

THE MINERAL INDUSTRY OF

KUWAIT

By Bernadette Michalski

The preponderant sector of the mineral industry continues to be the production and refining of crude oil. In 1997, the oil industry accounted for about 52% of the gross domestic product, generated nearly 95% of export revenues, and provided 90% of Government revenues. With the commissioning of the nation's first petrochemical complex in 1997, the production for export of such value-added commodities as ammonia and urea was expanded to include ethylene-based petrochemicals.

Government Policies and Programs

Kuwait's many investments, which included participation in foreign petroleum exploration, acquisition of foreign petroleum refining and distribution networks, and participation in overseas petrochemical facilities, have fostered an economy with globally dispersed assets. Under its privatization plan, the Kuwaiti Government expects to recover \$2.68 billion in equity distributed among 62 companies and by privatizing services that were being subsidized or provided free by the Government. These services included electric power production, transportation, and communications. The control of all oil and gas production, refining, transportation, and marketing in Kuwait continued to remain firmly under Government control.

Environment

The environmental damage resulting from oil seeping onto large areas of the ground and into the waters of the Gulf as a result of the invasion and occupation of Kuwait by Iraq in 1990-1991 is not yet fully understood. Kuwait's environmental damage as a result of the Gulf War has been assessed at \$16.3 billion (Washington Times, 1998).

Production

The Organization of Petroleum Exporting Countries (OPEC) continued Kuwait's crude oil production quota at 2 million barrels per day (Mbbbl/d) for 1997—the same level since the fourth quarter of 1993. Kuwait's crude oil production averaged just above 2 Mbbbl/d, including about 250,000 barrels per day (bbl/d) from the Partitioned Zone shared with Saudi Arabia. (See table 1.)

Trade

Total exports, virtually all hydrocarbon related, were valued at \$13.7 billion in 1997. Total imports, principally vehicles and other consumer goods, were valued at \$7.5 billion. The leading

market for Kuwait's petroleum was Japan, which imported 557,000 bbl/d of crude oil and petroleum products combined. European imports averaged 249,000 bbl/d; much of the crude oil, however, was delivered to Kuwait-owned European refineries, and the resulting products were marketed in Europe through the Kuwait-owned distribution system. The United States imported 252,000 bbl/d of mostly crude and unfinished oil from Kuwait, accounting for 2.4% of the U.S. petroleum imports for the year (Energy Information Administration, 1998).

Structure of the Mineral Industry

The Government of Kuwait imposed few restrictions on trade or financial flows and placed considerable emphasis on development of the economy by the private sector. The petroleum and natural gas extraction and processing industries, however, were under Government control. (See table 2.) The Supreme Petroleum Council comprised of the Prime Minister, six other Government ministers, and six representatives from the private sector who are appointed by the Emir for 3-year terms. The Kuwait Petroleum Corporation (KPC) reports directly to the Supreme Petroleum Council and operates through a number of specialized subsidiaries. These include Kuwait Oil Co. (KOC), which is responsible for domestic exploration and production; Kuwait National Petroleum Co. (KNPC), which is responsible for domestic refining and distribution; Kuwait Foreign Petroleum Exploration Co. (KUFPEC), which is responsible for upstream activities outside Kuwait; Kuwait Petroleum International (KPI), which is responsible for overseas refining and distribution; Kuwait Oil Tanker Co. (KOTC), which is responsible for maritime transport; and the Petrochemical Industries Co. (PIC), which is responsible for petrochemical development, production, and marketing.

Despite the liquidation of several billion dollars in assets since the Iraqi invasion, Kuwait retained substantial worldwide investments, including an extensive petroleum refining and distribution network in Western Europe, as well as downstream investments in Eastern Europe, India, and Southeast Asia.

Commodity Review

Metals

Arabian Light Metals Co. operated a 5,000-metric-ton-per-year (t/yr)-capacity aluminum extrusion plant. The company used billet imported from Bahrain, Dubai, and Egypt.

The construction of a 300,000-t/yr-capacity steel rebar mill was under consideration as a joint venture between private Kuwaiti

investors and the National Iranian Steel Company (NISCO). The proposed \$80 million plant is to be supplied with direct reduction iron from NISCO plants in Iran. Kuwait consumes about 500,000 t/yr of steel rebars (Middle East Economic Digest, 1998).

