Salt

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DOMESTIC PRODUCTION AND DEVELOPMENTS

In 1994, Canadian salt production was estimated at 11.5 Mt, a 5.2% increase over 1993. Most of this increase was due to increased production in rock salt. Estimated Canadian shipments of all types of salt in 1994 were 11.68 Mt, a 6.2% increase over 1993 shipments of 10.99 Mt. In 1994, shipments from Ontario accounted for 58% of all shipments, a slight decrease over 1993 shipments. Rock salt shipments accounted for 76% of total shipments, followed by salt in brines (17%) and evaporated salt (7%). The average unit value of salt shipments was estimated at $25.24/t, a 1% decrease over that of 1993. Salt production capacity in Canada increased very marginally in 1994 to 13.28 Mt, of which rock salt accounted for 76%, followed by captive brines (17%) and evaporated salt (7%). In 1994, rock salt mines operated at 88% of capacity; captive brining plants and evaporated salt facilities operated at 87% and 85%, respectively. Salt operations overall ran at an average rate of 88% of capacity, compared to 83% in 1993. Sales of salt products for de-icing purposes were good all across the country in the second half of the 1993/94 winter due to very harsh weather conditions. However, sales of salt products for de-icing purposes were soft, especially in eastern Canada, in the first half of the 1994/95 winter due to very mild conditions with limited precipitation.

The year 1994 was a turning point for the Canadian pulp and paper industry, which is one of the largest end users for chloralkali. Pulp mills operated at 94% of capacity in 1994, compared to 87% in 1993. Mills are expected to operate at close to full capacity in 1995. Canadian shipments of pulp, paper and paperboard rose 9.3% to 28.9 Mt in 1994, while exports increased by 10% over 1993, with the strongest markets being in Asia. According to the Canadian Pulp and Paper Association, shipments are forecast to rise by 3.8% to 30 Mt in 1995.

Chlorine continued to be under scrutiny with respect to its use in solvents (chlorofluorocarbons), in drinking water disinfection, and in pulp bleaching. Some Canadian pulp and paper producers are being required to abandon the use of chlorine if they wish to retain some of their markets. In North America, by 1995, caustic soda is forecast to represent 49.0% of bleaching chemical usage; chlorine will be reduced to 22.5% and sodium chlorate will account for 20.9%. The imbalance between chlorine and caustic soda may be shifting again in favour of caustic soda. In 1994, spot prices for caustic soda in the United States increased from a low of less than US$50/t to a value of about US$300/t, while chlorine prices continued to display some strength at about US$250/t. Producers of natural soda ash are also penetrating the caustic soda market, which may, in the end, reverse the imbalance between chlorine and caustic soda. The Canadian market for PVC (polyvinyl chloride) and its feedstocks (ethylene dichloride-EDC and vinyl chloride monomer-VCM) was still affected by the weakness of the construction sector; however, PVC output grew by about 10% due to increased foreign demand.

Sodium chlorate is considered to be the primary substitute for chlorine bleaching in pulp mills as it is the feedstock for the production of chlorine dioxide. No new sodium chlorate plants came on stream in 1994 as existing facilities had been operating at reduced capacity in 1993. In 1994, Canadian production of sodium chlorate was up by about 15% over the previous year, and is expected to experience similar growth in 1995 as a result of the improved performance forecast for the pulp and paper industry.

Atlantic Region

Salt production in the Atlantic provinces was from an underground rock salt mine at Pugwash, Nova Scotia; an underground potash and salt mine at Sussex, New Brunswick; and a brining operation near Nappan, Nova Scotia.

In Nova Scotia, The Canadian Salt Company Limited operates an underground rock salt mine at Pugwash in Cumberland County with a rated capacity of approximately 1.2 Mt/y. Most of the salt from this mine is used for snow and ice control. At the evaporated salt plant, saturated brine is fed to a quadruple effect vacuum pan, rated at 13 t/h, where brine solution is evaporated to produce high-quality salt crystals for use in the chemical and food industries. The

Canadian Salt Company Limited also owns a bagging operation located at Shelbourne and North Sydney, which is used at capacity for the bagging of solar salt supplied from the company's facility in the Bahamas.

