PHOSPHATE ROCK

By George A. Rabchevsky

Phosphates are essential for all plant and animal life cycles and are indispensable for all living organisms, - phosphorus is necessary for nutrition. Phosphate rock minerals were the only significant global resources of phosphorus.

Ten companies in the United States operated 22 phosphate rock mines in 1995. The United States is the world's leading producer and consumer of phosphate rock, which is used to manufacture phosphate fertilizers and industrial products for domestic use and export. Over 90% of phosphate rock mined was used to produce chemical fertilizers, and in 1995, production grew for the third consecutive year. Companies in Florida and North Carolina produced about 85% of the marketable phosphate rock mined in the United States and processed most of the refined mineral in fertilizer upgrading facilities.

Phosphate rock also is produced in the western States of Idaho and Utah where the mineral was upgraded into high analysis phosphate fertilizers and elemental phosphorus (P_4), which is used to produce downstream industrial products. The States of Idaho and Montana produce essentially all of the P_4 consumed domestically and exported from the United States.

In 1995, marketable phosphate rock production rose 6%. Consumption in the United States decreased slightly. Economic recovery led to an additional increase in the production of phosphate rock for a variety of industrial products manufactured principally from P_4, and purified wet-process phosphoric acid. Most mines and finished phosphate materials plants that had been closed resumed production.

U.S. phosphate rock sold or used by producers was 43.7 million metric tons, equating to 86% of effective industry capacity, and accounting for more than 26.5% of total global deliveries. Wet-process phosphoric acid (WPPA) production was 11.6 million tons as available phosphorus pentoxide (P_2O_5), which represented an industry operating rate of nearly 100%. Heavy demand for downstream phosphate fertilizer products produced from WPPA was reflected by rising prices for these products as the year progressed. The United States accounted for more than 50% of global interregional converted phosphate P_2O_5 trade in 1995, led by ammonium phosphates—diammonium phosphate (DAP) and monoammonium phosphate (MAP)—granular triple superphosphate (GTSP), and WPPA, in order of importance. Value-added byproducts from WPPA manufacture, principally hydrofluosilicic acid for water fluoridation, and uranium oxide yellow cake for electrical power generation continued to be recovered by the industry.

Many positive factors, which provide for an optimistic outlook through the turn of the century, can be traced 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 dictated that the U.S. industry should consolidate and incorporate advanced technologies in the WPPA manufacturing process, including wet rock grinding, and the cogeneration of electrical power from byproduct steam. The net result was that by 1995, a few major firms, operating under vastly improved economies of scale, dominated the industry. Added benefits were more effective vertical integration between phosphate rock mining, finished phosphate manufacture, and marketing. *(See tables 1 and 2.)*

Production

The U.S. Geological Survey, Department of the Interior, conducted semiannual Mineral Industry Surveys of all known U.S. phosphate rock producers to provide the public and private sectors with information and analysis on the situation and outlook for this mineral resource.

Florida.—In central Florida, phosphate rock was mined and processed by six producers: Cargill Fertilizer, Inc.; CF Industries, Inc.; IMC-Agrico Co.; Mobil Mining and Minerals Corp.; Potash Corporation of Saskatchewan Inc.; and U.S. Agri-Chemicals Corp. Their mines and plants were located in Hamilton, Hardee, Hillsborough, and Polk Counties. Nu-Gulf Industries Wingate Creek Mine and the associated Mulberry Phosphates, Inc., Piney Point ammonium phosphate conversion plant in Manatee County, FL, were idle.

In 1995, Potash Corporation of Saskatchewan Inc. (PCS), headquartered in Saskatoon, Canada, entered the phosphate business in Florida, buying two mines and chemical plants in northern Florida. It has a large vertically-integrated complex in North Carolina also. The PCS ore reserves are the largest in the U.S., approximately 39% of U.S. reserves. With the combined reserves at Aurora, NC and White Springs, FL, PCS expected to operate both plants for more than 55 years at full capacity. PCS, thus, became the third largest phosphate producer in the world, representing 8% of world phosphate production and 7% of world capacity. PCS sold phosphate rock for direct applications as fertilizer to customers in Brazil, El Salvador, Malaysia, and New Zealand.[1]

Phosphoric acid is the basis for all PCS downstream phosphate products. On average, 40% of its P_2O_5 is used to make liquid fertilizers, 35% solid fertilizers, and 20% animal feed supplements. The major solid fertilizer product is DAP (46% P_2O_5), destined for export and for domestic use as a custom-mix fertilizer. The major liquid fertilizer products are merchant grade acid (MGA, [54% P_2O_5]), which is exported and sold domestically, and superphosphoric acid (SPA, [70% P_2O_5]) sold only domestically.

On October 31, 1995, PCS acquired White Springs Agricultural Chemicals Inc. (formerly Occidental Chemical Corporation, a wholly owned subsidiary of Occidental Petroleum Corporation), for an aggregate price of $287 million. White Springs produced phosphate rock at 89% of capacity and P_2O_5 at 87%. At that operation, phosphate rock is produced at the Swift Creek Mine and processed at the Suwannee River and Swift Creek chemical facilities. In 1995, White Springs operation employed about 1,100 people, producing 540,000 tons of phosphate rock. Phosphate products from White Springs are sent by train to the port in Jacksonville, Florida.

Cargill Fertilizer, Inc. operated the 3-million-ton-per-year Fort Meade beneficiation plant in Polk County based on ore mined from its Carlton tract in Hardee County. The firm also operated the Hookers Prairie Mine, a 2.5-million-ton-per-year operation in Polk County. Marketable phosphate rock from Fort Meade was shipped to Cargill's Tampa Bay, FL, plant where 700,000 tons per year P_2O_5 WPPA, ammonium phosphates, and GTSP fertilizers were produced. The Hookers Prairie Mine supplied Cargill's WPPA and granular ammonium phosphate facility at Bartow, FL. Current reserves, together with planned acquisitions, should allow Cargill to continue mining phosphate rock in Florida well into the 21st century.

CF Industries commissioned its new 3.2-million-ton-per-year South Pasture Mine in Hardee County in the fall of 1995. CF ran a 900,000-ton-per-year P_2O_5, WPPA plant and granular ammonium phosphate complex at Plant City, FL. The new mine should provide CF with enough captive phosphate rock tonnage to sustain operations at Plant City for at least another 20 years. Reserves at South Pasture were about 90 million tons as recoverable product.[2]

IMC-Agrico Co. (a joint-venture partnership between IMC Fertilizer Group Inc. and Freeport-McMoRan Resource Partners L.P.) operated seven mines in Florida, having an aggregate annual capacity of about 30 million tons, representing about 55% of total U.S. capacity. Active operations included the Four Corners Mine on the Hillsborough-Manatee County line; the Fort Green and Payne Creek Mines in Polk-Hardee Counties; the Kingsford Mine in Polk-Hillsborough Counties; the Hopewell Mine, in Hillsborough County; together with Noralyn-Phosphoria in Polk County; and the Clear Springs Mine in Polk County. Two additional mines, the Fort Lonesome and Haynesworth Mines in Hillsborough and Polk Counties, were idle.