Industrial Minerals

Cement.—The heavy construction demands resulting from damages related to the Gulf War have ended, and any further construction programs are within the limits of the 2-million-ton-per-year (Mt/yr) cement mill capacity. The Kuwaiti cement industry imports all its clinker requirements.

Fertilizers.—PIC operated the Shuaybah Fertilizer Complex, which had the capacity to produce about 1 Mt/yr of ammonia and 800,000 t/yr of urea. The bulk of the complex's urea output is exported to China, Japan, and the Philippines. Ammonia exports, by order of volume, are destined for India, the Republic of Korea, Taiwan, Jordan, Tunisia, Turkey, Spain, and Greece.

Mineral Fuels

Natural Gas.—Production consisted solely of associated natural gas requiring KOC to maximize natural gas recovery at its oilfields to satisfy domestic demand. The utilization rate exceeded 85% in 1997. Kuwait's natural gas gathering network delivered the gas to three gathering stations distributed in different regions within the country. From each of these locations, it was piped to Shuaybah for fractionation. Associated natural gas from the Raudhatain and the Sabiriya Fields near the northern border with Iraq was processed in northern Kuwait, and a mixed liquids stream was delivered by pipeline to the fractionator at Shuaybah. Natural gas from the Minagish, the Umm Gudair, and the South Umm Gudair Fields, near the western border with Saudi Arabia, flowed as wet gas to the processing plant at Shuaybah. Natural gas from the Burgan complex, which included the Maqwa-Ahmadi Fields, was processed at two field recovery plants. The recovered liquids were then delivered by pipeline to Shuaybah for fractionation. The gas system has the capacity to process associated gas from as much as 3 Mbbbl/d of oil production (current production is only 2 Mbbbl/d), stripping liquids for export, and using dry gas for Kuwait's domestic needs for fuel for electric power and feedstock in fertilizer and petrochemical production. With crude oil production limited by OPEC quota, Kuwait experienced a natural gas shortage in the last quarter of 1997 requiring KPC to reduce the volume of deliveries to power stations and desalination plants so that the new petrochemical complex could be supplied with feedstock. The Ministry of Electricity and Water was required to substitute heavy fuel for natural gas in some of its powerplants.

Petroleum.—Production.—The bulk of Kuwait's 2-Mbbbl/d output was derived from the Burgan complex. About 80% of the crude oil produced in Kuwait had a low to medium gravity and a high sulfur content. It is blended into a single stream—Kuwait Export (31° API 2.5% S).

The country's sustainable crude oil production capacity was about 2.5 Mbbbl/d, including 275,000 bbl/d in the Partitioned

Zone. The Government planned to augment sustainable crude oil production capacity to 3 Mbbbl/d by 2000 and a further increase to 3.5 Mbbbl/d by 2005. No significant expansion was planned for the Burgan complex, which accounted for more than one-half of the nation's sustainable crude oil capacity, or about 1.6 Mbbbl/d. The Raudhatain Field capacity will be expanded from 250,000 to 550,000 bbl/d, The capacities of the Minagish Field and the Umm Gudair Field will be increased from 60,000 to 210,000 bbl/d and from 57,000 to 270,000 bbl/d, respectively. Additional capacity expansion was expected to result from the development of the light crude oil reservoirs in the deep Marat, Naja, and Sarjelu Formations under the main oilfields.

Refining.—Nearly one-half of Kuwait's crude output was refined domestically. The post-Gulf War refinery reconstruction program elevated total refining capacity to 886,000 bbl/d from the pre-War 770,000-bbl/d capacity. Domestic consumption of refined products averaged about 120,000 bbl/d; about 750,000 bbl/d was available for export, some of which was absorbed by KPC's retail and wholesale European distribution network. In addition to domestic refineries, KPC acquired equity in overseas refining centers. KPC's refining equities in Europe were the 75,000-bbl/d-capacity Europort refinery in Rotterdam and a 50% share in the 300,000-bbl/d-capacity Milazzo refinery in Sicily. KPC closed its 59,000-bbl/d Stignaes refinery in Denmark in 1997. KPC pursued joint-venture refineries in Chinak, India, Pakistan, and Thailand with the objective of eventually attaining 400,000 bbl/d of refining capacity in Asia. The proposed joint venture with the Indian Oil Corp. to construct a 250,000-bbl/d refinery in the State of Orissa was denied planning permission by Indian authorities in December 1997. By yearend, KPC signed an agreement with Qilu Petrochemicals Company of China to finance a 120,000-bbl/d expansion of its 160,000-bbl/d refinery in Shandong Province in eastern China. According to the agreement, KPC will supply the crude oil feedstock and technical assistance.