In New Brunswick, Potash Corporation of Saskatchewan Inc. (New Brunswick Division) produced potash and salt at its underground mine near Sussex. Salt is extracted at a rate of about 500 000 t/y and is sold mainly to the eastern United States and eastern Canada under a sales contract with Akzo Salt Limited. Reserves are estimated to be large enough to operate for as long as potash is extracted, which is at least 25 years. In 1994, about 95% of production was used in road de-icing and the remainder was for chemical use. The mine is now using the integrated method of utilizing salt tailings underground as fill to support the salt and potash mining operation. Approximately 1.5 Mt of processed salt tailings and rock-salt screen rejects are sent directly to active cut-and-fill potash stopes to be used as backfill. Clay slimes and excess brine slurries from the processing plant are also piped underground to be discharged into large cavities created by the extraction of rock salt. After the solids have settled, the clear brine solution is re-pumped to the surface for re-use. The entire operation results in a closed circuit or "zero effluent" system.

Sifto Canada Inc., a division of North American Salt Co., has a brining operation at Nappan in Cumberland County, Nova Scotia. Evaporated salt products are sold for table salt, fisheries, and water conditioning.

Quebec

There is only one operating producer in Quebec, Seleine Mines Inc., located on the Magdelen Islands. The 173-m level is almost mined out and is expected to last until the end of 1995; development work on the 255-m and 268-m levels is now complete. Each level contains reserves of about 8 Mt, which are sufficient to last about five years. Optimization of the crushing circuit has also been completed, which resulted in an increase in recovery of about 5%. Seleine Mines Inc. is owned by The Canadian Salt Company Limited.

Ontario

In 1994, salt was produced from two underground rock salt mines, Goderich and Ojibway, and from brining operations at Goderich, Windsor and Amherstburg. Salt is extracted from the Salina formation.

At Goderich, Sifto Canada Inc. operated an underground rock salt mine. Mining is currently conducted approximately 537 m below the surface, 2.5 km offshore Lake Huron. Reserves are estimated to be about 240 Mt and the mine has an annual capacity of 3.7 Mt of salt products, a 12% increase over the 1993 capacity. The mine continued its conversion to the bench mining technique; the conversion is expected to be completed by the spring of 1995. This conversion is responsible for the increased capacity. Sifto's salt is marketed mainly for ice control and is sold primarily in eastern Canada, the north-central United States (Great Lakes Basin), and regions accessible through the Mississippi River system. Salt produced at Goderich is also used by the chemical and water treatment industries. Evaporated salt is produced at the Sifto brining operation located near Goderich and is used mainly for the water-softening market.

The Canadian Salt Company Limited produced both rock salt from the Ojibway underground mine and vacuum salt products from brine wells near Windsor. The mine capacity is 2.5 Mt/y and current estimated reserves are 100 Mt. Rock salt is extracted using room-and-pillar mining methods from a 7.5-m unit of the Salina formation about 297 m below the surface. Brine is pumped from the 427-m and 457-m levels. Production is now taking place in the southwest portion of the 297-m level, within about 600 m of the shaft. Salt products include de-icing road salt (accounting for two thirds of production), and water softening, agricultural and chemical fine salt. The main markets are Canada and the midwestern United States for all salt products except chemical fine salt, which is marketed in Quebec for the manufacture of caustic soda and chlorine. The company has acquired the mineral rights to Fighting Island in the Detroit River; therefore, it now has sufficient reserves for at least 40 years.

In the vicinity of Amherstburg, General Chemical Canada Ltd. has operated a brining operation for the manufacture of sodium carbonate and by-product calcium chloride.

