,571	82,611	168,234
Brazil	123,587	92,457	179,012	112,746	136,593
Argentina	35,113	26,442	37,517	58,883	133,864
Pakistan	104,152	87,957	85,458	55,363	127,515
Korea	83,750	92,919	75,327	115,883	108,236
Thailand	23,786	18,627	42,315	59,233	88,411
Chile	53,965	52,883	53,672	42,667	81,779
India	263,163	172,808	133,563	283,982	80,972
All other	571,127	395,820	513,474	616,700	574,293
Total	2,482,953	1,877,277	2,780,141	3,319,005	3,150,748

Note.—Fertilizer export quantity data are suppressed by the U.S. Department of Commerce.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Diammonium phosphate is the mainstay of U.S. fertilizer exports, accounting for approximately 60 percent of total fertilizer exports. As stated previously, world demand for fertilizers declined during 1992 and 1993 in response to the economic recession. China has been the principal market for U.S. fertilizer exports, principally DAP, but also significant quantities of urea and potassium sulfate, with Australia ranked second in 1996. India[77] and Canada are the other traditionally significant U.S. fertilizer export markets, again principally for DAP. About 65 percent of total U.S. fertilizer exports are shipped from the U.S. Gulf Coast and Florida.

Foreign Trade Measures

Tariff measures

Major U.S. trading partners in fertilizers generally apply equivalent duty-free treatment for fertilizer products. U.S. exports of fertilizers generally receive duty-free treatment in Canada, Japan, and Mexico. The current tariff rate for certain U.S. fertilizer products entering Australia is low (2 percent) while all other fertilizer products enter Australia duty-free. Chinese MFN tariffs for fertilizers generally range from 5 to 6 percent.[78] Although the current tariff rates for fertilizers entering India range from 5 to 30 percent, there is a 100 percent tariff concession for all fertilizers.[79]

Nontariff measures

The EU imposes certain non-tariff barriers on imports of fertilizers. For example, the EU imposes a 93 percent water solubility standard for triple superphosphate (TSP) before it can be marked "EC-Type Fertilizer."[80] TSP manufactured from U.S. phosphate rock raw material is unable to meet this EU solubility standard, while TSP manufactured from Moroccan phosphate rock does. Numerous agronomic studies show that there is no technical or scientific basis for this standard.[81]

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[77] India is historically the second largest market for U.S. fertilizer exports. Official statistics concerning U.S. exports of fertilizers to India during 1996 are currently under review by the U.S. Department of Commerce.

[78] U.S. Department of Commerce country desk staff and country specific tariff schedules.

[79] S. K. Kohli, K. K. Bassi, and Preeti Avasthi, *Custom Tariff of India 1997-98*, (20th Edition), (Cen-Cus Publishers, New Delhi, 1997), pp. I/18, I/46, and III/203.

[80] EU Directive (76/116/EEC).

[81] Written submission from Mr. Gary Meyers, President, The Fertilizer Institute, Washington, DC, Sept. 19, 1997.

FOREIGN INDUSTRY PROFILE

The nations of the FSU, primarily the Russian Federation (Russia), together with Canada and the United States, possess the largest volume of recoverable natural gas, phosphate rock, and potash fertilizer reserves. Much of the fertilizer reserves in Russia are in areas with severe climates that prevent mining for several months of the year and with chemical composition such that they may not be competitive in a free market economy. Canada and the United States are considered by most consuming nations to be secure sources of high-quality fertilizers. Other nations with significant fertilizer natural resource reserves are Morocco, South Africa, Germany, and Poland.[82] However, world fertilizer production and factors of competition are most clearly delineated on a nutrient-specific basis (table 7).