Petrochemicals.—Equate, with equity held by PIC (45%), Union Carbide Corp. of the United States (45%), and the Bubiyan Investment Co. of Kuwait (10%), inaugurated Kuwait's first petrochemical complex in November 1997. The \$2 billion Shuaybah complex has the capacity to produce 650,000 t/yr of ethylene, 450,000 t/yr of high-density and linear low-density polyethylene, and 350,000 t/yr of ethylene glycol. Most of the petrochemical output will be exported, principally to Southeast Asia. At yearend, a 100,000-t/yr-capacity polypropylene plant, owned by PIC, came on-stream and was scheduled to consume 6,000 t/yr of ethylene feedstock supplied by the Shuaybah complex.

Reserves

As of January 1, 1998, Kuwait's proven reserves of crude oil were officially estimated by KOC to be 96.5 billion barrels, including 2.5 billion barrels representing Kuwait's share of the Partitioned Zone reserves. Kuwait enjoys a reserve-to-production ratio of 126 years. The bulk of crude oil reserves were located in the Burgan complex, containing about 65 billion barrels.

Natural gas reserves were 1,400 billion cubic meters. The reserves were based entirely on associated natural gas because

intensive exploration programs during the past decade uncovered no nonassociated gas reservoirs (Arab Petroleum Research Center, 1998).

Infrastructure

The crude, product, and natural gas pipeline network supporting petroleum production totals 390 kilometers. KOC operated all crude oil and natural gas lines, and KNPC operated all product pipelines. In 1997, combined electricity generating capacity was 6,900 megawatts (MW) from four powerplants. The Ministry of Electricity and Water projected power consumption levels at 9,300 MW by 2000. To meet the requirements, a 2,400-MW thermal power station at Al-Sabiyah was scheduled to be fully operational by that time.

Outlook

Increased refining capacity and petrochemical production affords Kuwait a stronger position in value-added products. Joint-venture refining projects in Asia are emerging and should provide additional secure outlets for Kuwait's oil in the future. Specially, as Kuwait Export Crude can be processed only by refiners with adequate desulfurization capacity. Proposed aluminum and steel plants, however, will require expanded power generation. The availability of associated natural gas as feedstock for the powerplants is dependent upon an increase in Kuwait's crude oil production quota by OPEC. A 10% increase in production quotas is anticipated in 1998. Should the availability of natural gas not keep pace with power requirements, it may be necessary to resort to higher priced fuel oil as feedstock.

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Middle East Economic Digest, 1997, Kuwait: Middle East Economic Digest, v. 41, no. 21, May 23, p. 24.
Washington Times, 1998, Special international report SKuwait: Washington Times, February 25, 4 p.

Major Sources of Information

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TABLE 1
KUWAIT: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997
Chlorine	25,000	35,000	50,000	50,000 e/	50,000 e/
Cement e/ thousand tons	500	1,000 r/	1,950 r/	2,000 r/	2,000
Clay products, nonrefractory, sand lime bricks e/ cubic meters	100,000	100,000	100,000	100,000	100,000
Lime, hydrated and quicklime e/	35,000	35,000	35,000	35,000	35,000
Natural gas: 2/					
Gross million cubic meters	5,170	7,560	10,870	10,890 r/	10,900
Dry do.	4,470	5,970	9,280	9,300 r/	9,250
Natural gas liquids e/ thousand 42-gallon barrels	40,000 3/	42,000 3/	45,000	45,000	45,000
Nitrogen:					
N content of ammonia	317,000	320,000	492,800 r/	411,900 r/	432,000
N content of urea	292,800	324,100	390,800	356,300	348,500
Petroleum:					
Crude 2/ thousand 42-gallon barrels	683,300	742,000	752,265	743,047 r/	732,574
Refinery products:					
Gasoline, motor do.	10,183	21,316	16,170	13,874 r/	15,475
Kerosene do.	16,315	45,100	49,494	44,202 r/	49,303
Distillate fuel oil do.	43,360	90,702	88,914	86,742 r/	96,754
Residual fuel oil do.	72,817	88,290	66,940	11,075 r/	12,353
Other do.	21,316	40,150	78,402	52,067 r/	58,882
Total do.	163,991	285,558	299,920	207,960 r/	232,767
Salt	40,863 r/	36,897 r/	37,038 r/	100,000 e/	100,000 e/
Sodium and potassium compounds, caustic soda	25,000	30,000	60,000	78,000 r/	78,000 e/
Sulfur:					
Elemental, petroleum byproduct	175,000	200,000	559,000	595,000 r/	664,000
Sulfuric acid e/	5,000 3/	5,000	10,000	10,000	10,000

