

# Sulphur

---

**Michel Prud'homme**

*The author is with the Mining Sector,  
Natural Resources Canada.  
Telephone: (613) 992-3733*

## WORLD OVERVIEW

**F**or the first time in five years, world elemental sulphur supply and demand rose in tandem. However, production continued to exceed consumption, leading to a third year of sustained surplus in world markets.

World elemental sulphur production rose by about 4% to 35.4 Mt. Increases were registered for both Frasch sulphur (+8%) and recovered sulphur (+31%). Production declines were reported in the Commonwealth of Independent States (C.I.S.) (20%) and Germany (9%). All other major sulphur-producing countries increased production. Canada, which registered a 7% increase, and the United States (+6%) together accounted for 46% of the global rise in production. In 1994, Frasch sulphur contributed to 16% of world elemental sulphur production, compared to 15% in 1993. Increases in Frasch sulphur output occurred mainly in the United States. The production of recovered sulphur showed continued growth; increases occurred in Canada, the United States, Japan, Saudi Arabia, the United Arab Emirates, and Mexico. Recovered sulphur accounted for 84% of total sulphur production; gas processing was in turn the source of 56% of recovered sulphur, while oil and heavy oil refining contributed 44%.

In 1994, world consumption of elemental sulphur rose for the first time since 1988 to reach 34 Mt, a 6% increase over the previous year. Consumption for fertilizers accounted for 89% and rose by 7% from 1993 to reach 30.1 Mt. This increase resulted from a strong demand for phosphate-based fertilizers in major consuming countries, with the exception of the C.I.S. Fertilizer demand was especially firm in China where the consumption of phosphate-based fertilizers recovered from the very low level that prevailed in 1993, approaching its 1992 level and leading to strong demand for sulphur in the United States. In India, phosphate demand picked up in response to

some state support and resulted in strong imports of phosphoric acid and di-ammonium phosphate, leading to higher demand for sulphur in exporting countries such as Morocco, Tunisia, South Africa, Senegal, and Jordan. World consumption of elemental sulphur for non-acid industrial uses declined marginally to about 3.9 Mt; major consuming areas were in Asia (26% of world consumption), North America (22%), Western Europe (19%), and the C.I.S. (10%).

## CANADIAN DEVELOPMENTS

### Elemental Sulphur

In 1994, Canada ranked as the world's second largest producer of elemental sulphur with a 23% share. It also remained the leading exporter with a 36% share of world trade. In Canada, sulphur is recovered from the processing of sour natural gas with a high hydrogen sulphide content, and from the refining of high-sulphur crude oil and heavy oil; there is no production derived from Frasch mining. Canadian sulphur production from natural gas processing accounted for 88% of total production, while the remainder was from oil sands plants (7%) and oil refineries (5%). Most sulphur production occurs in Alberta and, to a lesser degree, in British Columbia and Saskatchewan. In eastern Canada, all sulphur production is derived from oil refining.

A number of developments occurred during 1994: a sustained increase in sulphur production, the commissioning of a gas plant expansion in northeastern British Columbia, notice to PRISM Sulphur Corporation by its three major suppliers of the termination of their membership, a renewal of another anti-dumping review in the United States, a strong international price recovery, and a major improvement in offshore sulphur exports.

The production of sulphur in Canada in 1994 was estimated at 8.0 Mt, a 7% increase over the previous year. Increases were reported in all sectors: gas processing, oil sands, and oil refining. Gas-related sulphur production rose both in Alberta and British Columbia to close to 7.0 Mt from 6.6 Mt. High levels of sulphur recovery in 1994 were related to a strong performance by the natural gas sector in Canada. Marketable gas production grew by 4%, led by firm

export sales to the United States and by stronger sales in the domestic commercial and residential sectors. However, upstream gas prices declined by more than 20% due to oversupply and low demand in a warm winter.

Sulphur production from the oil sands operations reached a record level of approximately 0.63 Mt, a 7% increase over the previous year. Oil-related sulphur production was estimated at 0.35 Mt, a 3% increase over 1993, with much higher sulphur output from refineries in Ontario.

In 1994, Canadian shipments of elemental sulphur rose by 12% (+0.6 Mt) to 5.6 Mt, mostly triggered by strong offshore sales. Exports accounted for 88% of Canadian sales. In 1994, exports to the United States dropped by 40% from 1993 to 1.15 Mt, while offshore exports rose by 36% to 3.75 Mt. Offshore sales in the first half of 1994 were relatively stable in a pattern similar to 1993; in the second half of 1994, offshore sales doubled those of the same period in 1993, with monthly sales averaging 383 000 t and peaking at close to 485 000 t in November. Despite the drop in exports to the United States, the U.S. remained the dominant export destination for Canadian sulphur in 1994 accounting for 22% of Canada's total exports compared to 34% in 1993.

Late in 1993, Pennzoil Sulphur Company, a U.S. Frasch producer, requested another administrative review of Canadian sulphur exports to the United States for the period from December 1992 to November 1993. This request followed a similar action by Pennzoil in 1992 against 15 Canadian exporters concerning exports in the period from December 1991 to November 1992. Pennzoil's request was filed with the U.S. Department of Commerce (DOC), which is expected to render preliminary determinations on the company's two initial petitions early in 1995.

During the year, Canada's offshore exports of sulphur rose by 1.0 Mt (or 36%) to 3.8 Mt. Canadian sulphur was exported to more than 30 countries. In 1994, higher sales were reported in most markets, including in North Africa (+44%), Latin America (+60%), Asia (+57%), and Oceania (+23%). In Latin America, increases were reported in Mexico, Chile, and Brazil; sales to this region accounted for 22% of Canada's offshore exports. In Africa, Morocco remained the largest single destination for Canadian sulphur with a 21% share of Canada's offshore exports. Shipments to Morocco remained stable while sales to Tunisia more than doubled. Gains were registered in Israel and South Africa while lower sales occurred in Senegal; sales to Africa accounted for 62% of Canadian offshore exports compared to 56% in 1993. Exports to Asia accounted for 22%; China and India showed significant improvement over 1993.

Total Canadian sulphur sales in 1994 were estimated at 5.6 Mt, compared to 5.0 Mt in 1993, leading to an

increase in stocks by 2.4 Mt to reach 8.0 Mt by year-end. Canadian sulphur stocks in early January 1993 were estimated at around 5.6 Mt, distributed mainly amongst 18 sites in Alberta. With some recovery in offshore price and strong sales, monthly additions to stocks fell from a first-quarter average of 330 000 tonnes per month (t/m) to 190 000 t/m in the second quarter, to less than 100 000 t/m in the second half. On a yearly basis, additions to stocks averaged 200 000 t/m, compared to a rate of 300 000 t/m that prevailed in the second half of 1993. The main stock locations in Alberta were Ram River, Waterton, Kaybob III, East Calgary, and Crossfield.