IMC-Agrico's annual WPPA production capacity in Florida and Louisiana was about 4 million tons P_2O_5, which represented approximately 32% of total U.S. capacity and 11% of global capacity. WPPA and associated downstream conversion plants were operating at New Wales, Nichols, and South Pierce in Polk County; and, at Faustina and Uncle Sam, LA, along the Mississippi River. The firm shipped WPPA to its Taft, LA plant for upgrading into granular ammonium phosphates, and produced animal feed-grade phosphate supplements at New Wales, FL for Mallinckrodt Veterinary, Inc. Uranium oxide was extracted from WPPA produced at the Faustina and Uncle Sam, LA facilities, while uranium recovery facilities at New Wales and Plant City, FL were idle in 1994 and 1995.[3]

In early August, 1995, Mobil Mining and Minerals Co. began operating a new mine at South Fort Meade in southeastern Polk County, FL, with an annual capacity of 3.5 million tons. The mine was projected to be capable of sustaining annual design productivity over the next 25 years. In the summer of 1995, Mobil signed a letter of intent with Cargill and a limited partnership for the sale of its South Fort Meade Mine, which was completed in December 1995. Its Big Four Mine in Hillsborough County, was closed because of depletion in mid-1995; the Nichols Mine in Polk County was idled. Mobil signed a letter of intent to sell its 1 million tons per year Nichols Mine to Nichols Phosphate Acquisition Corp., a new company formed in December to buy the mine. The mine was expected to close by the year 2000 because of depletion of its economic reserves.[4;5] In addition to phosphate rock sales on the domestic and export markets, Mobil produced WPPA and ammonium phosphates in a wholly owned conversion facility at Pasadena, TX.

Farmland Industries, Inc.-Norsk Hydro, L.P., and Mulberry Phosphates, operated WPPA and ammonium phosphate plants at Green Bay and Bartow, FL, respectively, based on phosphate rock purchased domestically.

North Carolina.—On April 10, 1995, PCS purchased the Texasgulf Inc.'s phosphate operation in Aurora. The Aurora facility was acknowledged to be one of the most efficient world producers in terms of tons of production per employee, reflecting its vertical integration of mining and processing on one site. Phosphate products from PCS Aurora were sent by barge to its Atlantic port at Morehead City, NC. About 1,180 people were employed at Aurora. PCS operated a large mine and processing plant along the Pamlico River in Beaufort County, NC, near the towns of Aurora and Washington. The mine and beneficiation plants had the capability to produce flotation-grade, calcined-grade, and direct application-grade phosphate rock for domestic use and export. Phosphate rock reserves on three contiguous tracts were estimated at about 1 billion tons.

Up to 1.2 million tons P_2O_5 WPPA could be produced annually in a chemical complex adjacent to the mine; additional downstream products: SPA, DAP, MAP, liquid ammonium phosphates, GTSP, and calcium phosphate animal feed supplements also were produced at the site. Animal feed phosphate supplements, including defluorinated phosphate rock (DFP), were produced offsite.

PCS received the North Carolina Mining Commission's annual reclamation award for its work on a 25-acre site in the headwaters of Crawford Mill Run, a tributary to Durham Creek.[6]

Western States.—In Utah, Simplot-Farmland (SF) Phosphates Ltd. Co.—a joint venture between J. R. Simplot and Farmland Industries, Inc.—operated a major mining and phosphate rock benefication facility at Vernal, UT, which supplied its phosphate fertilizer production plant at Rock Springs, WY. Cominco Fertilizer Inc's. Warm Springs underground mine at Garrison, MT was closed in 1993, but small quantities of direct application phosphate rock continued

to be shipped from inventories. Rhone-Poulenc Chemical Co.'s elemental phosphorus plant at Silver Bow, MT was mothballed at yearend.

Idaho.—In Idaho, five firms mined or processed phosphate rock, either for the production of P_4 in electric furnaces for industrial applications, or for conversion to WPPA and finished phosphate fertilizers. Three producers conducted open pit mining from the Phosphoria Formation in Caribou County, ID, producing phosphate rock of about 60% bone phosphate of lime (BPL) average as feedstock for P_4 furnaces. FMC Corp. operated the Dry Valley Mine, Caribou county, on federal and private leases to provide feedstock for P_4 production at Pocatello, ID. The Monsanto Co. produced phosphate rock from the Enoch Valley Mine in the Caribou National Forest for P_4 production at Soda Springs, ID. Rhone-Poulenc Basic Chemicals Co. produced phosphate rock from the Rasmussen Ridge Mine in the Caribou National Forest for P_4 manufacture at Silver Bow, MT, and domestic sales. In 1995, total U.S elemental phosphorus production, in aggregate, was about 250,000 tons P_4.

J.R. Simplot produced beneficiated phosphate rock for fertilizer manufacture from the Smokey Canyon Mine in the Caribou National Forest. Marketable product was pumped through a 140 kilometer—buried slurry pipeline to Simplot's fertilizer conversion facility at Pocatello. The conversion facility was capable of producing about 400,000 tons P_2O_5 as WPPA annually for downstream SPA, ammonium phosphates, GTSP, and calcium phosphate animal feed-grade product. Ammonia, urea-ammonium nitrate (UAN) solutions, ammonium sulfate, and nitric acid also were produced.

Rhone-Poulenc supplyed phosphate rock ore to Nu-West Industries Inc. under the terms of a 7-year contract negotiated in November 1993. Rhone-Poulenc supplies about 1.5 million tons of phosphate ore annually to Nu-West for processing, and upgrading to WPPA, SPA, and ammonium phosphates at Conda, ID. Nu-West reported proven reserves approximating 60 to 70 million tons primarily on leased Federal and State lands.[7] Nu-West Industries operated a phosphoric acid plant at Conda.

On August 10, 1995, Nu-West Industries was sold to Agrium Inc., a Canadian agricultural and chemical company, located in Calgary, Alberta. Nu-West holdings include a finished phosphate fertilizer plant in Conda, ID and phosphate rock reserves near Soda Springs, ID.[8]

Utah.—Utah's only phosphate operation is SF Industries' Brush Creek Mine, located 18 km north of Vernal in Uinta County. SF Industries mines 2.2 million tons pet year of ore, which is processed by flotation into 816,000 tons of concentrate. The material is then transported over the Uinta Mountains through a 145 km—90 mile long underground slurry pipeline to a wholly owned conversion plant at Rock Springs, WY. SF's Rock Springs facility produced WPPA, SPA and granular ammonium phosphate fertilizer.[9]

Consumption

In 1995, U.S. apparent domestic consumption of phosphate rock decreased by about 2% compared with 1994. About 93% of the total was consumed in the manufacture of 11.6 million tons P_2O_5 WPPA for downstream fertilizer, animal feed derivatives, and purified WPPA for industrial applications. The balance was used to produce P_4 for industrial applications, including detergent and food additives, water and metal treatment chemicals, plasticizers, pesticides, vitamins, soft drinks, toothpaste, film, light bulbs, bone china, flame-resistant fabrics, optical glass, and other consumer goods.*(See tables 3, 4, and 5.)*

Stocks

Phosphate rock stocks continued the downward trend started in 1993. At yearend, stocks were averaging less than 2-month's production equivalent. This was in line with cost effective initiatives adopted by major producers in the industry. *(See table 1.)*

Transportation

In Florida, beneficiated phosphate rock was moved by rail and truck to phosphate upgrading facilities. Phosphate rock and finished phosphate materials were railed to ports at Tampa and Jacksonville, FL, for export or domestic use. Finished phosphate fertilizers and phosphate rock were barged north on the Mississippi River and other major tributaries for domestic consumption and were also transported inland by rail and truck.