Table 7
Fertilizers: World ammonia (N), phosphate rock (P), potash (K), and sulfur (S) production, 1992-96

Product and Country	1992	1993	1994	1995	1996
	(1,000 metric tons N)				
Ammonia (N):					
China	18,000	19,000	20,075	22,727	24,483
United States	13,400	12,600	13,397	12,977	14,564
India	7,452	7,176	7,503	8,287	8,549
Russia	8,786	8,138	7,264	7,940	7,932
Canada	3,100	3,410	3,474	3,773	3,840
Indonesia	2,690	2,888	3,012	3,336	3,647
Ukraine	3,908	3,242	3,004	3,109	3,302
Germany	2,110	2,101	2,170	2,518	2,512
Netherlands	2,590	2,472	2,479	2,450	2,353
Mexico	2,200	1,758	2,028	1,992	2,054
Trinidad & Tobago	1,570	1,462	1,649	1,696	1,801
Poland	1,490	1,343	1,607	1,890	1,796
All other	26,104	26,110	25,678	27,232	27,734
Total	93,400	91,700	93,340	99,927	104,567
	(1,000 metric tons product)				
Phosphate rock (P):					
United States	47,000	35,581	41,605	44,220	44,665
China	21,400	21,168	24,761	29,500	29,000
Morocco	19,145	18,193	19,765	20,200	20,830
Russia	11,500	10,381	8,021	9,068	8,680
Tunisia	6,400	5,500	5,699	7,241	7,100
Jordan	4,300	4,129	4,216	4,984	5,355
Israel	3,600	3,680	3,961	4,063	3,840
Brazil	2,850	3,419	3,938	3,888	3,823
Togo	2,083	1,794	2,149	2,569	2,731
South Africa, Republic of	3,080	2,466	2,545	2,790	2,655
All others	17,642	12,306	11,183	12,082	12,631
Total	139,000	118,617	127,843	140,605	141,310

See footnote at end of table.

[82] U.S. Department of the Interior, "Phosphate Rock," "Potash," and "Sulfur," *Mineral Commodity Summaries 1997*, Jan. 1997, pp. 125, 129, and 167.

Table 7—*Continued*
Fertilizers: World ammonia (N), phosphate rock (P), potash (K), and sulfur (S) production, 1992-96

Product and Country	1992	1993	1994	1995	1996
	(*1,000 metric tons K_2O* equivalent)				
Potash (K):					
Canada	7,270	6,840	8,040	8,855	8,170
Germany	3,460	2,860	3,290	3,280	3,200
Belarus	3,310	1,950	3,021	3,211	3,200
Russia	3,470	2,630	2,498	2,800	2,800
United States	1,710	1,510	1,400	1,480	1,390
Israel	1,300	1,310	1,260	1,320	1,320
Jordan	794	822	930	1,070	1,200
All others	2,586	2,478	2,661	2,684	2,620
Total	23,900	20,400	23,100	24,700	23,900
	(*1,000 metric tons S*)				
Sulfur (S):					
United States	10,700	11,000	11,500	11,800	11,700
Canada	7,490	8,430	8,850	9,010	9,132
China	5,900	6,360	6,900	6,530	7,295
Russia	3,500	3,600	3,510	4,000	3,250
Japan	2,750	2,920	2,820	2,860	3,245
Mexico	2,300	1,640	2,890	2,880	2,880
Germany	1,160	1,171	1,240	1,230	2,180
Poland	3,087	2,119	2,435	2,440	1,860
Saudi Arabia	2,370	2,400	2,300	2,200	1,750
All other	11,443	11,660	11,655	11,350	12,379
Total	50,700	51,300	54,100	54,300	55,671

Source: Compiled from official statistics of the International Fertilizer Industry Association and U.S. Department of the Interior, U.S. Geological Survey (formerly Bureau of Mines).

Nitrogenous Fertilizers

The world nitrogen industry initially developed during the early 1920s to mid-1930s in the developed countries of Western Europe, North America, and Japan. Beginning in the 1970s and early 1980s, much of the construction of new capacity shifted to the gas-rich countries of the Caribbean and the Middle East and to some large consuming countries such as China, India, Indonesia, and Pakistan, while many older plants in Western Europe and Japan closed. Many ammonia plants in the United States were also closed or idled during this period. China and the United States are the leading world producers of nitrogenous fertilizers, as reflected in ammonia production, followed by the FSU (Russia and Ukraine combined), and India. Available atmospheric nitrogen and sources of natural gas for production of ammonia are considered adequate for all countries listed.