### Alberta

During the period from late December 1993 until early spring, each of the three major sulphur suppliers of PRISM Sulphur Corporation gave notice that it would terminate its membership by the end of December 1994. The following producers will export independently as of January 1, 1995: Husky Oil Operations Ltd., Shell Canada Limited, and Amoco Canada Petroleum Company Ltd. PRISM is a sulphur export consortium formed in 1992 which markets Canadian sulphur in offshore markets on behalf of several sulphur producers in Alberta. Late in October, six other small sulphur producers opted to withdraw. PRISM restructured into 21 shareholders and confirmed a supply agreement until 1997; sulphur production capacity from these companies exceeds 2 Mt/y.

Conwest Exploration Company Ltd. announced plans for the construction of a new gas processing plant at Grand Prairie to exploit the Sexsmith/Valhalla sour gas field; a sulphur recovery unit with a 450-500-t/d capacity is planned for completion in 1995. Morrison Petroleum Ltd. is expected to complete a \$15 million expansion at its Coleman gas plant in Savannah Creek in southeastern Alberta by mid-1996; the project calls for an additional 300-t/d sulphur recovery capacity, to reach a total of 700 t/d.

Amoco Canada Petroleum Co. did not receive approval from the Alberta Energy Resources Conservation Board (AERCB) for the drilling of development wells in the Whaleback region in southern Alberta. Amoco planned a US\$1.2 billion oil and sour gas project at Hunter Creek, which would have had a sulphur capacity in the 400-500-t/d range.

During its first year of operation, the large-scale gas plant at Caroline, operated by Shell Canada Limited, ran at 70-80% of capacity, peaking at close to 100% in December 1994. The plant has a sulphur recovery capacity of 4000 t/d.

During 1994, the Alberta Department of Energy conducted an evaluation of the feasibility of taking sulphur as royalty-in-kind; the department made a determination in the early fall that it would not pursue the concept. The royalty rate for sulphur in

Alberta is 16.66% of sulphur production, which would have equated to around 1 Mt/y of additional sulphur volume to be marketed.

Suncor Inc. invested \$15 million to install new sulphur recovery and scrubbing equipment at its oil sands operation in Fort McMurray; this project will allow a reduction in sulphur dioxide emissions by 50%. Late in 1994, Suncor announced a \$250 million expansion project over three years to increase its upgrading capacity by close to 20%. Syncrude Canada Ltd. received approval from the AERCB to expand its production of crude oil by 26% by 1998 and was granted an extension of its operating permit until 2025. In the fall of 1994, Syncrude announced plans for important long-term investments. Through improvements in recovery efficiency and higher crude throughput, sulphur production at both oil sands operations is projected to increase by 13% between 1994 and 2000.

Several other activities occurred in the Alberta sulphur industry in 1994: Norcen Energy Resources Ltd. gained a 98.5% share of North Canadian Oils Ltd., Pennzoil Co. took over Co-enerco Resources Ltd., Torch Energy Advisors Inc. acquired a 25% stake in Gulf Canada Resources Ltd., Talisman Energy Inc. acquired Bow Valley Inc., and Alberta Energy Co. was fully privatized after the Alberta government sold its 36% interest.

### **British Columbia**

A 12-day strike disrupted sulphur exports from the Vancouver area in late January-early February. Close to 3500 longshoremen called a strike on January 27. In early February, return-to-work legislation was passed.

In November 1994, Westcoast Energy Inc. completed its \$300 million expansion at the Pine River gas processing plant; the expansion doubled the plant's sulphur capacity from 1080 t/d to 2000 t/d. Westcoast will also complete three other projects in northeastern British Columbia between 1995 and 1997: (1) the \$673 million Grizzly Valley Expansion project, which calls for a new gas gathering and processing plant at Chetwynd-Tumbler Ridge with a sulphur recovery capacity of 1600 t/d, to be completed by late 1997; (2) a \$266 million expansion near Fort St. John involving the construction of a new gas plant at Beg-Jedney near Aitken Creek with a sulphur capacity of 200 t/d, to be completed by late 1995; and (3) a \$55 million debottlenecking project at the Fort St. John/McMahon gas plant, which is expected to increase raw gas throughput by 14%, starting in 1995.

The B.C. Ministry of Environment, Lands and Parks approved an application from Shell Canada Ltd. and Amoco Canada Petroleum Co. for the construction of a long-term sulphur blocking facility near the new Pine River expansion plant. The construction of the 500 000-t basepad was completed in the fall. Its

design was based on Shell's facility at Shantz, Alberta.

Imperial Oil Ltd. will close its Ioco oil refinery at Port Moody on June 30, 1995. The site will continue to operate as a terminal for storage and distribution of asphalt and other oil-related products. The Ioco plant's sulphur recovery capacity was rated at 20 t/d.

### **Eastern Canada**

In Newfoundland, Newfoundland Processing Limited is expected to begin recovery sulphur at the Come-by-Chance oil refinery in 1995. The operation was idle until late in 1994 after a fire shut it down in April. In August, the refinery was sold to Vitol S.A. of Houston. The refinery's sulphur recovery capacity is estimated at 6000 t/m. Recovered sulphur is to be poured on block at the plant site.

## **Sulphuric Acid**

The production of sulphur products (sulphuric acid, sulphur dioxide, and elemental sulphur) from smelters in 1994 was estimated at 990 400 t, a 10% increase from 1993. Sulphuric acid production from smelters was estimated at close to 2.67 Mt H<sub>2</sub>SO<sub>4</sub>. This represented 87% of total sulphur product output from smelters in 1994. Increases in sulphuric acid production were reported in all provinces, with the major increase occurring in Ontario. Shipments in 1994 totalled 938 000 t, representing a 10% increase over 1993. Exports to the United States were strong (sales levels were 20% higher than 1993 during the first nine months). Shipments to the domestic market rose 6% with improvements reported in the pulp and paper, ammonium sulphate, and uranium ore processing sectors. Lower sales were registered in the manufacture of ammonium phosphate due to the closure of Cominco Ltd.'s plant at Trail, British Columbia, and in the manufacture of titanium dioxide pigments following a decision by Kronos Canada Ltd. to halve its sulphate-process capacity at Varennes, Quebec.

In 1993, Canadian sulphuric acid production totalled 3.78 Mt H<sub>2</sub>SO<sub>4</sub>, of which smelter acid contributed 2.43 Mt and elemental sulphur contributed 1.35 Mt. Domestic consumption was estimated at 2.2 Mt, a 3% decrease over 1992. Sulphuric acid consumption in eastern Canada amounted to 0.64 Mt, a 33% decrease over 1992, and accounted for 30% of total Canadian consumption. Agricultural chemicals accounted for 49% of sulphuric acid consumption, followed mainly by pulp and paper (17%), inorganic chemicals (13%), and nonferrous smelting and refining (6%).

The 1993 consumption of sulphur dioxide (SO<sub>2</sub>) in Canada was estimated at about 95 000 t SO<sub>2</sub>, of which 70% was used by pulp and paper plants. Exports totalled 75 000 t SO<sub>2</sub>. Demand for liquid sulphur dioxide decreased marginally in pulping mills, but grew in the mining and smelting sectors.