In North Carolina, PCS barged phosphate rock and finished products to the port at Morehead City for export and domestic shipment. Rail facilities also were utilized extensively for transport.

Western producers moved phosphate rock from mines to plants by rail, truck, and slurry pipeline. Finished product was moved predominately by rail and truck.

Prices

In 1995, marketable phosphate rock was valued at $21.75 per metric ton, f.o.b. mine, as a weighted average, rising about 2% from that of 1994. Industry consolidation and restructuring over the past few years resulted in improved operating efficiencies and lower raw materials costs. The price of domestic phosphate rock was reflective of producer cost because of a higher degree of vertical integration between captive phosphate rock production and upgraded phosphate manufacture. Export prices rose 11% in 1995, from $25.60 weighted average to $28.35. *(See tables 6, 7, and 8.)*

Foreign Trade

Phosrock, the U.S. phosphate rock export association, set up in 1970 to handle the bulk of U.S. rock exports, was to be officially dissolved in 1996. Membership, which in the late 1980s included all the major U.S. phosphate rock producers

after Texasgulf opted to join the association in February 1989, decreased to just two companies, IMC-Agrico and Mobil Mining and Minerals Co. Mobil's withdrawal from the phosphate industry left the organization with no rationale to continue.[10]

U.S. phosphate rock exports continued the downward trend started in 1992, with a negligible decrease in 1995. Geographically, about 49% of U.S. phosphate rock export shipments were directed to the Far East—principally, the Republic of Korea and Japan, 18%; Oceania, 11%; Canada, 5%; and Latin America, 3%. Exports to India increased the most, imports rose 29% in 1994 and 12% in 1995. Exports of phosphate fertilizers accounted for about 55% of U.S. fertilizer production; rock exports accounted for just 7% of total U.S. rock production in 1995, dropping from 16% in 1990.[11]

Closures of WPPA plants in Western Europe and Canada, the ongoing political restructuring in Eastern Europe, and the popularity of value-added converted phosphate products in international trade, resulted in a major decline in global phosphate rock trade in recent years. This, in turn, has intensified competitive forces between major offshore phosphate rock producing countries for dwindling raw materials markets and placed downward pressure on U.S. exporters. Additionally, U.S. phosphate rock shipments in North America—Canada and Mexico—have been largely displaced by Togo and Morocco, respectively.

U.S. was the largest importer of phosphate from Morocco, taking nearly 1.8 million tons in 1995. Arcadian Corp. and Mississippi Phosphates Corp. used Moroccan phosphate rock in phosphate conversion plants at Geismar, LA, on the Mississippi River, and at Pascagoula, MS, on the U.S. Gulf Coast. Arcadian also operated a purified WPPA industrial grade plant at Geismar on behalf of Rhone-Poulenc Chemical Co.

U.S. converted phosphate trade volume and unit value were up by 10% in 1995 led by record DAP shipments to China and India; MAP exports decreased by about 20%. In 1995, U.S. DAP export shipments were 66% of the global total; MAP, 36%; TSP, 28%; and merchant-grade WPPA, 13%. *(See tables 8, 9, 10, 11, 12, 13, 14, and 15.)*

World Review

World phosphate rock production was about 131 million tons in 1995, a slight increase compared with 1994, the third year of increase after 5 successive years of decline. Phosphate rock was produced in about 40 countries, the United States being the largest followed by China, Morocco, and Russia.

The United States continued to lead global phosphate rock output, accounting for about 33% of total production and 10% of total shipments. About 6.5% of the total increase in world phosphate rock production and 4% increase in shipments between 1994 and 1995 was attributable to rising domestic and international demand for upgraded U.S. phosphate materials. Production and shipments were also up in African countries and in the Middle East.

In Asia, phosphate rock production continued to be dominated by China, with an estimated output of 27 million tons, or 20% of the world total. Asia continued to be the largest consumer of phosphate materials, followed by Russia, U.S. and Canada, Europe, Africa, and Oceania.[12]

***Africa.*—Gabon**.—The Gabonese mining company Société du Moyen Ogooué (Somimo) was looking for industrial and financial partners to aid with the development of a large phosphate deposit, located about 150 km southeast of Liberville. The deposit was discovered in 1988/89 during a national mineral inventory survey. Reportedly, the deposit also contains potentially economic concentrations of niobium. The pre-feasibility study states that the deposit contains estimated minable reserves of 140 million tons ore assaying 24% P_2O_5, 75% of which would be mined in an open pit. Impurities are reported low, with very little cadmium and a very low iron-aluminum to P_2O_5 ratio. The reserves are sufficient with at least a 20-year life span, producing 2 million tons per year of high grade concentrates from about 5 million tons per year ore. Production would be consumed domestically and also exported throughout the region. Somimo is a consortium comprising the Gabonese government (62%), Elf-Gabon (23%), and La Source Compagnie Miniére (15%), formerly a subsidiary of the French group Bureau de Recherches Geologiques et Minieres.[13]

Morocco.—Morocco possesses at least 50% of the world's phosphate rock reserves. It was the second largest world produced after the U.S. and was the largest phosphate rock exporter. All phosphate facilities were operated by Office Cherifien des Phosphates (OCP).

In the major mining center at Khouribga, phosphate extraction was to gradually shift from the depleting Sidi Daoui reserves to a large new open pit mine at Sidi Chenane. At Youssoufia, white rock reserves were being depleted and being replaced by black rock mined underground and upgraded by calcining. Two mines at Ben Guerir provided lower grade phosphate rock for domestic conversion. Bou Craa in the Western Sahara was producing about 1.2 million tons of high grade 80% BPL material for export. In 1995, Morocco produced a record 20.2 Mmt of phosphate rock, of which almost 50% was of 69%-72% BPL.

Senegal.—An approximate two-fold expansion of WPPA capacity to 640,000 tons per year P_2O_5 was planned by the turn of the century. At that time, the Keur Mor Fall deposit should deplete and a new mine would be commissioned at Tobene. Phosphate rock exports were to be largely displaced by upgraded product.

South Africa.—South Africa benefitted more from the export of phosphoric acid rather than phosphate rock. India and the Philippines became customers of South African exporters since the trade embargo was lifted. Indian Ocean Fertilizer planned to debottleneck its Richards Bay WPPA plant to a rated capacity of 500,000 tons per year P_2O_5 by 1996. Foskor beneficiated phosphate-bearing tailings from ore mined by the Palabora Mining Company Ltd. (PMC), and produced high grade phosphate rock assaying 80% BPL and above for domestic conversion and export, at Phalaborwa.