Information about nitrogenous fertilizer production in China is limited and often difficult to interpret; however, it is reported that both production and consumption of nitrogenous fertilizers in China have increased more than anticipated.[83] China is not an exporter; rather, it

[83] Pierre L. Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (paper presented at the 65th Annual Conference of the International Fertilizer Industry Association (IFA), in Beijing, China, during May 19-22, 1997), pp. 14-15.

has been a steady nitrogenous fertilizer importer (in the form of urea), and remains the largest market for U.S. urea exports.[84]

In 1996, Russia ranked fourth in world ammonia production with approximately 70 percent capacity use. Fertilizers are among the most profitable of Russian export products,[85] and in the absence of significant ammonia exports from China, the United States, and India, Russia remains key to the world ammonia supply.

The 1991 dissolution of the FSU saw the domestic Russian fertilizer market essentially collapse. Agricultural consumers were insolvent, the domestic agricultural support budget proved insufficient, federal aid proved ineffective, the government failed to promote domestic demand, interest rates for commercial credits were high, and the fertilizer distribution network was destroyed.[86] Fertilizer producers turned to exports.

Russian export taxes gradually decreased, and then were abolished. Since Russian fertilizers are subject to a standard VAT tax, the domestic supply price was about 20 percent higher than relative f.o.b. export prices. In consideration of delineated domestic market conditions, and with an extremely seasonal domestic fertilizer market, economic prudence dictated export level maintenance of at least 50 percent of sales.[87]

With realization of the necessity for long-term plans and forecasts for considerable growth in domestic Russian fertilizer consumption, solvent Russian fertilizer producers have embraced strategic plans. Investment in production modernization, storage networks in key agricultural regions, ecological improvements, product diversification, and upgraded management systems had begun by 1996.

The Russian Government sustains and controls natural monopolies such as RAO "Gazprom," RAO "UES" (electric monopoly), and the ministry of transportation. However, companies that adapted to market conditions with no outstanding RAO "Gazprom" debts may claim a 40 percent discount on gas for fertilizer production. Companies unable to repay debts, especially for gas, may enter tolling agreements with RAO "Gazprom," whereby gas is paid for with product. Although such tolling produces further debt, bankruptcy remains rare due to social disturbance concerns.[88]

Although seventh in world ammonia production in 1996, the Ukrainian nitrogen industry still faces many challenges, including: working capital limited by high input gas[89] and energy

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[84] International Fertilizer Industry Association, *Urea Statistics 1996*, (Paris, France, May 1997).

[85] Viatcheslav Kantor, "The Russian Nitrogen Industry," (paper presented at the IFA Production and International Trade Committee Meeting, Warsaw, Poland, Oct. 14-15, 1997), p. 2.

[86] Ibid., p. 6.

[87] Ibid., pp. 6-8.

[88] Ibid., p. 9.

[89] Natural gas input to fertilizer production is sourced from Russian or Turkmenistan suppliers; Ukrainian natural gas production satisfies domestic population demand needs.

prices, and capital-intense modernization and repair of production processes and equipment.[90] In addition, total state taxes have increased such that the total of direct and indirect taxes on nitrogenous fertilizers exceeds 50 percent of profit.[91] Further, preferential VAT import taxes (20 percent) on machinery, equipment, and spare parts have been abolished. Most Ukrainian nitrogenous fertilizer enterprises have been privatized and sell product based on price and port of loading. However, a government requirement remains whereby approximately 5 percent of nitrogenous fertilizer production be supplied to local authorities in order to achieve regional agricultural targets.