Cominco Ltd. of Vancouver announced plans to spend \$145 million to build another lead smelter at Trail using the Russian Kivcet smelting technology. The smelter is expected to be commissioned in 1996; sulphuric acid production by the company is projected to increase when the smelter comes on stream. In June, the company also converted its 0.16-Mt/y ammonium phosphate facility at Trail for the production of granular ammonium sulphate.

Sherritt Inc. purchased the phosphate fertilizer complex of Imperial Oil at Redwater, Alberta. The assets included two sulphuric acid plants with a total capacity of 0.9 Mt/y acid.

## WORLD DEVELOPMENTS

In 1994, world production of sulphur in all forms rose 2% to 51.2 Mt. Of this amount, elemental sulphur accounted for 69%; sulphuric acid, 19%; and pyrites, 12%. Increases in the production of elemental sulphur and sulphuric acid from smelters offset reductions in pyrites output.

For the first nine months of 1994, world trade of elemental sulphur declined by 2% to 9.3 Mt. About three quarters of this 0.2-Mt decrease occurred in North America, the remainder in Central Europe. Canada accounted for 36% of world trade, a level similar to 1993. Other major exporters were Saudi Arabia (18%) and Poland (15%). In 1994, sulphur imports rose in Africa (+10%) and Western Europe (+25%). North Africa was the leading importing region with volumes reaching 3.5 Mt for the first nine months of 1994. This region accounted for 37% of world sulphur trade, followed by Asia (18%) and North America (13%). In 1994, Canada was the dominant exporter in the following regions: Oceania (87%), North America (67%), Latin America (58%), and Asia (32%). Canada remained a close second to Saudi Arabia in Africa (27%) and the Middle East (39%). No Canadian sales were reported in Western Europe (which was supplied by Poland, Germany, and France) and Central Europe (which was supplied by Poland and Germany).

### United States

In 1994, the United States was the world's largest sulphur producer accounting for 29% of world production; it was also the largest Frasch-producing country.

U.S. production of elemental sulphur rose 6% to 10.1 Mt; sulphur recovered from oil refineries and gas processing plants accounted for 73% of this total, amounting to 7.2 Mt (a 1% increase over 1993). U.S. Frasch sulphur production increased by some 42% over the previous year to reach 2.7 Mt. The rise was mainly due to higher output from the new Main Pass mine in Louisiana, which was offset marginally by a

small decline in production at the Culberson mine in Texas. As announced late in 1993, the 0.75-Mt/y Caminada mine in Louisiana closed in early 1994. Production of other forms of sulphur (e.g., sulphuric acid) remained unchanged at 1.4 Mt and accounted for approximately 12% of overall production of sulphur in all forms.

In 1994, sulphur was produced at 169 plants operating in 30 states. Elemental sulphur consumption was reported at 11.1 Mt, a 6% increase over the previous year. Apparent consumption of sulphuric acid rose 9% to 41.4 Mt H<sub>2</sub>SO<sub>4</sub> for use mostly in fertilizers (61%), chemicals (10%), petroleum refining (7%), and metal mining (5%). Exports of elemental sulphur rose by 6% to 0.8 Mt. Imports declined for a third consecutive year to 1.5 Mt, of which Canada supplied 73%, with the rest coming from Mexico. Producers' stocks of elemental sulphur declined by 0.3 Mt to 1.1 Mt at year-end.

In the first quarter of 1994, the Main Pass sulphur operation reached full production capacity at 5500 long tons per day (lt/d), and worked at rates above 6200 lt/d, 6600 lt/d, and 6400 lt/d in the second, third and fourth quarters respectively. In 1994, Pennzoil Sulphur Co. completed its US\$7.5 million development work to improve efficiency at the Culberson Frasch mine by installing a new mining technology (the Continuous Reinjection System) and gas-fired power generation equipment. In October 1994, Freeport-McMoRan Resource Partners, Ltd. agreed to acquire the assets of Pennzoil Sulphur. These included the Culberson mine; the sulphur terminal and loading facilities at Galveston, Texas, and Tampa, Florida; the charter of the Marine Duval sulphur tanker; and a fleet of railcars. The acquisition was completed in early January 1995.

### Commonwealth of Independent States

In 1994, the Commonwealth of Independent States (C.I.S.) was the world's third largest producer of sulphur with a 9% share of world production. Its elemental sulphur production declined 22% to 3.2 Mt; of this amount, Frasch production decreased by 45% to 0.3 Mt, and the production of recovered sulphur declined by 18% to 2.9 Mt. The decline in Frasch sulphur occurred mainly in Ukraine at Yavorov. (Production from Turkmenistan at Gaudark is less than 0.2 Mt/y.) In recent years, tonnage from residual stocks has supplemented production to achieve higher exports. During 1994, liquid and lump sulphur from Yavorov started to be exported through the Ukrainian ports of Kherson and Kersh to Mediterranean markets. Astrakhan sulphur has also been barged or railed for export through the port of Mariupol. Lower-priced seaborne sulphur from the C.I.S. emerged by mid-1994 due to attractive international pricing in North African sulphur markets.

In 1994, the Astrakhan 1 sour gas plant continued to operate at high rates, resulting in a 10% increase in

sulphur recovery to reach 1.35 Mt. Part of its production is reportedly being stocked. The Astrakhan 2 plant is expected to start up in early 1996. In the near future, a US\$200 million project is planned that will include a new granulation plant and loading facilities at Astrakhan and a new 2.0-Mt/y formed and liquid sulphur export terminal at Yuzhny. In Russia, sulphur production was also reported stable at the Mubarek gas plant (0.4 Mt) and the Orenburg gas plant (1.0 Mt). Gas-related development works are planned at the Karachaganak sour gas field (8% H<sub>2</sub>S) in Kazakhstan to supply the Russian Orenburg gas plant, whose local reserves have been depleting. In Kazakhstan, sulphur production at the Tengiz KTL-1 plant rose significantly to 0.25 Mt due to higher oil and associated gas production. At Tengiz, the construction of additional gas/oil separation units (that each include a 0.35-Mt/y sulphur recovery capacity) has been postponed until access to pipeline systems is secure. Development plans for Tengiz included a second gas/oil processing plant (KTL-2), which is now slated for 1996, and a third plant (KTL-3), which will not be completed before 1998. In 1994, Tengiz's liquid sulphur was poured on block or sold locally in Kazakhstan.