Togo.—Togo exports of phosphate rock rose again in 1995

by 19% to 2.65 million tons bringing the country back to its highest level since 1991. The Government relies heavily on the income from phosphates to support the national budget. However, production rose to 2.6 million tons in 1995 from 2.1 million tons in 1994 and from 1.8 million tons in 1993, reflecting the determination of the Government to keep the phosphate industry well managed. The export growth was largely determined by the increased demand from Iran.[14]

Togo's State-owned Office de Togolais des Phosphates and India's Rashtriya Chemicals and Fertilizers began a feasibility study on a proposed joint-venture phosphate plant. The project comprises a 330,000 tons per year P_2O_5 phosphoric acid unit and a 400,000 tons per year DAP plant at Kpeme. In 1995, there were no downstream processing facilities in Togo.[15]

***Asia.*—**In China, a total of 1 million annual tons P_2O_5 as WPPA was scheduled to come on-stream in seven provinces, primarily during 1996 and 1997. Chinese imports of phosphate rock ceased altogether, while it was exported to India, Korea, Malaysia, and the Philippines. China exported phosphate rock most probably from the Yunnan province, the rock was transported long distances to the ports.

Reportedly, China's State Environmental Protection Bureau proposed to limit the country's production of detergents containing phosphates. Detergents were dumped into the Lake Dianchi in Kunming City promoting the rapid growth of water plants and spoiling the drinking water. The Yunnan provincial government is apparently planning to spend $360 million over 18 years to clean up the lake.[16]

***Former Soviet Union.*—**Production of phosphate rock in Russia decreased greatly in the past 4 years because of economic and political changes in the former Soviet Union. In 1995, phosphate rock production, mostly on the Kola Peninsula in Russia, rose 10% to 8.8 million tons and 6% in Kazakhstan at Karatau to 2.2 million tons; output in these countries decreased about 25% and 49% between 1993 and 1994, respectively.[17] Production at the Kola mines has fallen from 19 million tons in 1990 to an estimated 8 million tons in 1995.[18] Both Republics experienced continued problems with rising production costs, logistical problems, and declining domestic phosphate demand, and inadequate electrical power supplies for elemental phosphorus furnaces in Kazakhstan.

The Gomel Chemicals Plant in Belarus was to spend about $50 million to construct a 540,000 tons per year sulfuric acid plant. The acid will help the company raise its phosphate fertilizer production to capacity levels (300,000 tons per year). In 1995, the company produced 52,000 tons of phosphate fertilizers and 435,000 tons of sulfuric acid.[19]

***Latin America.*—Brazil.—**Production of phosphate rock in Brazil decreased slightly in 1995 to 3.9 million tons; 1994 and 1995 years were the best production periods in Brazil. Adubos Trevo AS, one of the largest private fertilizer companies in Brazil, ceased production because of financial difficulties. Trevo lost $20 million in 1995, the greatest loss in its history. To avoid losses in 1994, Trevo closed its granulation plants and stopped production at some of its eight bulk blending units. Trevo's 500,000 tons per year granulation plant at Rio Grande and the 195,000 tons per year single superphosphate (SSP) unit at Cubatao were closed indefinitely, thus laying off about 300 workers. In 1995, the production of SSP was expected to be 500,000-700,000 tons.[20]

Peru.—In Peru, 37,000 tons of phosphate rock production was estimated for 1995. Phosphate rock deposits 30 km from the Pacific Ocean near Bayovar Bay were explored and a total of about 380 million tons reserves as 66% BPL concentrate was reported. State-owned Impresa Minera Grau SA was considering privatizing the Bayovar operation. The concentrate was sold on the local market and was also exported to Australia, Brazil, Chile, Colombia, New Zealand, and Venezuela.[21]

A mine and beneficiation plant to produce 2 million tons of concentrate annually was envisioned, which would include some production of direct application rock. Conversion plants to produce WPPA and DAP were also being considered. Fresh water aquifers and adequate electrical power was available in the vicinity.[22]

***Middle East.*—Israel.—**Rotem Fertilizer planned to commission a new 300,000-ton-per-year P_2O_5 WPPA plant at Mishor Rotem in the second half of 1996. Negev Phosphates mined phosphate rock at Arad, Oron and Nahal Zin, with a combined annual capacity of about 5.5 million tons.

Jordan.—Jordan's share of global phosphate rock market fell slightly to almost 12.8%. Jordan Phosphate Mines (JPM) continued working on two new projects, one at Aqaba and the other near the new mining operation at Es Shidiya. At Aqaba, JPM planned to complete a debottlenecking project designed to raise WPPA capacity 10% to 450,000 tons per year P_2O_5 by 1996, while an 80,000 tons per year P_2O_5 joint venture with Nippon of Japan was under construction and scheduled for operation in 1997. In addition, a 200,000 tons per year P_2O_5 joint venture WPPA project was planned with Fauji Fertilizer of Pakistan (FFP) for completion in 1997 or 1998. This material was to be exported to supply the FFP-JPM joint venture DAP facility planned at Port Qasim near Karachi, Pakistan.

At Es Shidiya, a 200,000 tons per year P_2O_5 WPPA joint-venture project between JPM and India's Southern Petrochemical Industries Corp. (SPIC)—Indo Jordan Chemicals—was under construction and scheduled operational in 1997. WPPA will be shipped to SPIC's phosphate fertilizer plant at Tuticorin, Tamil Nadu in southern India. JPMC planned to gradually expand the new 3 million tons per year mine at Es Shidiya.

Saudi Arabia.—Development continued at the Al Jalamid phosphate rock deposit, 120 km from the town of Turayf in northern Saudi Arabia near the border of Iraq. The proposed $1.7 billion project was to include an open pit mine and beneficiation plant with an annual production capacity of 4.5 million tons of high quality 71% BPL phosphate rock, a slurry pipeline for the transport of flotation concentrate to Al Jubail on the Persian Gulf, and an attendant 2.9 million tons per year DAP fertilizer facility.

A feasibility study was completed on the Al Jalamid deposit by Jacobs International, Inc. under the direction of the U.S. Geological Survey (USGS) for the Directorate General of

Mineral Resources (DGMR). The study indicated that the deposit contained proven reserves of 213 million tons of crude ore averaging 46% BPL. The project will probably not be fully implemented until after the turn of the century.

Western Europe.—In 1995, Western Europe produced 671,200 tons of phosphate rock, almost all in Finland, and imported 9 million tons of phosphate rock primarily from Israel, Jordan, Morocco, Russia, and others.

Two of Europe's major phosphate chemical companies started projects to recycle phosphates from waste water. In the Netherlands, Hoechst AG's phosphate plant at Vlissingen, and in Sweden, Kemira AG's plant at Helsungborg began phosphate recycling pilot plants. The recycling program involves the recovery of phosphates from sewage material as it passes through treatment plants. These projects are part of Europe's movement toward making phosphates in detergents more environmentally acceptable. In addition, the costs of phosphate raw materials will decline as a result of such projects.[23]

Enichem S.p.A., the Italian State-owned chemical company, decided to stop the production of normal or single superphosphate (SSP) at its Porto Marghera fertilizer complex. The company is the country's main SSP producer and following the closure Italy will become a net importer.[24]

Eastern Europe.—Almost all phosphate rock was produced in Russia in 1995, with an output 11 Mmt. Eastern Europe imported 3.4 Mmt of phosphate rock, primarily by Poland.