e/ Estimated. r/ Revised.

1/ Table includes data available through November 15, 1998.

2/ Includes Kuwait's share of production from the Partitioned Zone.

3/ Reported figure.

TABLE 2
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY FOR 1997

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of facilities	Annual capacity
Caustic soda		Petrochemical Industries Co. (Government, 100%)	Shuaybah	30
Chlorine		do.	Shuwaikh	27
Do.		do.	Shuaybah	21
Nitrogen:				
Ammonia		do.	do.	1,100
Urea		do.	do.	900
Petroleum, crude	million barrels	Kuwait Oil Co. (Government, 100%)	Burgan	550
Do.	do.	do.	Raudhatain	95
Do.	do.	do.	Sabiriya	58
Do.	do.	do.	Ahmadi	20
Do.	do.	do.	Minagish	25
Do.	do.	do.	Umm Gudair	25
Do.	do.	do.	Maqwa	25
Do.	do.	do.	Bahra	15
Do.	do.	do.	Abdali	9
Do.	do.	do.	Ratqa	5
Do.	do.	Wafra Oil Co. (Saudi Arabian Texaco, 50 %; Kuwait Oil Co., 50%)	Wafra	100
Do.	do.	do.	South Fuwaris	2
Do.	do.	do.	South Umm Gudair	10
Do.	do.	Arabian Oil Co. (Japanese Petroleum Trading Co., 80%; Saudi Arabia, 10%; Kuwait, 10%)	Khafji	100
Do.	do.	do.	Hout	10
Petroleum, refinery products	do.	Kuwait National Petroleum Co. (Government, 100%)	Mina Al-Ahmadi	159
Do.	do.	do.	Shuaybah	72
Do.	do.	do.	Mina Abdulah	93
Petrochemicals:				
Ethylene		Equate Petrochemical Complex (Petrochemical Industries Co., 45%; Union Carbide Corp., 45%, Bubiyan Investment Co., 10%)	Shuaybah	650
Polyethylene		do.	do.	450
Ethylene glycol		do.	do.	350

TABLE 3
KUWAIT: EXPORTS OF MINERAL COMMODITIES IN 1997 1/

(Metric tons unless otherwise specified)