## Poland

Poland was the fourth largest world producer of elemental sulphur in 1994 accounting for 6% of world production. Poland produced Frasch sulphur at two mines and one industrial plant at Baznia (30 000 t/y). The major mines are located at Jeziorko and Osiek, while some production occurs at Grzybow for feeding a nearby carbon disulphide plant. In 1994, sulphur production in Poland rose by 12% to 2.1 Mt from 1.9 Mt in 1993, due to higher output from the new Osiek Frasch mine. Production at Osiek is expected to reach 0.7 Mt as production from Jeziorko stabilizes at lower levels. In the last two years, a major reduction in sulphur stocks allowed Poland to maintain its exports at previous levels; reductions continued in 1994, bringing stocks close to exhaustion. Late in 1993, local environmental regulations required that exports of crushed sulphur from the Gdansk sulphur terminal be stopped. Two new 1000-t/d wet-process forming units were installed at Gdansk, while a single 1000-t/d dry-process unit was started at Jeziorko. Ultimately, Polish sulphur exports will only be in granulated and liquid forms.

## Saudi Arabia

Saudi Arabia was the fifth largest sulphur producer in the world in 1994 with a 5% share. Saudi Arabian sulphur production was reported at 1.65 Mt. Close to 85% came from natural gas processing. Production from oil refineries has been flat at 0.25 Mt/y for the last two years. Sulphur exports have been highly supported by a series of massive withdrawals from sulphur stocks. Remelts reached close to 60 000 t/m

during the first half of 1994 and, by the third quarter, stocks were reported depleted. An expansion is planned at the Ras Tanura oil refinery with an 80-t/d increase in its sulphur recovery by 1998.

## Japan

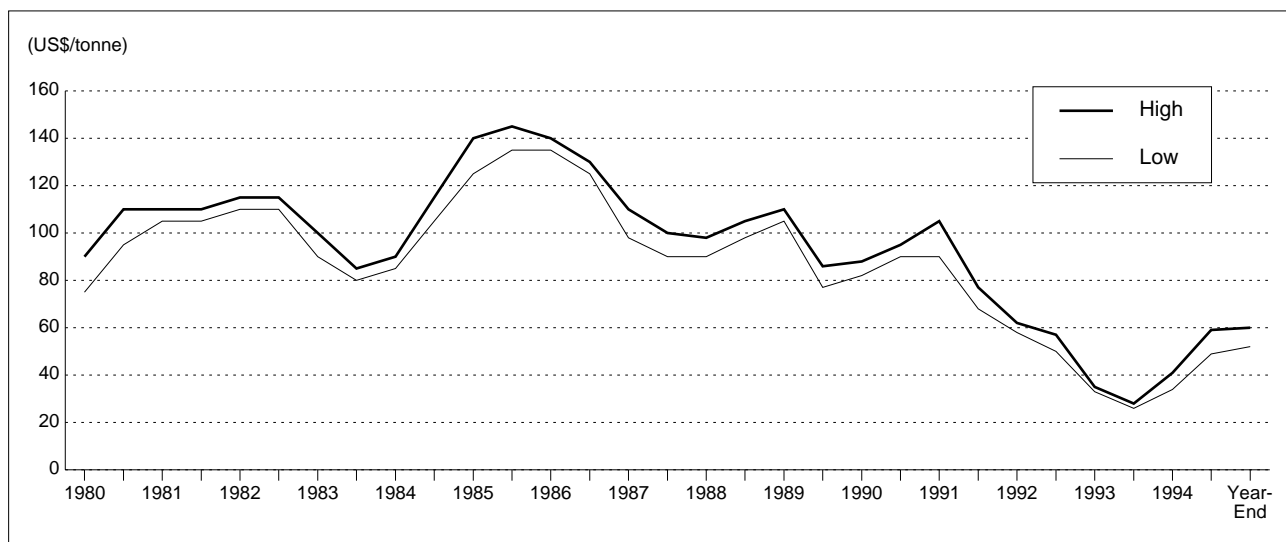
Japan was the world's sixth largest producer of sulphur in 1994, accounting for close to 5% of world production. In 1994, Japanese sulphur production rose by 6% to 1.6 Mt, all of which was derived from oil refining. Refineries operated at very high rates; however, sulphur output was lower than expected due to an increase in sweet crude oil imports from Saudi Arabia. Higher sulphur recovery is expected in the near future, resulting from a higher capacity utilization forecast at refineries due to heavier sulphur content in incoming crudes and more stringent Japanese specifications for its domestic diesel fuel.

## PRICES

Late in 1993, f.o.b. Vancouver prices for sulphur were at their lowest level in the last 20 years. Entering 1994, quotations were between US\$25 and \$30/t. In the first half, prices went up by US\$7-\$10/t while Canadian export sales were relatively flat compared to the previous year, reflecting a combination of higher offshore demand and discipline on the part of Canadian suppliers. By June 1994, prices were around US\$42-\$50/t, a 50% increase over December 1993. In the second half, strong sales commitments in offshore markets provided solid ground for another price increase which, by year-end, lifted the Vancouver quotations by an additional US\$10/t to US\$52-\$63/t. The net increase in 1994 was US\$27/t, doubling the January 1993 prices. The gap between spot and contract prices rose gradually from US\$1/t in January to close to US\$10/t in June, then stabilized at US\$7/t for the rest of the year.

Prices in North American markets increased very gradually as a result of stronger offshore prices and firmer demand in North America. At the beginning of 1994, prices for liquid sulphur (free on rail (f.o.r.) Alberta) varied between US\$0/t and \$2/t. Quotations remained unchanged until March, when new prices reflected the improving situation in both offshore and North American markets. In North America, higher utilization rates in the phosphate fertilizer industry pushed up prices in the Florida market, resulting in a subsequent increase in the f.o.r. Alberta prices to a range of US\$4-\$7/t in the second and third quarters. In the fourth quarter, tightness in supply in the United States and a sustained strong demand from phosphate fertilizer producers led to another increase in prices, reaching US\$5-\$12/t.

**Figure 1**  
**Canada, Sulphur Price Quotations, 1980-94**  
 f.o.b. Vancouver Contract



Source: Natural Resources Canada.

## USES

The principal use of about 60% of all sulphur consumed in the world is as a process agent in the manufacture of fertilizers such as superphosphate, ammonium phosphate, and ammonium sulphate. The second largest consuming sector is the chemical industry, where sulphur is used as sulphuric acid in products ranging from pharmaceuticals to synthetic fibres. Other consumers of sulphur include manufacturers of pulp and paper, iron and steel, nonferrous metals, and titanium dioxide pigments. These consuming industries use sulphur in the form of sulphuric acid, which accounts for almost 90% of total sulphur consumption. (Some 60% of sulphuric acid consumption is in fertilizers.) Manufactured products that require sulphur in non-acid form in their production include insecticides and fungicides, pulp and paper, photography, leather products, rayon, and rubber.

## OUTLOOK

In 1995, world demand for sulphur will continue to improve, subject to phosphate fertilizer consumption remaining strong in the importing consuming countries of China and India. Phosphate demand in developing countries is forecast to increase by close to 6% and to be static in developed countries. In Central Europe and the C.I.S., phosphate consumption will grow marginally. Overall world demand for phosphate fertilizers is projected to increase by 4.4%, with expectations of strong consumption in China, India and Brazil. Increased production and trade in finished and semi-finished phosphate fertilizers will

translate into additional demand for elemental sulphur, in particular in Mexico, Tunisia, South Africa, Senegal, and India. Sulphur consumption is expected to remain stable in Indonesia, Japan, the C.I.S., and Morocco, while declines are projected in South Korea and the United States. World sulphur consumption is forecast to increase by 2.5% (+0.8 Mt) in 1995 to reach 34.8 Mt. This increase will be mainly led by the fertilizer sector; demand is predicted to remain relatively flat in the non-fertilizer sector.