Prairie Provinces

In Saskatchewan, four companies produced salt from the Middle Devonian Prairies formation. International Minerals & Chemical Corporation (Canada) Limited (IMCC) supplied by-product rock salt from its potash operation at Esterhazy to Kayway Salt, who is distributing it locally for road de-icing. Kayway Salt is presently considering the U.S. market, especially North Dakota, Wisconsin and Montana. Sifto Canada Inc. operated a brining operation near Unity for the production of fine vacuum pan salt. Since the closure of its fused salt plant, the company has adopted the compaction method to produce water softener salt. Other uses of its salt include for agriculture and in food processing. The Canadian Salt Company Limited at Belle-Plaine produced evaporated salt from by-product brines sourced from an adjacent potash solution mine operated by Kalium Chemicals, a division of Kalium Canada, Ltd. Most of the production goes towards water softening; other uses include for agriculture and in food processing and ice control. Saskatoon Chemicals, a division of Weyerhaeuser Canada Ltd., produced brines from

wells near Saskatoon for the manufacture of caustic soda, chlorine and sodium chlorate to be used internally in its pulp and paper operations.

Nusalt Corporation processed salt-rich potash tailings from Potash Corporation of Saskatchewan's Rocanville operation. The potash tailings are dried and bulk delivered to local distributors for road de-icing. Other applications are for cattle feed and water softening. Nusalt is currently seeking new markets, such as the United States.

Central Canada Potash Limited began salt production in September 1992. Salt is recovered from its potash tailings and the reported capacity is 328 000 t/y. The main product is de-icing salt, which accounts for 80% of production; the remaining 20% is for general use. Products are mostly sold locally in British Columbia, Alberta and Saskatchewan. The company is now moving to the commercial market where its products can be found under the Canadian registered trademark "Sabre." Salt is bagged at three locations. The company is seeking new markets, both in Canada and the United States.

In Alberta, four producers operated brining operations. At Fort Saskatchewan near Edmonton, Dow Chemical Canada Inc. extracted salt brines for the manufacture of chloralkali and, at Lindberg, The Canadian Salt Company Limited produced fine vacuum pan salt. Near Bruderheim, two companies, Canadian Oxy Ltd. and Albchem Industries, operated solution mines to produce sodium chlorate used mostly for pulp bleaching in the prairie provinces and western Canada.

British Columbia

There was no production of salt in this province where three companies operated four chloralkali plants. These operations used solar salt imported from Mexico, the United States and Chile.

CONSUMPTION

In Canada, the apparent consumption of salt has averaged 9.0 Mt/y since the mid-1980s, a 30% increase compared to the early 1980s. In 1993, the apparent consumption of salt in Canada was estimated at 8.9 Mt, a 6% decrease over 1992. In 1993, imports, mainly in British Columbia, Ontario and Quebec, accounted for about 12% of total domestic consumption. Chemical and de-icing uses accounted for between 90% and 95% of Canadian consumption, with the remainder being used for water conditioning, food processing, fisheries, and other industrial uses. Most of the salt used as a de-icing agent is consumed in Ontario, Quebec and Atlantic Canada. Average yearly consumption of salt in Canada for ice and snow control ranges between 3.2 and 4.5 Mt.

Some 60% of world salt consumption is as a chemical raw material, followed by table salt (20%) and road de-icing salt (10%); the remaining 10% is used in animal feed and water treatment. The consumption pattern differs in North America where the chemical industry consumes about 56% of total production, followed by highway usage (24%) and the food industry (7%).

Chloralkali and Related Uses

The main news for the Canadian chloralkali industry is the upcoming closure of the ICI plant at Cornwall. The closure, which "is the result of technological, economic and environmental factors," was initially scheduled for the end of October 1994, but has now been postponed until the end of March 1995. The plant used the old mercury cell technology and had a capacity of 38 500 t of caustic soda and 35 000 t of chlorine. The plant was 60 years old and employed 50 people. To compensate for this closure, ICI is planning to boost the capacity of its Becancour plant by about 20 000-25 000 t/y.