The Ukranian Government is planning to develop a phosphate rock deposit in the Starovyzhevshiy district in the Volyn region, allocating about $70,000 for the project. The deposit is 10 meters below the surface and will be mined by opencast method. Reserves in the district and its neighboring districts (Ratnovskiy and Kamen-Kashirskiy) total 36 Mmt.

Polish chemicals trading company, Ciech, purchased a 66% stake in the state-owned phosphates producer, Gdanskie Zaklady Nawozow Fosfotowych (Fosfory). Fosfory has the capacity to produce up to 300,000 mt/yr of TSP and produced NPK also. In 1995, the company produced 110,000 mt of TSP and 60,000 mt of NPK, of which 29,000 mt and 25,000 mt were respectively exported. The company expects to end its production of phosphoric acid in four or five years, and the company may decide to import TSP rather than acid. The production of acid became uneconomical because of the high cost of phosphogypsum disposal, transported 20 kilometers inland.

Current Research and Technology

The Florida Institute of Phosphate Research (FIPR) in Bartow, FL, was actively involved in chemical processing, mining and beneficiation, reclamation, and environmental services on phosphates. FIPR's priority projects in order of importance were phosphogypsum, reclamation, public health, industry efficiency, and waste clay ponds.

In the chemical processing area, FIPR contracted Jacobs Engineering of Lakeland, FL, to explore ways of significantly reducing the quantity of phosphogypsum produced in WPPA manufacture by removing some or all of the free calcite and dolomite from ground rock feed for a WPPA plant, by flotation. The advantages would be a lowering of sulfuric acid consumption per ton of P_2O_5 produced, lower carbon dioxide production and a concomitant decrease in defoamer usage, together with higher throughput. Related projects involving phosphogypsum were centered about more efficient filtration and recovery of phosphate values in WPPA production and environmental remediation.

Outlook

Regional supply-demand balances presented at the IFA Annual Conference in Singapore during May 1995 indicated that global phosphate rock supplies would be adequate during the 5-year forecast period 1995-99, with the surplus gradually declining from 15% of supply capability in 1995 to 12% by 1999. Global phosphate rock supply capability was forecast to increase about 7% or 11 million tons during the period, principally to cover new converted phosphate capacity additions. In the United States, surplus phosphate rock availability was expected to be maintained at 6 to 8 million tons per year (12% to 15% of supply capability on average) throughout the remainder of the decade.

Phosphate rock exports are expected to further decline. Imports will probably further increase in order to feed phosphoric acid plants in the Mississippi River area. The Pasadena phosphoric acid plant is currently supplied with phosphate rock from the Florida Nichols Mine. In the future, it could shift to imported rock while the Nichols phosphate could be sold to other processing plants located in Central Florida.

The global WPPA P_2O_5 outlook was less certain, however, given variables in the projected outlook for supply capability in the former U.S.S.R. For example, the global P_2O_5 surplus availability narrowed from 6% of supply capability (1.5 million tons) in 1995 to an extremely tight 1% (300,000 tons) by 1999, under the assumption that operating capability in the former U.S.S.R. would not improve beyond the current 38%. Conversely, if operating capability in the former U.S.S.R. were to gradually improve to 65% of capacity by 1999, the global surplus availability could increase to 7% of supply capability (2.0 million tons P_2O_5). It is likely that the region would be required to import phosphate rock under this high-side scenario.

There were relatively small increases in net surplus WPPA P_2O_5 supply availability forecast for the principal exporting regions of Africa, the Middle East and North America—The United States and Canada—between 1995 and 1999. In North America, the WPPA P_2O_5 surplus availability was projected to remain constant at about 5.3 million tons, as the change in demand was approximately equal to that of supply. In the United States, there was no new WPPA capacity forecast on-stream through 1999 except for minor debottlenecking and the possible startup of an idle plant in Florida.

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[1]Potash Corporation of Saskatchewan Inc., Saskatoon, Canada,

1995 Annual Report.

[2]Annual Report 1994. CF Industries, Inc., Long Grove, IL.

[3]Securities and Exchange Commission. IMC Fertilizer Group, Inc., Form 10-K Report, fiscal year ended June 30, 1994.

[4]Phosphorus & Potassium, Jan.-Feb. 1996, p. 11.

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TABLE 1
SALIENT PHOSPHATE ROCK STATISTICS 1/

(Thousand metric tons and thousand dollars unless otherwise specified)

	1991	1992	1993	1994	1995
United States:					
Mine production (crude ore)	154,000	155,000	107,000	157,000	165,000
Marketable production	48,100	47,000	35,500	41,100	43,500
P2O5 content	14,500	14,100	10,700	12,100	12,800
Value	$1,110,000	$1,060,000	$759,000 2/	$869,000 r/ 2/	$947,000 2/
Average per metric ton	$23.06	$22.53	$21.38 3/ 4/	$21.14 r/ 3/ 4/	$21.75 3/ 4/
Sold or used by producers 5/	44,700	45,100	40,100	43,900 r/	43,700
P2O5 content	13,500	13,500	11,900	13,100	13,000
Value	$1,030,000	$1,020,000	$856,000 2/	$929,000 r/ 2/	$950,000 6/
Average per metric ton	$23.06	$22.53	$21.38 3/ 4/	$21.14 r/ 3/ 4/	$ 21.75 7/
Exports 8/	5,080	3,720	3,200	2,800	2,760
P2O5 content	1,640	1,200	1,020	886	875
Value	$163,000	$120,000	$91,200	$71,700	$8,300
Average per metric ton	$32.00	$32.29	$28.51	$25.60	$28.35
Imports for consumption	552	1,530	534	620 9/	1,080 e/ 9/
C.i.f. value	$28,000	$56,200	$32,300	$30,200	$55,200 e/
Average per metric ton 10/	$50.73	$36.71	$60.45	$48.76	$51.01
Consumption 11/	40,200	42,900	38,300	42,900 r/ e/	42,000 e/
Stocks, Dec. 31: Producers	10,200	12,600	9,220	5,980	5,710
World: Production	150,000	139,000 r/	119,000 r/	128,000 r/	131,000 e/

e/ Estimated. r/ Revised.

1/ Data are rounded to three significant digits.

2/ The total value is based on a weighted value.

3/ Computer-calculated average value based on the weighted sold or used values.

4/ Weighted average of sold or used values.

5/ Includes domestic sales and exports.

6/ Total value of all domestic and export sales.

7/ Rate derived by using common averaging.

8/ Exports reported to the U.S. Geological Survey by companies.

9/ Some phosphate rock import tonnage and value were suppressed by the Bureau of the Census.

10/ Average unit value obtained from unrounded data.

11/ Expressed as sold or used plus imports minus exports. Includes some estimated phosphate rock tonnage imported from Morocco not reported by the Bureau of the Census in 1994 and 1995.