World elemental sulphur production is forecast to continue to grow by 7% (+2.5 Mt) in 1995 to reach 37.9 Mt. Frasch sulphur production is expected to decrease marginally with declines in the United States not being offset by a small increase in Poland. Recovered sulphur production will continue to grow as more gas- and oil-related projects are developed worldwide. Recovered sulphur production is expected to reach 32.5 Mt, a 9% increase over 1994. This 2.7-Mt increase will come from both gas processing (+1.6 Mt) and oil refining (+1.0 Mt). Higher sulphur production is anticipated in the C.I.S. (+0.8 Mt), Canada (+0.4 Mt), Germany (+0.3 Mt), and the United Arab Emirates (+0.2 Mt). Uncertainties remain regarding the possible reactivation of Iraqi sulphur exports pending the end of United Nations trade sanctions. (Iraq could bring into the marketplace more than 0.6 Mt from its Mishraq mine and unknown quantities from stocks.) Exports from the C.I.S. are expected to increase in 1995 as more product is formed and available to the Mediterranean markets. Accrued production from the Middle East would compensate for a reduction in export capability from Saudi Arabia following the depletion of its stocks. In 1995, Canadian sulphur production is

projected at 8.3 Mt, a 0.2-Mt increase related to gas processing; production from oil sands and crude oil is expected to grow marginally in 1995.

In the medium term, Canadian sulphur production is forecast to reach 8.7 Mt/y by 1998, and close to 9.0 Mt by 2000. Sulphur production from gas is set to increase as a result of strong demand being forecast for Canadian gas in both domestic and U.S. markets, and subsequent developments related to expansion and additional processing capacity in British Columbia and Alberta. Between 1994 and 2000, demand for western Canadian gas is expected to increase by 15% to reach close to 151 000 million m<sup>3</sup> by 2000. Derived sulphur production from natural gas in Alberta will range between 6.3 and 6.6 Mt/y; this level would assume that close to 45 000 million m<sup>3</sup> of sour gas will be found and tied in. In British Columbia, gas-related sulphur production is forecast at close to 1.2 Mt/y by 1998 and 1.4 Mt/y in 2000. Sulphur recovery from oil sands is expected to grow as developments at both oil sands operations come on stream; sulphur production is expected to reach 0.7 Mt/y by the end of the decade. Sulphur production from oil refining is projected to be 0.4 Mt/y by 2000.

In the medium term, the International Fertilizer Industry Association of Paris forecasts that world elemental sulphur demand will grow at an annual rate of 2.2% between 1994 and 1998 to reach 35.5 Mt/y in 1998. Sulphur consumption in non-acid applications is projected at 4.3 Mt/y in 1998, a total increase of 6% from 1994. Sulphur consumption in fertilizers is forecast to grow at close to 2.3%/y between 1994 and 1998 to about 31.2 Mt/y by 1998. World consumption of sulphuric acid for the manufacture of fertilizers is forecast to grow at an annual rate of 3.7% between 1994 and 1998 to reach 96.3 Mt H<sub>2</sub>SO<sub>4</sub> by 1998.

Potential world production in 1998 for elemental sulphur is estimated at between 43 and 44 Mt, a 29% increase overall over 1994. Frasch production is expected to increase by 11% in the 1994-98 period,

taking into account the resurgence of Iraq's Frasch production. Recovered sulphur output is forecast to grow by 26% overall. Over the next four years, world supply/demand will remain unbalanced with annual surpluses above 5.0 Mt/y; most of these surpluses will occur in Canada and the C.I.S. Exacerbating this sustained imbalance is the prospect of major increases in involuntary sulphuric acid production from smelters. Smelter acid production is forecast to grow by 23% between 1994 and 1998, reaching 36.9 Mt H<sub>2</sub>SO<sub>4</sub>, as more stringent regulations are applied to metal smelting and refining. In light of limited opportunities for alleviating these sustained surpluses in elemental sulphur, more suppliers are contemplating the potential for substituting pyrite-based acid with elemental sulphur-based acid. World production in 1994 of acid based on pyrite equated to 6.0 Mt of elemental sulphur. Pyrite production occurred mainly in China (67%), the C.I.S. (14%), Western Europe (11%), and South Africa (5%). Production in Western Europe is declining in Italy and Spain, and is forecast to account for less than 9% in 1998. Production is forecast to increase almost exclusively in China where pyrite acid production will rise by 22% between 1994 and 1998 to reach 13.9 Mt H<sub>2</sub>SO<sub>4</sub> (or 4.5 Mt as elemental sulphur). The displacement of pyrite by elemental sulphur appears to be an economically attractive and feasible proposition. However, it would require considerable technical, social and financial commitments which are not yet present in pyrite-producing countries.

*Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 60. (2) Information in this review was current as of February 1, 1995.*

## TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2503.00	Sulphur of all kinds, other than sublimed sulphur, precipitated sulphur and colloidal sulphur				
2503.10.00	Crude or unrefined sulphur	Free	Free	Free	Free
2503.90.00	Other	Free	Free	Free	Free
2802.00.00	Sulphur, sublimed or precipitated; colloidal sulphur	Free	Free	Free	Free
2807.00.00	Sulphuric acid; oleum	Free	Free	Free	Free
2811.23.00	Sulphur dioxide	Free	Free	Free	Free

Sources: Customs Tariff, effective January 1995, Revenue Canada; Harmonized Tariff Schedule of the United States, 1995.