The Ukrainian Ministry of Foreign Economic Relations and Trade has set criteria for Ukrainian nitrogenous fertilizer exports. These criteria include export shipment pre-payment, export contract registration, export card application and issuance, and correlation between export contract price and an indicative monthly Ministry price. As of 1997, Ukrainian enterprises retain hard currency received in payment for export shipments.[92]

FSU nitrogenous fertilizer exports are expected to increase slightly in 1997. The expected increase may relate to the port of Yuzhny's (Ukraine) investment in new shiploading equipment, Yuzhny plans for railcar unloading debottlenecking, and lower than expected rail transport cost increases.[93]

In India, two ammonia plants and two ammonia-urea complexes are under construction and are expected to be commissioned in 1998. The start-up of a new Indian ammonia-urea complex during late 1996 may slightly decrease ammonia import requirements, but this decrease is expected to be at least partly offset by the commissioning of new DAP plants using imported ammonia. Lacking significant investment to improve existing ports or railway infrastructure, fertilizer plant capacity is being built close to consumption areas so as to satisfy future Indian demand.[94] The two ammonia plants are replacing older capacity. Additional Indian nitrogenous fertilizer projects under consideration include a gas pipeline from Qatar or Iran to India via Pakistan, to be preceded by imports of liquid natural gas with power-generation priority. Despite these plans, the Indian market needs additional fertilizer imports or construction of plants using feedstock other than natural gas to meet demand.

Many developing countries wish to enter the fertilizer market, and request international petroleum and gas companies to explore and develop their resource fields. However, such natural gas production increases would most probably go to satisfy demand for power generation. Therefore, the possibilities of building additional gas-based developing-country ammonia plants are relatively limited.[95]

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[90] Nikolai V. Violentov, "Report on the Situation in the Ukrainian Nitrogen Industry," (paper presented at the IFA Production and International Trade Committee Meeting, Warsaw, Poland, Oct. 14-15, 1997), pp. 2-3.

[91] Thirty percent direct tax on profit, ibid., p. 2.

[92] Ibid., p. 4.

[93] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Beijing, 1997), p. 16.

[94] Ibid., pp. 6-7.

[95] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 12-14.

Certain countries are capitalizing on technological innovations such as retrofitting ammonia plants to reduce energy consumption and increase capacity. This process is feasible when plants are rather old, as in the United States. Another recent development is the retrofitting and relocation of second-hand plants. Eight second-hand ammonia plants were recently, or are being, relocated (dismantled, moved, then reassembled) in Pakistan, Trinidad, and the United States.[96]

Phosphatic Fertilizers

The United States and China are the leading world producers of phosphatic fertilizers, as reflected in phosphate rock production, followed by Morocco, Russia, Tunisia, and Jordan. China, despite being the world's second largest phosphate producer, has steadily expanded phosphatic fertilizer imports, as local Chinese supply is inadequate to meet domestic agricultural sector growth demands.[97] China recently expanded, and has to further expand, phosphatic fertilizer production capacity. However, China's phosphatic fertilizer imports, specifically DAP, will likely continue to grow as most Chinese projects for new phosphatic fertilizer plants are close to phosphate deposits in remote areas close to interior end-use agricultural regions.[98] Most Chinese imported phosphatic fertilizer is consumed in areas closer to ports. With reported Chinese railway and road infrastructure improvements, Chinese phosphate exports were estimated at approximately 1 million metric tons during 1996. The majority of Chinese phosphate rock exports likely resulted from operational completion of a Yunan province mine before downstream phosphoric acid and TSP plants were completed.[99] As the Chinese agricultural sector continues to receive end-use priority for domestic phosphate production, export increases are expected to be minor.

Morocco produced about 16 percent of the world's phosphate rock during 1996 through the government-owned Office Cherifien de Phosphates (OCP). Morocco is expected to invest in new capacity or debottlenecking joint ventures before 2000. An OCP joint venture with Prayon-Rupel (Belgium) to produce purified phosphoric acid is targeted for input to increase capacity utilization of downstream Moroccan DAP production. Moroccan phosphate rock

[96] Ibid., p. 4.

[97] Peter J. Heffernan, "Prospects for Phosphate Production and Trade to 2010," (paper presented at the IFA Production and International Trade Committee Meeting, Warsaw, Poland, Oct. 14-15, 1997), p. 6.