TABLE 2
PRODUCTION OF PHOSPHATE ROCK IN THE UNITED STATES, BY REGION 1/

(Thousand metric tons and thousand dollars)

	Mine production (crude ore)		Marketable production			
			Beneficiated			
Period/region	Rock	P2O5 content	Rock	P2O5 content	Value 2/	Ending stocks Rock
1994	157,000	23,700	41,100	12,100	869,000 r/	5,980
1995:						
January-June:						
Florida and North Carolina	79,300	12,100	19,300	5,700	398,000	4,080
Idaho, Montana, Utah	4,390	1,020	2,670	744	50,300	2,100
Total	82,200	13,100	22,000	6,440	449,000	6,180
July-December:						
Florida and North Carolina	78,300	11,100	18,700	5,500	442,000	3,670
Idaho, Montana, Utah	4,920	1,160	2,820	888	55,500	2,040
Total	83,200	12,200	21,500	6,390	498,000	5,710
Grand total	165,000	25,300	43,500	12,800	947,000	XX

r/ Revised. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Computer-calculated value based on the weighted sold or used value.

TABLE 3
PHOSPHATE ROCK SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY GRADE AND REGION 1/

(Thousand metric tons and thousand dollars)

Period and grade (percent BPL 2/ content)	Region						United States total		
	Florida and North Carolina			Idaho, Montana, Utah					
	Rock	P2O5 content	Value 3/	Rock	P2O5 content	Value 3/	Rock	P2O5 content	Value 3/
January-June 1994	18,700	5,650	409,000 r/	3,110	872	51,400 r/	21,800	6,520	460,000 r/
July-December 1994	19,300	5,780	420,000 r/	2,870	809	48,600 r/	22,100	6,590	469,000 r/
January-June 1995:									
72 to less than 74	999	330	27,400	439	150	16,000	1,440	480	43,400
70 to less than 72	99	31	2,660	--	--	--	99	31	2,660
66 to less than 70	15,300	4,560	311,000	446	140	8,360	15,800	4,700	319,000
60 to less than 66	3,060	837	61,300	746	203	6,810	3,800	1,040	68,100
Below 60	--	--	--	1,010	266	18,800	1,010	266	18,800
Total	19,500	5,770	402,000	2,650	759	50,000	22,100	6,530	452,000
July-December 1995:									
72 to less than 74	851	284	25,900	440	150	16,100	1,290	434	42,000
70 to less than 72	187	60	4,960	--	--	--	187	60	4,960
66 to less than 70	14,500	4,400	318,000	408	128	11,600	14,900	4,530	330,000
60 to less than 66	3,040	852	90,800	553	151	5,100	3,600	1,000	95,900
Below 60	--	--	--	1,570	414	25,300	1,570	414	25,300
Total	18,600	5,600	440,000	2,970	843	58,100	21,600	6,440	498,000
Grand total	38,100	11,400	842,000	5,620	1,600	108,000	43,700	13,000	950,000

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ 1.0% BPL (bone phosphate of lime or tricalcium phosphate)=0.458% P2O5.
3/ F.o.b. mine.

TABLE 4
PHOSPHATE ROCK SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE 1/

(Thousand metric tons)

Use	1994		1995					
			January-June		July-December		Total	
	Rock	P2O5 content	Rock	P2O5 content	Rock	P2O5 content	Rock	P2O5 content
Domestic: 2/								
Wet-process phosphoric acid	38,500 r/	11,500 r/	19,600	5,770	19,600	5,860	39,200	11,600
Normal superphosphate	15	6	7	2	9	3	16	5
Triple superphosphate	30	9	--	--	15	5	15	5
Deflourinated rock	65	21	58	19	43	14	101	33
Direct applications	--	--	--	--	--	--	--	--
Elemental phosphorus	2,510 r/	706 r/	992	267	553	151	1,550	418
Ferrophosphorus	--	--	--	--	--	--	--	--
Total	41,100 r/	12,200	20,700	6,060	20,300	6,030	40,900	12,100
Exports: 3/	2,800	886	1,470	465	1,290	410	2,760	875
Grand total	43,900 r/	13,100	22,100	6,530	21,600	6,440	43,700	13,000

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes rock converted to products and exported.
3/ Exports reported to the U.S. Geological Survey by companies.

TABLE 5
PHOSPHATE ROCK SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY USE AND REGION 1/

(Thousand metric tons)

Period and use	Region: Florida and North Carolina Rock	Region: Florida and North Carolina P2O5 content	Region: Idaho, Montana, Utah Rock	Region: Idaho, Montana, Utah P2O5 content	United States: Total Rock	United States: Total P2O5 content
1994	38,000 r/	11,400 r/	5,980 r/	1,680 r/	43,900 r/	13,100
1995:						
January-June:						
Domestic: 2/						
Agricultural: 3/	18,000	5,280	1,650	492	19,600	5,770
Industrial	64	21	992	267	1,060	288
Subtotal	18,000	5,300	2,650	759	20,700	6,060
Exports: 4/	1,470	465	--	--	1,470	465
Total	19,500	5,770	2,650	759	22,100	6,530
July-December:						
Domestic: 2/						
Agricultural: 3/	17,200	5,170	2,420	692	19,600	5,860
Industrial	67	21	551	151	619	168
Subtotal	17,300	5,190	2,970	843	20,300	6,030
Exports: 4/	1,290	410	--	--	1,290	410
Total	18,600	5,600	2,970	843	21,600	6,440
Grand total	38,100	11,400	5,620	1,600	43,700	13,000

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes rock converted to products and exported.
3/ Primarily sales/use of wet-process phosphoric acid.
4/ Exports reported to the U.S. Geological Survey by companies.

TABLE 6
VALUE OF FLORIDA AND NORTH CAROLINA PHOSPHATE ROCK, BY GRADE

(Dollars per metric ton, f.o.b. mine)

Grade (percent BPL 1/ content)	1994 Domestic	1994 Export	1994 Average	1995 Domestic	1995 Export	1995 Average
74 or more	--	--	--	--	--	--
72 to less than 74	26.78	27.46	27.13	24.38	32.97	28.81
70 to less than 72	20.85	35.27	26.09	22.88	29.74	26.64
66 to less than 70	19.67	23.54	19.90	20.82	25.55	21.08
60 to less than 66	29.90	--	29.90	24.92	--	24.92
Less than 60	--	--	--	--	--	--
Weighted average	21.79	25.60	22.08	21.63	28.35	22.12

1/ 1.0% BPL (bone phosphate of lime or tricalcium phosphate)=0.458% P2O5.

TABLE 7
VALUE OF IDAHO, MONTANA, AND UTAH 1/
PHOSPHATE ROCK, BY GRADE

(Dollars per metric ton, f.o.b. mine)

Grade (percent BPL 2/ content)	1994 Domestic	1994 Average	1995 Domestic	1995 Average
72 to less than 74	34.84	34.84	36.52	36.52
70 to less than 72	--	--	--	--
66 to less than 70	18.71	18.71	23.36	23.36
60 to less than 66	12.17	12.17	9.17	9.17
Less than 60	14.37	14.37	17.02	17.02
Weighted average	16.91	16.91	19.22	19.22

1/ There were no exports reported from this region.
2/ 1.0% BPL (bone phosphate of lime or tricalcium phosphate)=0.458% P2O5.