TABLE 1. CANADA, SULPHUR SHIPMENTS AND TRADE, 1993 AND 1994

Item No.	1993		1994p		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
<b>SHIPMENTS<sup>1</sup></b>					
	Sulphur in smelter gases <sup>2</sup>	856 236	109 380	938 333	95 883
	Elemental sulphur <sup>3</sup>	5 220 304	9 804	5 793 071	91 295
	Total sulphur content	6 076 540	119 184	6 731 404	187 178
<b>IMPORTS</b>					
2503.10	Sulphur, crude or unrefined				
	United States	140	36	370	51
	France	79	21	-	-
	Total	219	57	370	51
2503.90	Sulphur, n.e.s.				
	United States	7 132	2 593	2 724	827
	Germany	181	71	16	6
	Netherlands	-	-	2	...
	United Kingdom	-	-	11	4
	Total	7 313	2 664	2 753	838
2802.00	Sulphur sublimed or precipitated; colloidal sulphur				
	United States	783	275	895	316
	France	275	206	378	283
	Germany	2	1	7	5
	Total	1 061	483	1 280	605
2807.00	Sulphuric acid; oleum				
	United States	95 721	7 348	68 130	5 891
	Taiwan	-	-	76	9
	Germany	8	1	28	3
	Mauritius	-	-	9	1
	Japan	-	-	1	...
	Singapore	-	-	1	...
	Switzerland	-	-	7	...
	United Kingdom	62	8	5	...
	Portugal	-	-	4	...
	South Korea	15	58	-	-
	Total	95 806	7 415	68 261	5 908
2811.23	Sulphur dioxide				
	United States	410	149	252	96
	Germany	3	2	-	-
	United Kingdom	...	...	2	1
	Switzerland	-	-	9	5
	Total	414	151	262	102
<b>EXPORTS</b>					
2503.10	Sulphur, crude or unrefined				
	United States	1 505 427	49 938	1 113 091	67 522
	Morocco	788 607	29 829	855 098	41 351
	Brazil	427 466	20 002	542 416	34 467
	South Africa	230 613	8 068	369 634	19 141
	Tunisia	99 163	5 700	297 187	18 417
	Indonesia	303 107	13 403	339 030	16 195
	People's Republic of China	114 648	7 539	246 422	11 812
	New Zealand	134 020	6 030	189 242	8 748
	Israel	205 283	7 705	220 887	8 469
	Mexico	32 188	918	117 763	6 811
	Australia	52 858	2 219	108 982	6 217
	India	-	-	112 201	5 365
	Other countries	266 523	11 445	431 751	23 367
	Total	4 159 903	162 806	4 943 704	267 893
2503.90	Sulphur, n.e.s.				
	United States	28 818	3 127	39 553	4 059
	New Zealand	5 156	149	-	-
	Total	33 974	3 276	39 553	4 059



TABLE 1 (cont'd)

Item No.	1993		1994 <sup>p</sup>			
	(tonnes)	(\$000)	(tonnes)	(\$000)		
<b>EXPORTS (cont'd)</b>						
2802.00	Sulphur, sublimed or precipitated; colloidal sulphur United States		90	11	159	46
	Total		90	11	159	46
2807.00	Sulphuric acid; oleum					
	United States		1 368 794	61 175	1 679 828	93 507
	Taiwan		9	18	16	39
	Bermuda		24	3	259	34
	Grenada		14	6	5	2
	Costa Rica		—	—	2	2
	St. Vincent and the Grenadines		9	2	3	1
	Other countries		162	27	12	. . .
	Total		1 369 012	61 237	1 680 124	93 591
2811.23	Sulphur dioxide					
	United States		62 545	12 488	66 243	15 780
	Total		62 545	12 488	66 243	15 780

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified; <sup>p</sup> Preliminary.

<sup>1</sup> Data compiled regardless of origin (i.e., domestic and foreign source materials). <sup>2</sup> Sulphur in liquid SO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub> recovered from the smelting of metallic sulphides and from the roasting of zinc-sulphide concentrates. <sup>3</sup> Producers' shipments of elemental sulphur produced from natural gas; also included are small quantities of sulphur produced in the refining of domestic crude oil and synthetic crude oil.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, SULPHUR SHIPMENTS AND TRADE, 1983-94

	Pyrites	Shipments <sup>1</sup>			Imports <sup>2</sup>	Exports <sup>2</sup>
		In Smelter Gases	Elemental Sulphur	Total	Elemental Sulphur	Elemental Sulphur
(tonnes)						
1983	—	678 286	6 631 123	7 309 409	2 365	5 670 275
1984	—	844 276	8 352 978	9 197 254	3 019	7 326 847
1985	—	822 359	8 102 163	8 924 522	3 167	7 848 380
1986	—	758 141 <sup>r</sup>	6 953 298 <sup>r</sup>	7 711 439 <sup>r</sup>	10 763	6 257 054
1987	—	783 115	7 322 791	8 105 906	24 711	6 571 800
1988	—	867 800 <sup>r</sup>	8 106 641	8 974 441 <sup>r</sup>	21 825	7 384 160
1989	—	831 503 <sup>r</sup>	6 868 930	7 700 433 <sup>r</sup>	18 311	5 514 059
1990	—	879 149 <sup>r</sup>	6 873 495	7 752 644 <sup>r</sup>	13 203	6 057 523
1991	—	883 565 <sup>r</sup>	6 937 884	7 821 449 <sup>r</sup>	9 026	5 845 372
1992	—	914 978 <sup>r</sup>	6 393 932	7 308 910 <sup>r</sup>	8 645	5 653 506
1993	—	856 236	5 220 304	6 076 540	7 532	4 193 877
1994 <sup>p</sup>	—	938 333	5 793 071	6 731 404	3 123	4 983 257

Sources: Natural Resources Canada; Statistics Canada.

— Nil; <sup>p</sup> Preliminary; <sup>r</sup> Revised.

<sup>1</sup> Shipment data compiled regardless of origin (i.e., domestic and foreign source materials). <sup>2</sup> Includes only elemental sulphur in a crude or refined form.