[98] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Beijing, 1997), p. 35.

[99] Pierre L. Louis, "Update on the Fertilizer Situation in China," (paper presented at the IFA Production and International Trade Committee Meeting, Warsaw, Poland, Oct. 14-15, 1997), pp. 10-11.

exports are expected to increase to supply both French phosphoric acid production and other markets. Phosphoric acid exports are also expected to increase, under a long-term agreement, to supply a DAP plant under construction in Pakistan.[100]

Russia ranked fourth in world production of phosphatic fertilizers during 1996, as measured in phosphate rock output. As internal Russian demand collapsed following the disintegration of the FSU, the Russian industry re-oriented toward significant phosphate exports to preserve production.[101] Such action disrupted world trade patterns and severely depressed phosphate prices during the early 1990s.[102] Before the disintegration of the FSU, traditional export markets for Russian phosphatic fertilizers were the countries of East and West Europe, with small quantities delivered to Cuba. Current Russian phosphate export markets include Norway, Belgium, Poland, Germany, and Romania. Russian exports stabilized as high rail transportation costs contributed to infeasible raw material and product shipments to and from plants isolated from input material sources and overseas consumers, especially during the winter when less expensive river transportation is not possible. Domestic Russian phosphatic fertilizer consumption stabilized during 1996, general economic improvement is anticipated, and recovery of production and demand is expected during the period 1997-2005.[103] Rehabilitation and updating of the Black Sea port terminal of Murmansk to handle high-tonnage vessels is expected to enable Russian phosphate access to remote markets such as Asia and the Americas.[104]

Tunisia and Jordan ranked fifth and sixth in world phosphate production during 1996. The phosphate industry in both countries is government owned and export oriented. Tunisian phosphate rock capacity expansion is not anticipated; however, new Tunisian DAP capacity is scheduled for completion in 1997. New Jordanian phosphatic fertilizer capacity production is expected to reach the export market by 2000. The new Jordanian plants are joint ventures with Japan and India, exports from which are expected to satisfy a portion of these countries' import demand.[105]

World demand for phosphatic fertilizer is expected to increase with population growth; supply is expected to increase first through increased capacity utilization and expansion in major consuming regions. World phosphate resources are plentiful and development limited only by the confluence of available quality phosphate rock, sulfur and other major input raw materials, the world market, and proximity to major demand growth regions.[106]

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[100] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), pp. 21-22.

[101] Alexandre Gorbatchev, Vladimir Golovanov, and Sergei Kouprianov, "Current Situation and Outlook for Phosphate Production at Kola," (paper presented at the IFA Production and International Trade Committee Meeting, Warsaw, Poland, Oct. 14-15, 1997), p. 8.

[102] Heffernan, "Prospects for Phosphate Production and Trade to 2010," Oct. 14-15, 1997, p. 7.

[103] Gorbatchev, et al, "Current Situation and Outlook for Phosphate Production at Kola," Oct. 14-15, 1997, pp. 4 and 8.

[104] Ibid., p. 9.

[105] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), pp. 28-29.

[106] Heffernan, "Prospects for Phosphate Production and Trade to 2010," Oct. 14-15, 1997, pp. 8-9.

Potassic Fertilizers

World potash production capacity is primarily resident in Canada, the FSU (Russia and Belarus), and Germany. The potash industry is dominated by world trade. In 1996, 80 percent of all potash production was shipped outside the country in which it was produced. Canada, Jordan, and Israel export virtually all their potash production. These countries have very small domestic potash markets and rely on export sales to keep mines operational.[107]

The global potash industry underwent many changes during 1992-96. The industry changed structurally from a state-owned, broad-based, specialized industry to a mostly privatized, consolidated, and integrated industry.[108] Since 1994, the potash supply environment has been positive; demand recovered and grew; and prices moved upward. Further industry refinements of rationalization, capacity expansions, and differentiated product integration followed.[109]