TABLE 8
VALUE OF U.S. PHOSPHATE ROCK, BY GRADE

(Dollars per metric ton, f.o.b. mine)

Grade	1994			1995		
(percent BPL 1/ content)	Domestic	Export	Average	Domestic	Export	Average
74 or more	34.84	--	34.84	--	--	--
72 to less than 74	30.79	27.46	29.65	30.40	32.97	31.3
70 to less than 72	20.85	32.27	26.09	22.88	29.74	26.64
66 to less than 70	19.18	23.54	19.87	20.90	25.55	21.15
60 to less than 66	27.60	--	27.60	22.15	--	22.15
Less than 60	14.37	--	14.37	17.02	--	17.02
Weighted average	20.89	25.60	21.14	21.29	28.35	21.75

1/ 1.0% BPL (bone phosphate of lime or tricalcium phosphate)=0.458% P2O5.

TABLE 9
U.S. EXPORTS OF GROUND AND
UNGROUND PHOSPHATE ROCK 1/ 2/

(Thousand metric tons)
(HTS Nos. 2510.10.0000 and 2510.20.0000)

	Quantity	
Country	1994	1995
Australia	183	211
Belgium	197	268
Brazil	30	15
Canada	309	137
France	(3/)	--
Germany	139	(3/)
India	255	359
Japan	471	463
Korea, Republic of	1,010	993
Mexico	9	3
Netherlands	350	270
New Zealand	186	128
Other	171	143
Total	3,310	2,990

1/ Data are rounded to three significant digits.
2/ Dollar values suppressed by the Bureau of the Census.
3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 10
U.S. EXPORTS OF SUPERPHOSPHATES
(CONCENTRATED) 1/

(Thousand metric tons)
(HTS NO. 3103.10.0020)

	Quantity	
Country	1994	1995
Argentina	14	19
Australia	225	202
Bangladesh	52	21
Brazil	209	34
Canada	25	18
Chile	151	108
Colombia	8	9
Costa Rica	2	3
Japan	31	58
Peru	6	--
Uruguay	5	15
Other	73	227
Total	801	714

1/ Dollar values suppressed by the Bureau of the Census.

Source: Bureau of the Census.

TABLE 11
U.S. EXPORTS
OF DIAMMONIUM PHOSPHATES 1/ 2/ 3/

(Thousand metric tons)
(HTS No. 3105.30.0000)

Country	Quantity	
	1994	1995
Argentina	205	232
Australia	415	438
Belgium	98	103
Brazil	134	59
Canada	78	80
Chile	53	41
China	5,410	5,600
Colombia	108	130
Costa Rica	11	9
Dominican Republic	45	47
Ecuador	22	69
France	49	35
Germany	123	53
Guatemala	12	9
India	435	1,110
Iran	190	270
Ireland	27	--
Italy	14	--
Japan	504	501
Kenya	78	11
Mexico	116	40
New Zealand	165	182
Pakistan	503	194
Peru	35	10
Spain	10	22
Thailand	68	160
Turkey	40	157
Uruguay	42	69
Other	205	433
Total	9,190	10,100

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Chemical analysis: Nitrogen (18%); P2O5 (46%).

3/ Dollar values suppressed by the Bureau of the Census.

Source: Bureau of the Census.

TABLE 12
U.S. EXPORTS OF
MONOAMMONIUM PHOSPHATE 1/ 2/ 3/

(Thousand metric tons)
(HTS No. 3105.40.0000)

Country	Quantity	
	1994	1995
Australia	197	182
Brazil	301	77
Canada	417	505
Chile	58	44
Colombia	68	74
Costa Rica	26	15
Ecuador	2	8
Guatemala	8	27
Japan	131	131
Mexico	115	52
New Zealand	14	14
Peru	5	(4/)
Thailand	35	8
Uruguay	8	10
Venezuela	(4/)	1
Other	93	56
Total	1,480	1,200

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Chemical analysis: Nitrogen (11%); P2O5 (52%).
3/ Dollar values suppressed by the Bureau of the Census.
4/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 13
U.S. EXPORTS OF
PHOSPHORIC ACID 1/2/

(Thousand metric tons)
(HTS No. 2809.20.0010)

Country	Quantity	
	1994	1995
Australia	17	1
Canada	61	137
Colombia	9	11
India	190	157
Indonesia	18	36
Venezuela	74	61
Other	147	172
Total	516	575

1/ Principally, "Merchant Grade" (54% - P2O5) Product. Excludes superphosphoric acid tonnage reported under HTS No. 2809.20.0020, amounting to 298,000 tons in 1994 and 424,000 tons in 1995. The majority of these tonnages is believed to be Merchant phosphoric acid instead of superphosphoric acid.
2/ Dollar values suppressed by the Bureau of the Census.

Source: Bureau of the Census.

TABLE 14
U.S. EXPORTS OF ELEMENTAL PHOSPHORUS 1/

(HTS No. 2804.70.0000)

	1994		1995	
Country	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
Brazil	663	$1,380	98	$202
Canada	519	936	682	1,230
Japan	7,460	14,100	7,310	13,600
Korea, Republic of	54	82	194	432
Mexico	6,220	9,170	5,280	8,130
Netherlands	--	--	40	99
Other	320	688	149	345
Total	15,200	26,400	13,700	24,100

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ F.a.s. values.

Source: Bureau of the Census.

TABLE 15
U.S. IMPORTS FOR CONSUMPTION OF PHOSPHATE ROCK AND PHOSPHATIC MATERIALS 1/

(Thousand metric tons and thousand dollars)

		1994		1995	
Phosphatic materials	HTS No. 2/	Quantity	Value 3/	Quantity	Value 3/
Natural calcium 4/ phosphates, unground	2510.10.0000	620	31,200	618	32,800
Natural calcium 4/ phosphates, ground	2510.20.0000	1	215	56	3,140
Dicalcium phosphate	2835.25.0000	3	3,900	3	4,660
Phosphorus	2804.70.0000	1	3,020	--	--
Normal superphosphate	3103.10.0010	(5/)	28	(5/)	57
Triple superphosphate	3103.10.0020	44	8,150	25	4,720
Diammonium phosphate	3105.30.0000	15	4,270	21	6,010
Fertilizer containing nitrates and phosphates	3105.51.0000	189	21,100	51	6,490
Phosphoric acid	2809.20.0010	1	376	1	548

1/ Data are rounded to three significant digits.
2/ Harmonized tariff schedule of the United States.
3/ Declared c.i.f values.
4/ Excludes reported imports from Canada and Israel.
5/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 16
PHOSPHATE ROCK ANNUAL
WORLD PRODUCTION CAPACITY 1/ 2/
(DECEMBER 31, 1995)

(Thousand metric tons per year)

Region/country	Capacity	Percent
United States	51,000	31.0
Africa 3/	44,200	27.0
Socialist Asia 4/	27,200	16.0
Western Europe and the former U.S.S.R. 5/	20,900	13.0
Middle East 6/	13,900	8.0
Latin America 7/	5,300	3.0
South Asia 8/	1,600	1.0
Oceania 9/	1,300	1.0
World total	165,000	100.0

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes capacities of operating plants as well as plants on "Standby" basis.

3/ Includes Algeria, Morocco, Senegal, South Africa, Togo, and others.

4/ Includes China, North Korea, Vietnam, and others.

5/ Includes Finland, Kazakstan, and Russia.