TABLE 3. CANADA, NATURAL SOUR GAS PROCESSING PLANTS, SULPHUR CAPACITY, 1991-94

Operating Company	Source Field or Plant Location	H <sub>2</sub> S in Raw Gas (percent)	Daily Sulphur Capacity <sup>1</sup> (tonnes)			
			1991	1992	1993	1994
<b>SOUR GAS, ALBERTA</b>						
Alberta Energy Company Ltd.	Sinclair-Hythe	3	256	256	256	256
Amerada Hess Corporation	Olds-Garrington	14	389	389	389	389
Amoco Canada Petroleum Company Ltd.	Bigstone Creek	15	385	385	385	385
Amoco Canada Petroleum Company Ltd.	Caroline North-Garrington	0.3	10.4	10.4	10.4	10.4
Amoco Canada Petroleum Company Ltd.	Caroline South-Harmattan	0.4	8	8.3	8.6	8.6
Amoco Canada Petroleum Company Ltd.	East Crossfield-Elkton	34	1 797	1 797	1 797	1 797
Amoco Canada Petroleum Company Ltd.	Kaybob I/II-Fir	8	1 090	1 090	1 090	1 090
Amoco Canada Petroleum Company Ltd.	Windfall-Whitecourt	12	1 333	1 333	1 333	1 333
Canadian Occidental Petroleum Ltd.	Mazeppa-Okotoks-Medallion	25	577	577	577	577
Canadian Occidental Petroleum Ltd.	Paddle River	0.1	19	19	19.4	19.4
Chevron Canada Resources Limited	Kaybob South III-Obed	8	3 557	3 557	3 557	3 557
Chevron Canada Resources Limited	Medicine Lodge	7.5	45	55.9	55.9	55.9
Chevron Canada Resources Limited	Nevis	4	197	196.6	245.8	215.0
Gulf Canada Limited	Brazeau River-Nordegg	1.7	46.5	46.5	46.5	46.5
Gulf Canada Limited	Brazeau River-Peco	1.3	110	110	110	110
Gulf Canada Limited	Homeglen-Rimbey	0.5	128	127.5	127.5	127.5
Gulf Canada Limited	Strachan	9	953	953	953	953
Home Oil Company Limited	Carstairs	0.5	65	64.8	64.8	64.8
Husky Oil Ltd.	Rainbow Lake	2	142	142	142	142
Husky Oil Ltd.	Ram River (Ricinus)	16.5	4 572	4 572	4 572	4 572
Imperial Oil Resources Limited	Bonnie Glen	0.4	34.5	34.5	34.5	34.5
Imperial Oil Resources Limited	Quirk Creek	9	301	301.2	301.2	301.2
Imperial Oil Resources Limited	Redwater	3	11	11	11	11
Mobil Oil Canada, Ltd.	Harmattan-Elkton-Leduc	52	66	66.2	66.2	66.2
Mobil Oil Canada, Ltd.	Lone Pine Creek	13.5	162	162	162	162
Mobil Oil Canada, Ltd.	Wimborne	10.5	182	182	182	182
Morisson Petroleum Limited	Savannah Creek (Coleman)	12	389	389	389	389
Norcen Energy Resources Limited	Minnehik-Buck Lake	0.1	45	45	45	45
North Canadian Oils Limited	Progress	0.7	16	14.5	14.5	49.5
OMV (Canada) Ltd.	Rainbow-Fire	1.0	20	19.9	19.9	19.9
Pembina Corporation	Turner Valley	1.2	16	15.9	15.5	15.5
Pennzoil Co.	Zama	4	74	74	74	74
Petro-Canada Inc.	Brazeau River-Peco	21	447.3	447.3	447.3	447.3
Petro-Canada Inc.	Gold Creek	2.4	43	43	43	43
Petro-Canada Inc.	Hanlan Robb	8	1 092	1 092	1 092	1 092
Petro-Canada Inc.	Wildcat Hills	7	280	280.3	280.3	280.3
Petrogas Processing Inc.	East Calgary-Balzac	16	1 696	1 696	1 696	1 696
Poco Petroleum Ltd.	Sturgeon Lake South	9.5	98	98	98	98
Shell Canada Limited	Burnt Timber Creek	13	489	489	489	489
Shell Canada Limited	Caroline	25	-	4 504	4 504	4 504
Shell Canada Limited	Caroline-Bearberry	90	228	228	-	-
Shell Canada Limited	Jumping Pound	7.5	597	597	597	597
Shell Canada Limited	Waterton	15	3 107	3 107	3 107	3 107
Suncor Inc.	Rosevear North	8	111	111.3	111.3	111.3
Suncor Inc.	Rosevear South	6.5	171	171	171	171
Suncor Inc.	Simonette River	5.5	95	95	95	95
Talisman Energy Inc.	Edson-Pine Creek	1.4	292	292	292	292
Talisman Energy Inc.	Teepee Creek	0.4	30	23	23	23
Wolcott Gas Processing Ltd.	W. Pembina-Brazeau	11	520	520	520	520
<b>SOUR GAS, BRITISH COLUMBIA</b>						
Amerada Hess Corporation	Boundary Lake	-	3.7	3.7	3.7	3.7
Amoco Canada Petroleum Company Ltd.	Cypress	-	14.1	14.1	14.1	14.1
Westcoast Energy Inc.	Fort Nelson	2	674	674	674	674
Westcoast Energy Inc.	Taylor Flats-McMahon	1.6	460	558	558	558
Westcoast Energy Inc.	Pine River	12	1 055	1 070	1 085	2 000

Source: Energy Resources Conservation Board publication, January 1995.

- Nil.

<sup>1</sup> Maximum design capacity.

**TABLE 4. CANADA, CRUDE OIL AND OIL SANDS REFINERY SULPHUR CAPACITIES OPERATING IN 1992-94**

Operating Company	Location	Daily Capacity		
		1992	1993	1994
(tonnes)				
<b>CRUDE OIL REFINERIES</b>				
Canadian Ultramar Limited	St. Romuald, Quebec	50	50	50
Chevron Canada Limited	Burnaby, British Columbia	10	10	10
Imperial Oil Limited	Dartmouth, Nova Scotia	76	76	76
	Edmonton, Alberta	40	40	40
	Nanticoke, Ontario	35	35	35
	loco, British Columbia <sup>1</sup>	20	20	–
	Sarnia, Ontario	140	140	140
Irving Oil Limited	Saint John, New Brunswick	100	100	100
Petro-Canada Products Inc.	Edmonton, Alberta	56	56	56
	Lake Ontario-Mississauga, Ontario	44	44	44
	Lake Ontario-Oakville, Ontario	40	40	40
	Port Moody, British Columbia <sup>2</sup>	25	–	–
Shell Canada Limited	Burnaby, British Columbia <sup>2</sup>	15	–	–
	Sarnia, Ontario	35	35	35
	Scotford, Alberta	14	14	14
Sulconam Inc.	Montréal, Quebec	300	300	300
Suncor Inc.	Sarnia, Ontario	50	50	50
Total effective capacity		1 050	1 010	990
<b>HEAVY OIL UPGRADERS</b>				
Consumers' Co-operative Refineries Limited	Regina, Saskatchewan	220	220	220
Husky Oil Operations Ltd.	Lloydminster, Saskatchewan	250	250	250
Total effective capacity		470	470	470
<b>OIL SANDS PLANTS</b>				
Suncor Inc.	Mildred Lake, Alberta	850	850	850
Syncrude Canada	Fort McMurray, Alberta	1 255	1 255	1 255
Total effective capacity		2 105	2 105	2 105

Sources: Natural Resources Canada; company interviews, 1994.

– Nil.

<sup>1</sup> Operation shut down in 1994. <sup>2</sup> Operation shut down in 1993.