Significant surplus potash capacity has existed worldwide during 1992-96, mostly in Canada and the FSU (Russia and Belarus combined). As a result, major world producers operated at partial capacity to prevent price erosion. Canadian producers operated at about 75 percent capacity[110] as a "managed recovery" policy, i.e., swift adjustment of production to demand.[111] The October 1997 permanent closure of a New Brunswick mine, idled since summer 1996 due to uncontrollable water inflow, effected a minor reduction in Canadian potash capacity.[112]

After the break-up of the FSU, domestic demand collapsed, internal production declined, and exports increased. A modest recovery in domestic FSU demand, stabilized exports, and a capacity use rate of approximately 60 percent are expected though 2001.[113]

Potash production in the former East and West Germany has been restructured into unified German production. Ten mines were closed and six mines are now in operation, with no major production or export changes anticipated up to 2000.[114]

In December 1996, PCS of Canada, the world's largest potash producer, reached an agreement with the German corporation BASF AG to purchase from them 51 percent of Kali und Salz Beteiligungs AG (K & S AG) of Hanover, Germany. K & S AG also owns 50 percent of

[107] Kenneth F. Nyiri, "Outlook for Potash," (paper presented at The Fertilizer Industry Round Table, St. Petersburg Beach, Oct. 28, 1997), pp. 1-2.

[108] Michel Prud'homme, "World Potash Supply," (paper presented at the IFA Production and International Trade Committee Meeting, Warsaw, Poland, Oct. 14-15, 1997), p. 1.

[109] Ibid.

[110] About 45 percent for the largest producer and 90 percent for all others.

[111] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances" (IFA Berlin, 1996), p. 40.

[112] "Potacan Mine is Washed Up," *Fertilizer Markets*, vol. 8, No. 15, (Nov. 3, 1997), p. 1.

[113] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (IFA Beijing, 1997), p. 22.

[114] Louis, "Fertilizers and Raw Materials Supply and Supply/Demand Balances," (IFA Berlin, 1996), p. 39.

Potacan, Ltd., in Toronto, Canada, the former[115] operator of a potash mine near Sussex, New Brunswick. Entreprise Miniere et Chemique (EMC) of Paris, France, shares equal ownership of Potacan with K & S AG. This PCS acquisition was denied by the German Cartel Office; the denial was then appealed to the German Monopolies Commission which upheld the Cartel Office ruling. PCS and BASF then appealed directly to the German Ministry of Economic Affairs which also refused to sanction the agreement between the two companies. BASF and PCS have a further line of appeal through the courts, but the two companies are expected to abandon further pursuit of the purchase.[116]

International demand must remain strong to keep potash market supply and demand in balance, and international potash purchases can be very erratic. During some years buyers may build inventory to carry through a portion of next season and thus reduce imports during the following year.[117]

Near term, 1997-2005, developed world potash capacity changes may likely involve capacity curtailment due to ore depletion, further rationalization, or closure of obsolete facilities. With substantial world surplus capacity, expansion projects are expected to be incremental at existing mines, or regional new capacity directed toward domestic internal markets in Asia.[118]

Sulfur

Sulfur is essentially a by-product of oil and gas production, and is produced without regard to market conditions. The United States, Canada, China, and Russia are the world's largest producers of sulfur. Together these countries consistently account for over 55 percent of world production. A world oversupply of sulfur existed during 1996.[119]

Significant portions of Canadian sulfur production are either exported or poured to vatted block stocks.[120] Exports of Canadian sulfur to the U.S. market are low, both for economic reasons and as a result of antidumping actions.[121] Canadian offshore export shipments to Africa, Latin America, and Asia increased significantly during 1996. However, many Canadian producers vatted stocks because the 1996 Vancouver price did not cover forming[122] and transportation costs.[123] Canadian sulfur production is expected to increase during 1997-2002 as production of natural gas increases to meet strong U.S. demand and to feed new gas export pipelines.[124] Canadian producers will continue to respond to market conditions and decrease sulfur supply

[115] The Potacan mine closed permanently in Oct. 1997 due to flooding. See footnote 112.