The industrial chemicals industry consumes salt for the manufacture of chloralkali such as caustic soda (sodium hydroxide), chlorine, and sodium chlorate. Salt for four caustic soda and chlorine plants in Canada is obtained from on-site brining and natural brines; other plants use mined rock salt or imported solar or evaporated salt. Other industrial chemicals that require significant quantities of salt include sodium bicarbonate, sodium chlorite, sodium hypochlorite, sodium carbonate (soda ash), and calcium chloride.

Chlorine, which is a major market for salt, is the principal pulp-bleaching agent responsible for the presence of traces of dioxin (2, 3, 7, 8,-TCDD (tetrachlorodibenzo-p-dioxin)) and furan (2, 3, 7, 8,-TCDF (tetrachlorodibenzo-p-furan)) in certain pulp and paper mill effluents in North America. These chlorinated compounds have been identified as carcinogenic to some animals; however, their effect in small dosages on humans is the focus of controversy.

In 1994, the release of furans and dioxins was banned in pulp mill effluents in Canada. This is further to an announcement by the government in February 1991 requiring compliance by pulp and paper mills with new amendments to regulations under the *Fisheries Act*. These amendments establish new procedures for effluent measurement and, for the first time, make **all** mills in Canada, new and old, subject to regulations governing the discharge of suspended solids and oxygen-depleting substances. To obtain an extension beyond the December 31, 1993, deadline, a company should have demonstrated that it made all reasonable efforts to comply with these regulations. An extension will be subject to public consultation and ministerial approval. No extensions will be granted after December 31, 1995. Several mills have asked for extensions.

The degree to which dioxins present a toxicity hazard is currently the focus of debate in the United States,

Canada and Europe. In this regard, the U.S. Environmental Protection Agency (EPA) and the Centers for Disease Control in Atlanta have stated that there is new evidence suggesting that dioxin is not as potent a carcinogen as originally believed. However, in September 1994, the EPA released a draft of an extensive review of all available scientific information on dioxin and related compounds. In the conclusions of this draft it is stated that, "With regard to carcinogenicity, a weight-of-the-evidence evaluation suggests that dioxin and related compounds are likely to present a cancer hazard to humans," and that "based on all of the data reviewed in this reassessment and scientific inference, a picture emerges of TCDD and related compounds as potent toxicants in animals with the potential to produce a wide range of effects, some of which may be adverse, in humans at very low levels." This report has become very controversial; for example, the Committee of Applied Sciences of the French Academy of Sciences has published its own report (80 pages versus the 2000 pages published by the EPA) in which it stated that, "contrary to popular opinion, there is no evidence to suggest that dioxins and their related compounds constitute a major risk to public health." It also stated that "no fatal case of poisoning by these products has ever been reported" and that "current exposure is well below the daily acceptable dose" (set by the World Health Organization at 10 picograms/kilogram/day).

In Canada, a new study by the National Water Research Institute in Burlington found that there is no link between chronic biological changes in fish and effluents from all types of kraft mills, whether using chlorine as a bleaching agent or not. However, these findings are unlikely to change policies in Canada on dioxin as another study by Environment Canada found that pulp mill effluents are toxic and will endanger human life as long as chlorine is used, even if all dioxins were to be removed.

In early 1992, the province of British Columbia issued a regulation calling for the elimination of chlorine-compound pollution from pulp mills by the year 2002. Under this regulation, absorbable organic halides (AOX) should be reduced to 1.5 kg/t by 1995 and to zero by 2002. In 1993, the province of Ontario issued new rules for the pulp and paper industry. Under these rules, discharges of AOX should drop 40% from the current 2.5 kg/t by the end of 1995, and by a total of 68% by the end of 1999, bringing the total discharge of AOX to 0.8 kg/t. However, the Ontario regulation does not go as far as the British Columbia initiative as it does not call for the total elimination of AOX by the year 2002. Final decisions on this issue may take until the end of the decade. Currently, eight Ontario mills are still using chlorine.

In the United States, the EPA proposed a new rule to cut toxic air and water pollutants from about 350 pulp and paper mills. Under the proposed new rule, all dioxin discharges in water would be virtually eliminated. This new rule is to take effect in 1998.