**TABLE 5. CANADA, PRINCIPAL SULPHUR DIOXIDE AND SULPHURIC ACID PRODUCTION CAPACITIES, 1994**

Operating Company	Plant Location	Raw Material	Annual Capacity		
			Liquefied SO <sub>2</sub>	Sulphuric Acid <sup>1</sup>	Sulphur Equivalent <sup>2</sup>
			(000 tonnes)		
<b>EASTERN CANADA</b>					
Brunswick Mining and Smelting Corporation Limited	Belledune, N.B.	SO <sub>2</sub> lead and zinc conc.		176	58
CE Zinc	Valleyfield, Que.	SO <sub>2</sub> zinc conc.		430	140
Falconbridge Limited	Kidd Creek, Ont.	SO <sub>2</sub> zinc conc.		220	72
	Kidd Creek, Ont.	SO <sub>2</sub> copper conc.	30	470	168
	Sudbury, Ont.	SO <sub>2</sub> nickel conc.		355	116
Gaspé Copper Mines, Limited	Murdochville, Que.	SO <sub>2</sub> copper conc.		165	54
Inco Limited	Copper Cliff, Ont.	SO <sub>2</sub> pyrrhotite and nickel conc.		1 000	325
	Copper Cliff, Ont.	SO <sub>2</sub> copper conc.	100	n.a.	50
Noranda Copper Smelting and Refining	Rouyn-Noranda, Que.	SO <sub>2</sub> copper conc.		450	147
Sulco Chemicals Ltd.	Elmira, Ont.	Elem. sulphur		33	11
Subtotal			130	3 299	1 141
<b>WESTERN CANADA<sup>3</sup></b>					
Border Chemical Company Limited	Transcona, Man.	Elem. sulphur		150	49
Cameco Corporation-Rabbit Lake Operation	Rabbit Lake, Sask.	Elem. sulphur		72	23
Cameco Corporation-Key Lake Operation	Key Lake, Sask.	Elem. sulphur		72	23
Cominco Ltd. <sup>4</sup>	Trail, B.C.	SO <sub>2</sub> lead and zinc conc.	80	430	210
Hudson Bay Mining and Smelting Co.	Flin Flon, Manitoba	SO <sub>2</sub> zinc conc.		n.a.	35
Sherritt Inc.	Fort Saskatchewan, Alta.	Elem. sulphur		233	75
Sherritt Inc.	Redwater, Alta.	Elem. sulphur		910	297
Westcoast Energy Inc.	Prince George, B.C.	Elem. sulphur	30	75	40
Subtotal			110	1 942	752
Total Canada			240	5 241	1 893

Sources: Natural Resources Canada; Canadian company interviews, 1994.

n.a. Not applicable.

<sup>1</sup> 100% H<sub>2</sub>SO<sub>4</sub>. <sup>2</sup> Elemental sulphur equivalent of sulphuric acid is 32.7% and sulphur equivalent of liquefied SO<sub>2</sub> is 50%. <sup>3</sup> Marsulex Inc. idled its 160 000-t/y acid plant in Fort Saskatchewan in 1993. <sup>4</sup> Cominco operation at Trail also has a 30 000-t/y production capacity for elemental sulphur, which has been added to the total sulphur equivalent production capacity of Cominco.

**TABLE 6. CANADA, SULPHURIC ACID PRODUCTION, TRADE AND APPARENT CONSUMPTION, 1983-93**

	Production	Imports	Exports	Apparent Consumption
	(tonnes, 100% acid)			
1983	3 686 427	126 573	273 204	3 539 796
1984	4 043 389	28 330	553 780	3 517 939
1985	3 890 092	17 306	744 732	3 162 666
1986	3 536 062	29 127	755 606	2 809 583
1987	3 436 977	44 623	803 178	2 678 422
1988	3 804 856	40 078	851 622	2 993 312
1989	3 718 578	28 433	978 190	2 768 821
1990	3 829 570	71 319	1 280 502	2 620 387
1991	3 675 839	79 207	1 265 740	2 489 306
1992	3 776 086	86 284	1 340 213	2 522 157
1993	3 779 142	95 806	1 556 557	2 318 391

Sources: Natural Resources Canada; Statistics Canada.

**TABLE 7. CANADA, SULPHURIC ACID, REPORTED CONSUMPTION BY END USE, 1991-93**

	1991	1992	1993p
	(tonnes)		
Agricultural chemicals and fertilizers	1 120 460	1 164 240	1 081 250
Pulp and paper	336 531	338 411	381 998
Industrial inorganic chemicals	424 615	336 211	291 459
Nonferrous smelting and refining	84 049	118 712	129 923
Uranium mines	123 896	122 723	111 830
Crude and refined petroleum products	41 971	34 812	38 290
Other mines, metal and nonmetal	30 154	25 261	35 422
Soap and cleaning compounds	16 829	25 542	25 881
Metal rolling and extruding	11 613	7 120	5 950
Electrical products	5 722	3 529	3 298
Food, brewery and distillery	1 449	2 077	3 260
Plastics and synthetic resins	653	2 747	792
Leather and textile	24 178	20 302	168
Other end uses	102 767	99 943	113 478
Total	2 324 887	2 301 630	2 222 999

Source: Reports from producing companies, compiled by Natural Resources Canada.  
 p Preliminary.

**TABLE 8. WORLD PRODUCTION OF SULPHUR, 1991-93**

	1991 <sup>r</sup>		1992 <sup>r</sup>		1993 <sup>p</sup>	
	All Forms <sup>1</sup>	Elemental	All Forms	Elemental	All Forms	Elemental
(000 tonnes)						
<b>WESTERN EUROPE</b>						
Finland	648	42	617	46	622	32
France	1 238	1 013	1 222	988	1 326	1 073
Germany	2 108	1 396	2 266	1 350	2 313	1 451
Italy	700	330	630	310	639	350
Netherlands	380	243	401	273	421	298
Spain	938	85	877	159	810	180
Others	1 480	662	1 419	659	1 269	677
Total, Western Europe	7 492	3 771	7 432	3 785	7 400	4 061
<b>CENTRAL EUROPE</b>						
Poland	4 092	3 912	3 145	2 952	2 103	1 901
Others	916	105	848	130	645	155
Total, Central Europe	5 008	4 017	3 993	3 082	2 748	2 056
<b>FORMER SOVIET UNION</b>						
	8 281	5 335	8 253	5 390	6 671	3 991
<b>AFRICA</b>						
South Africa	556	140	575	167	635	188
Others	223	3	236	4	196	4
Total, Africa	779	143	811	171	831	192
<b>NORTH AMERICA</b>						
Canada	7 060	6 205	7 396	6 521	8 498	7 608
United States	11 619	9 513	11 604	9 368	11 643	9 499
Total, North America	18 679	15 718	19 000	15 889	20 141	17 107
<b>LATIN AMERICA</b>						
Mexico	2 058	1 791	1 784	1 484	1 240	900
Others	1 004	335	1 022	388	1 170	489
Total, Latin America	3 062	2 126	2 806	1 872	2 410	1 389
<b>MIDDLE EAST</b>						
Iran	744	744	763	763	795	795
Iraq	500	500	500	500	500	500
Kuwait	0	0	0	0	246	246
Saudi Arabia	1 640	1 640	1 650	1 650	1 650	1 650
Other	212	212	235	235	269	269
Total, Middle East	3 096	3 096	3 148	3 148	3 460	3 460
<b>ASIA</b>						
China	5 907	313	6 512	307	6 363	310
Japan	2 762	1 244	2 887	1 341	3 063	1 510
South Korea	298	54	375	124	498	212
Others	1 036	361	984	374	1 061	452
Total, Asia	10 003	1 972	10 758	2 146	10 985	2 484
<b>OCEANIA</b>						
	312	43	356	47	373	57
Total World	56 712	36 221	56 557	35 530	55 019	34 797

Source: The British Sulphur Corporation Limited, 1994.

<sup>p</sup> Preliminary; <sup>r</sup> Revised.<sup>1</sup> All forms includes elemental sulphur, sulphur contained in pyrites, and contained sulphur recovered from metallurgical waste gases, mostly in the form of sulphuric acid.