Commodity	Total	Destinations	
		United States	Other (principal)
METALS			
Alkali metals	1	--	All to Yemen.
Aluminum metal including alloys, semimanufactures	99	--	Saudi Arabia 57; Bahrain 35; Egypt 5.
Copper metal including alloys, semimanufactures	1	--	All to Oman.
Gold metal including alloys, unwrought and partly wrought kilograms	396,936	--	United Arab Emirates 300,936; India 86,000; Bahrain 10,000.
Iron and steel, metal:			
Scrap	188,296	--	India 149,467; Pakistan 34,483; Lebanon 692.
Semimanufactures:			
Flat-rolled products:			
Of iron or nonalloy steel:			
Not clad, plated, coated	367	--	Bahrain 137; Lebanon 93; Saudi Arabia 55.
Clad, plated, coated	701	--	Egypt 494; United Arab Emirates 99; Saudi Arabia 37.
Of alloy steel	33	32	Egypt 1.
Bars, rods, angles, shapes, sections	386	--	Saudi Arabia 144; Bahrain 139; United Arab Emirates 66.
Wire	167	--	Saudi Arabia 56; United Arab Emirates 46; Iran 45.
Tubes, pipes, fittings	1,485	1	Saudi Arabia 751; United Arab Emirates 337; Oman 111.
Zinc metal including alloys, unwrought value, thousands	\$1	--	All to Saudi Arabia.
INDUSTRIAL MINERALS			
Abrasives, n.e.s., grinding and polishing wheels and stones	3	--	All to United Arab Emirates.
Cement	18	--	Do.
Diamond, natural, gem, not set or strung value, thousands	\$588	\$407	United Kingdom \$181.
Fertilizer materials:			
Crude, n.e.s.	20	--	All to Lebanon.
Manufactured:			
Ammonia	100,130	--	India 65,000; Republic of Korea 15,000; Hong Kong, China 10,000.
Nitrogenous	775,881	--	India 411,500; China 188,500; Philippines 58,000.
Unspecified and mixed	2	--	All to United Arab Emirates.
Mica, worked including agglomerated splittings	652	--	United Arab Emirates 602; Saudi Arabia 50.
Precious and semiprecious stones other than diamond, natural value, thousands	\$17	--	All to India.
Salt and brine	3,183	18	Saudi Arabia 3,015; Lebanon 44; United Arab Emirates 42.
Stone, sand and gravel:			
Dimension stone, worked	264	--	Qatar 94; Lebanon 82; United Arab Emirates 43.
Gravel and crushed rock	22	--	All to Saudi Arabia.
Sulfur:			
Elemental, colloidal, precipitated, sublimed	579,000	--	India 237,000; Morocco 175,000; Tunisia 127,000.
Sulfuric acid	42	--	All to Saudi Arabia.
Other, crude	212	--	United Arab Emirates 98; Saudi Arabia 81; Kazakhstan 21.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades including briquets	3	--	All to Bahrain.
Petroleum:			
Crude thousand metric tons	57,300	--	Unspecified.
Refinery products:			
Liquefied petroleum gas do.	3,462	--	Do.
Gasoline	222,914	--	Do.
Kerosene and jet fuel thousand metric tons	8,292	--	Do.
Distillate fuel oil do.	12,400	--	Do.
Lubricants	3,521	2	India 1,882; Pakistan 652; Qatar 163.
Residual fuel oil thousand metric tons	7,293	--	Unspecified.
Bitumen and other residues	20	--	All to United Arab Emirates.
Bituminous mixtures	112	--	United Arab Emirates 80; Qatar 33.
Petroleum coke	827,000	535,000	India 140,000; Egypt 110,000; Turkey 22,000.

1/ Table prepared by Glenn J. Wallace, U.S. Geological Survey.

Source: United Nations Statistical Office (microfiche).

TABLE 4
KUWAIT: IMPORTS OF MINERAL COMMODITIES IN 1997 1/

(Metric tons unless otherwise specified)