[116] "German Setback for PCS," *Fertilizer International*, (No. 360 Sept./Oct. 1997), p. 11.

[117] Nyiri, "Outlook for Potash," Oct. 28, 1997, p. 7.

[118] Prud'homme, "World Potash Supply," Oct. 14-15, 1997, p. 3.

[119] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Beijing, 1997), p. 40.

[120] The most practical way to store sulfur is in large vat blocks.

[121] See section entitled "U.S. government trade-related investigations."

[122] The process of conversion from molten liquid to a solid form.

[123] Louis, "Fertilizer and Raw Materials Supply and Supply/Demand Balances," (IFA Beijing, 1997), p. 41.

[124] Ibid., p. 40.

by pouring to block storage or increase supply through melting of what had previously been blocked.[125]

Domestic Russian sulfur production decreased irregularly during 1992-96 as domestic consumption declined primarily due to internal factors resulting from the break-up of the FSU. Russian export shipments also declined, due to high rail transportation costs and the seasonal nature of less costly river transportation to deep water ports on the Black Sea. A portion of 1996 Russian sulfur production was stored for replenishment of depleted inventories and in response to previously mentioned logistic and economic conditions. Russian sulfur export shipments are expected to resume during late 1997.[126]

A portion of world sulfur production is market related, particularly Polish sulfur production by the Frasch process. With market oversupply conditions, Polish Frasch producers are expected to progressively reduce production through the year 2000.[127] Significant idle sulfur production capacity in Iraq exhibits a positive effect on market oversupply.[128]

Non-fertilizer sulfur demand has increased, and served to bring sulfur supply and demand close to balance. However, such equilibrium may be disrupted by significant exports of FSU sulfur or resumption of Iraqi exports. Additionally, worldwide recovered sulfur is expected to grow long term and put pressure on remaining Frasch producers.[129]

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[125] Ibid., p. 41.
[126] Ibid., p. 45.
[127] Ibid.
[128] Ibid., p. 48.
[129] Ibid.

APPENDIX A
TARIFF AND TRADE AGREEMENT TERMS

TARIFF AND TRADE AGREEMENT TERMS

In the ***Harmonized Tariff Schedule of the United States*** (HTS), chapters 1 through 97 cover all goods in trade and incorporate in the tariff nomenclature the internationally adopted Harmonized Commodity Description and Coding System through the 6-digit level of product description. Subordinate 8-digit product subdivisions, either enacted by Congress or proclaimed by the President, allow more narrowly applicable duty rates; 10-digit administrative statistical reporting numbers provide data of national interest. Chapters 98 and 99 contain special U.S. classifications and temporary rate provisions, respectively. The HTS replaced the *Tariff Schedules of the United States* (TSUS) effective January 1, 1989.

Duty rates in the ***general*** subcolumn of HTS column 1 are most-favored-nation (MFN) rates, many of which have been eliminated or are being reduced as concessions resulting from the Uruguay Round of Multilateral Trade Negotiations. Column 1-general duty rates apply to all countries except those enumerated in HTS general note 3(b) (Afghanistan, Cuba, Laos, North Korea, and Vietnam), which are subject to the statutory rates set forth in ***column 2***. Specified goods from designated MFN-eligible countries may be eligible for reduced rates of duty or for duty-free entry under one or more preferential tariff programs. Such tariff treatment is set forth in the ***special*** subcolumn of HTS rate of duty column 1 or in the general notes. If eligibility for special tariff rates is not claimed or established, goods are dutiable at column 1-general rates. The HTS does not enumerate those countries as to which a total or partial embargo has been declared.

The ***Generalized System of Preferences*** (GSP) affords nonreciprocal tariff preferences to developing countries to aid their economic development and to diversify and expand their production and exports. The U.S. GSP, enacted in title V of the Trade Act of 1974 for 10 years and extended several times thereafter, applies to merchandise imported on or after January 1, 1976 and before the close of June 30, 1998. Indicated by the symbol "A", "A*", or "A+" in the special subcolumn, the GSP provides duty-free entry to eligible articles the product of and imported directly from designated beneficiary developing countries, as set forth in general note 4 to the HTS.