6/ Includes Egypt, Iraq, Israel, Jordan, Syria, and others.

7/ Includes Brazil, Colombia, Mexico, Peru, Venezuela, and others.

8/ Includes India, Pakistan, and Sri Lanka.

9/ Includes Australia, Christmas Island, and Nauru.

Source: International Fertilizer Industry Association (IFA) and the U.S. Geological Survey (United States).

TABLE 17
PHOSPHATE ROCK, BASIC SLAG, AND GUANO: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Commodity and	Gross weight					P2O5 content				
Country 3/	1991	1992	1993	1994	1995 e/	1991	1992	1993	1994	1995 e/
Phosphate rock:										
Albania e/	9	2	2	2	2	1	(4/)	(4/)	(4/)	(4/)
Algeria	1,090	1,136	718	738 r/	757 5/	322 e/	340 e/	220 e/	226 r/	232 5/
Australia	2	2	2	2 e/	2	(4/)	(4/)	(4/)	(4/) e/	(4/)
Brazil	3,280	2,850	3,420	3,530 r/	3,530	650	650 r/	700 r/	700 r/	700
Chile	13 r/	18	15	10 r/	10	3 r/	5 r/	4 r/	3 r/	3
China e/	22,000	21,400 r/	21,200 r/	24,000	21,000	6,500	6,400 r/	6,350 r/	6,400 r/	6,400
Colombia	32	32	45 r/	48 r/	50	7 r/ e/	7 r/ e/	9 r/ e/	10 r/ e/	11
Egypt e/	1,652 5/	2,000 5/	1,585 5/	1,500	1,500	413	500	390	390	390
Finland	472	555	628	647 r/	671 5/	171 r/ e/	201	227 r/	236 r/	244 5/
India	610	488	969 r/	1,176 r/	1,250	168 e/	132 r/ e/	262 r/ e/	318 r/ e/	338
Indonesia e/	6 5/	8	7	7	8	2	2	2	2	2
Iraq e/ 6/	400	600	800	1,000	1,000	120	180	240	300	300
Israel 6/	3,370 e/	3,595	3,680 r/	3,961 r/	4,063 5/	1,070 e/	1,130 e/	1,148 r/	1,232 r/	1,264 5/
Jordan	4,433	4,296	4,129 r/	4,217 r/	4,984 5/	1,460 e/	1,410 e/	1,367 r/	1,399 r/	1,655 5/
Kazakstan e/	XX	7,000	4,000	2,000 r/	2,200	XX	1,750	1,000	500 r/	550
Korea, North e/	500	500	510	510	520	160	160	163	163	164
Mexico 7/	596	515	237	533	620 5/	180 e/	160 e/	72 r/	156 r/	180 5/
Morocco 8/	17,900	19,145	18,193 r/	19,764 r/	20,200 5/	5,700 e/	6,180 e/	5,778 r/	6,274 r/	6,381 5/
Nauru	530	747	634	613	496 5/	204	288	244	233 r/	190 5/
Netherlands Antilles e/	15	15	10	15	15	5	5	3	5	5

See footnotes at end of table.

TABLE 17--Continued
PHOSPHATE ROCK, BASIC SLAG, AND GUANO: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Commodity and Country 3/	Gross weight					P2O5 content				
	1991	1992	1993	1994	1995 e/	1991	1992	1993	1994	1995 e/
Phosphate rock--Continued:										
Pakistan	19	20	14	15 e/	15	6	6 e/	4 e/	5 e/	5
Peru	18 r/	37 r/	37 r/	37 r/	37	6 r/	12 r/	12 r/	12 r/	12
Philippines	21	5	92	20 e/	20	7 e/	2 e/	31 e/	7 e/	7
Russia e/	XX	11,500	9,400	8,000	8,800	XX	4,000	3,300	2,800	3,000
Senegal 9/	1,741	2,284	1,667	1,670 r/	1,600	630 e/	830 e/	606 e/	605 r/ e/	600
South Africa	3,180	3,080	2,466 r/	2,545 r/	2,790 5/	1,210 e/	1,170 e/	962 r/	995 r/	1,087 5/
Sri Lanka	20	26	36	32 r/	32	6 e/	6 e/	12 e/	11 r/ e/	11
Syria	1,359	1,266	931	1,203 r/	1,551 5/	425 e/	395 e/	286	371 r/	477 5/
Tanzania e/	22 5/	22 5/	22	22	22	7	7	7	7	7
Thailand	6	8	11	10 e/	10	2	2	3	3 e/	3
Togo	2,965	2,083	1,500 r/	2,250 r/	2,000	1,080 e/	760 e/	540 r/	800 r/ e/	720
Tunisia	6,352	6,400	5,500	5,699 r/	7,241 5/	1,880 e/	1,890 e/	1,647 r/	1,712 r/	2,182 5/
Turkey	4	65	78 r/	80 e/	80	1	20	24 r/	24 e/	24
U.S.S.R. e/ 10/	28,400	XX	XX	XX	XX	9,250	XX	XX	XX	XX
United States	48,100	47,000	35,500	41,100	43,500 5/	14,500	14,100	10,700 r/	12,100	12,800 5/
Venezuela	162	10	--	11 r/	180 5/	53 r/ e/	3	--	3 r/	49 5/
Vietnam	275	290	363	470 r/	480	88 e/	93 e/	116 e/	144 r/ e/	145
Zimbabwe, concentrate	117	142	153	151 r/	150	41	42	45	45	45
Total	150,000	139,000 r/	119,000 r/	128,000 r/	131,000	46,300	42,800 r/	36,500 r/	38,200 r/	40,100
Basic (Thomas converter) slag:										
Egypt e/	8	8	8	8	8	2	2	2	2	2
France	538	356	253 r/	155 r/	200	97	64	46 r/	28 r/	36
Germany	142	120	110 r/	134 r/	125	21	18	16 r/	20 r/	19
Luxembourg	536	519	555	472 r/	500	95 e/	93 e/	100 e/	85 r/ e/	75
Total	1,220	1,000	926 r/	769 r/	833	215	177	164 r/	135 r/	132
Guano:										
Chile	1	(4/)	--	--	--	(4/) e/	(4/) e/	--	--	--
Philippines	12	(4/)	5	5 e/	5	4 e/	(4/) e/	2 e/	2 e/	2
Total	13	1 r/	5	5	5	4	(4/)	2	2	2

e/ Estimated. r/ Revised. XX Not applicable.

1/ Table includes data available through June 6, 1996. Data for major phosphate rock-producing countries derived in part from the International Fertilizer Industry Association; other figures are from official country sources where available.

2/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

3/ In addition to the countries listed, Belgium may have produced small quantities of phoshate rock and Namibia may have produced small quantities of guano, but output is not officially reported; and available information is inadequate for formulation of reliable estimates of output levels.

4/ Less than 1/2 unit.

5/ Reported figure.

6/ Beneficiated.

7/ Includes only output used to manufacture fertilizers.

8/ Production from Western Sahara area is included.

9/ Does not include aluminum phosphate production, gross weight estimated as follows in thousand metric tons: 1991--92; 1992--75; 1993--75; 1994--75; and 1995--75.

10/ Dissolved in Dec. 1991.