Commodity	Total	Sources	
		United States	Other (principal)
METALS			
Alkali metals	436	--	Germany 340; Italy 37; Saudi Arabia 20.
Aluminum:			
Oxides and hydroxides	138	--	United Kingdom 99; Japan 38.
Metal including alloys, semimanufactures	22,672	1,544	Bahrain 12,398; France 943; Saudi Arabia 817.
Copper metal including alloys, semimanufactures	13,221	265	Saudi Arabia 9,218; United Kingdom 1,593; Greece 1,213.
Gold metal including alloys, unwrought and partly wrought thousand kilograms	13,652	--	Switzerland 9,465; South Africa 2,910; Germany 875.
Iron and steel, metal:			
Scrap	181	--	All from Germany.
Pig iron, cast iron, related materials	702	--	All from United Kingdom.
Semimanufactures:			
Flat-rolled products:			
Of iron or nonalloy steel:			
Not clad, plated, coated	55,093	178	South Africa 9,252; Ukraine 5,581; Germany 5,331.
Clad, plated, coated	75,850	581	Germany 21,874; Japan 12,128; South Africa 10,166.
Of alloy steel	833	44	Japan 293; France 143; United Kingdom 91.
Bars, rods, angles, shapes, sections	482,445	375	Turkey 201,023; Saudi Arabia 159,655; Qatar 56,342.
Wire	12,964	24	Saudi Arabia 7,397; China 2,880; India 575.
Tubes, pipes, fittings	151,892	11,366	Japan 23,540; Germany 18,894; Italy 16,597.
Lead metal including alloys, all forms	6	4	Saudi Arabia 1; United Kingdom 1.
Mercury value, thousands	\$4	--	All from United Kingdom.
Nickel metal including alloys, all forms	1	--	All from India.
Silver metal including alloys, unwrought and partly wrought value, thousands	\$60	--	South Africa \$30; United Arab Emirates \$30.
Tin metal including alloys, all forms do.	\$2	--	All from Germany.
Zinc metal including alloys:			
Unwrought	337	10	Belgium-Luxembourg 132; Finland 50; Saudi Arabia 47.
Blue powder	162	57	Germany 60; Norway 20; United Kingdom 20.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural, corundum, emery, pumice, etc.	3	--	All from Syria.
Grinding and polishing wheels and stones	1,127	4	Italy 624; India 391; France 27.
Barite and witherite	219	--	China 150; Finland 19; India 18.
Boron oxides and acids	16	16	
Cement thousand metric tons	1,867	--	Saudi Arabia 942; India 211; United Arab Emirates 173.
Chalk	84	--	Belgium-Luxembourg 63; Italy 21.
Diamond, natural, gem, not set or strung value, thousands	\$1,448	\$25	Italy \$615; Belgium-Luxembourg \$410; India \$192.
Fertilizer materials:			
Crude, n.e.s.	352	--	All from Saudi Arabia.
Manufactured:			
Ammonia	4	--	Do.
Unspecified and mixed	3,481	53	Belgium-Luxembourg 1,088; Germany 409; Italy 309.
Lime	2,960	--	Saudi Arabia 1,616; Oman 1,131; Iran 213.
Mica, worked including agglomerated splittings	6,503	--	Germany 2,725; Saudi Arabia 2,425; United Arab Emirates 1,353.
Precious and semiprecious stones other than diamond, natural value, thousands	\$221	\$3	India \$72; Thailand \$42; Hong Kong, China \$31.
Pyrite, unroasted	15,951	--	India 14,404; Iran 1,512; Saudi Arabia 35.
Salt and brine	10,482	133	Saudi Arabia 3,698; Netherlands 3,080; Iran 2,901.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	927,012	--	United Arab Emirates 915,054; Saudi Arabia 11,957.
Worked	224,034	83	Italy 79,867; Syria 71,818; Jordan 25,003.
Gravel and crushed rock	333,143	--	Iran 158,961; United Arab Emirates 80,804; Italy 54,426.
Sand other than metal-bearing	10,329	202	Saudi Arabia 8,030; United Arab Emirates 382; Norway 360.
Sulfur:			
Dioxide	11	--	All from Germany.
Sulfuric acid	3,437	(2/)	Saudi Arabia 1,950; Bahrain 1,455; China 25.
Talc, steatite, soapstone, pyrophyllite	5,066	--	Germany 3,496; Netherlands 847; Sri Lanka 322.

See footnotes at end of table.

TABLE 4--Continued
 KUWAIT: IMPORTS OF MINERAL COMMODITIES IN 1997 1/

(Metric tons unless otherwise specified)

Commodity	Total	Sources	
		United States	Other (principal)
INDUSTRIAL MINERALS--Continued:			
Other, crude	198,963	--	Iran 91,881; Saudi Arabia 45,720; Egypt 44,694.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	13	--	Netherlands 6; United Kingdom 5; Spain 1.
Coal, all grades including briquets	439	120	Netherlands 79; Syria 77; Iran 50.
Petroleum refinery products:			
Mineral jelly and wax	36	--	United Kingdom 30; Netherlands 5.
Lubricants	24,169	3,367	United Arab Emirates 11,305; Oman 3,238; Saudi Arabia 2,250.
Bitumen and other residues	66	--	All from Saudi Arabia.
Bituminous mixtures	29,249	420	Saudi Arabia 23,268; Italy 3,388; Greece 743.

1/ Table prepared by Glenn J. Wallace, U.S. Geological Survey.

2/ Less than 1/2 unit.

Source: United Nations Statistical Office (microfiche).