The ***Caribbean Basin Economic Recovery Act*** (CBERA) affords nonreciprocal tariff preferences to developing countries in the Caribbean Basin area to aid their economic development and to diversify and expand their production and exports. The CBERA, enacted in title II of Public Law 98-67, implemented by Presidential Proclamation 5133 of November 30, 1983, and amended by the Customs and Trade Act of 1990, applies to merchandise entered, or withdrawn from warehouse for consumption, on or after January 1, 1984. Indicated by the symbol "E" or "E*" in the special subcolumn, the CBERA provides duty-free entry to eligible articles, and reduced-duty treatment to certain other articles, which are the product of and imported directly from designated countries, as set forth in general note 7 to the HTS.

Free rates of duty in the special subcolumn followed by the symbol "IL" are applicable to products of Israel under the ***United States-Israel Free Trade Area Implementation Act*** of 1985 (IFTA), as provided in general note 8 to the HTS.

Preferential nonreciprocal duty-free or reduced-duty treatment in the special subcolumn followed by the symbol "J" or "J*" in parentheses is afforded to eligible articles the product of designated beneficiary countries under the ***Andean Trade Preference Act*** (ATPA), enacted as title II of Public Law 102-182 and implemented by Presidential Proclamation 6455 of July 2, 1992 (effective July 22, 1992), as set forth in general note 11 to the HTS.

Preferential or free rates of duty in the special subcolumn followed by the symbol "CA" are applicable to eligible goods of Canada, and rates followed by the symbol "MX" are applicable to eligible goods of Mexico, under the ***North American Free Trade Agreement***, as provided in general note 12 to the HTS and implemented effective January 1, 1994 by Presidential Proclamation 6641 of December 15, 1993. Goods must originate in the NAFTA region under rules set forth in general note 12(t) and meet other requirements of the note and applicable regulations.

Other special tariff treatment applies to particular ***products of insular possessions*** (general note 3(a)(iv)), ***products of the West Bank and Gaza Strip*** (general note 3(a)(v)), goods covered by the ***Automotive Products Trade Act*** (APTA) (general note 5) and the ***Agreement on Trade in Civil Aircraft*** (ATCA) (general note 6), ***articles imported from freely associated states*** (general note 10), ***pharmaceutical products*** (general note 13), and ***intermediate chemicals for dyes*** (general note 14).

The ***General Agreement on Tariffs and Trade 1994*** (GATT 1994), pursuant to the Agreement Establishing the World Trade Organization, is based upon the earlier GATT 1947 (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) as the primary multilateral system of disciplines and principles governing international trade. Signatories' obligations under both the 1994 and 1947 agreements focus upon most-favored-nation treatment, the maintenance of scheduled concession rates of duty, and national treatment for imported products; the GATT also provides the legal framework for customs valuation standards, "escape clause" (emergency) actions, antidumping and countervailing duties, dispute settlement, and other measures. The results of the Uruguay Round of multilateral tariff negotiations are set forth by way of separate schedules of concessions for each participating contracting party, with the U.S. schedule designated as Schedule XX.

Pursuant to the **Agreement on Textiles and Clothing** (ATC) of the GATT 1994, member countries are phasing out restrictions on imports under the prior "Arrangement Regarding International Trade in Textiles" (known as the **Multifiber Arrangement** (MFA)). Under the MFA, which was a departure from GATT 1947 provisions, importing and exporting countries negotiated bilateral agreements limiting textile and apparel shipments, and importing countries could take unilateral action in the absence or violation of an agreement. Quantitative limits had been established on imported textiles and apparel of cotton, other vegetable fibers, wool, man-made fibers or silk blends in an effort to prevent or limit market disruption in the importing countries. The ATC establishes notification and safeguard procedures, along with other rules concerning the customs treatment of textile and apparel shipments, and calls for the eventual complete integration of this sector into the GATT 1994 over a ten-year period, or by Jan. 1, 2005.