Many mills in North America have continued the conversion of their bleaching process away from chlorine technology. A limit of 1.5 kg/t for AOX, which include furans and dioxins, would require a substitution level of up to 80-90% in older mills, and up to 60-70% in more recent mills.

Most mills in Canada have carried out extensive process modifications and improvements in effluent treatment. Several have opted to reduce chlorine usage by installing other bleaching processes such as extended lignification, oxygen delignification, sodium chlorate bleaching, integrated chlorine dioxide with hydrochloric acid recycling, and ozone and hydrogen peroxide bleaching processes. Although environmentalists consider sodium chlorate as a step in the right direction in the move away from chlorine, they still would like the pulp and paper industry to adopt dioxin-free bleaches, such as oxygen and hydrogen peroxide. It is estimated that the use of chlorine in Canadian pulp and paper mills has decreased by 65% in the last decade.

De-Icing

Sodium chloride, or salt, remains the primary de-icing agent. Different de-icers are used in accordance with site requirements. On streets and highways, rock salt, calcium chloride-salt mixtures, salt brines, and mechanical measures (plowing and blowing) are mostly used. On bridges, salt, sand-salt mixtures, and salt alternative methods are used; pavement heating and non-corrosive chemicals with corrosion inhibitors are under investigation. On runways and airways, non-corrosive compounds are used and comprise urea, formamide, and glycols. In residential and commercial areas, rock salt, potassium chloride (potash), calcium chloride, and various combinations of these materials with abrasives are regularly used. Calcium chloride is the second most used de-icer, being effective at temperatures ranging between –10° and –20°C; this chemical is usually mixed with salt at a 2-4% rate. The use of abrasives is mostly limited to highways and residential areas; a mixture of coarse sand and small crushed stone is spread to improve the skid resistance of slippery roads.

After the harsh winter conditions of 1993/94, the Salt Institute, in order to avoid shortages, engaged in a campaign to convince municipalities and local governments to increase their storage capacity, mainly in the northeastern United States. The desired tonnage would be one full year of supply.

Growing concerns over the environment and the corrosion of infrastructure, such as bridge decks and parking lots, have led to numerous experiments with de-icing salt substitutes. Research on alternatives has focused on abrasive mixes, magnesium chloride,

ammonium compounds, tetrapotassium pyrophosphates, calcium magnesium acetate (CMA), sodium formate, isopropyl alcohol, ethylene glycol, and technical urea. Studies have also been conducted on non-chemical treatments, including a series of measures that are mainly used in Europe such as ice-retardant pavement surfacing and roadway heating. The effects of salt-spreading on the environment depend on a variety of factors such as weather conditions, road characteristics, traffic loads, winter maintenance methods, and local topography. Environmental effects may include adverse impacts on plant growth and crop productivity in the immediate vicinity of highways, as well as higher salinity levels in streams and groundwater systems. For many years, provincial and regional agencies in charge of road maintenance have pursued the objective of optimizing the use and selection of ice and snow control methods. Cost, operational reliability, public safety, and environmental considerations have all resulted in improvements to existing methods and better road safety and rideability.

Tests by the Ontario Ministry of Transportation indicate that CMA is only effective at temperatures around –6° and –7°C. Although CMA has proven to be effective and environmentally safe, its temperature limitation and its price, which is about 30 times that of salt, will continue to limit its application. In 1991, the Research and Development Branch of the Ontario Ministry of Transportation published a paper presenting the results of research on highway de-icers. Several de-icers were compared; salt was still acknowledged to be the most efficient and least expensive de-icer for use in the province of Ontario.

Other Uses

Other sectors that consume salt include water softening, food processing, and the fisheries industry, which together account for close to 5% of total consumption in Canada. Salt consumption in Canada for water softening is estimated at 150 000-200 000 t/y. All Canadian production is consumed in the domestic market; trade in water-conditioning salt is estimated to be small. Typical annual consumption per household in Canada ranged between 350 and 450 kg/y of salt. The bulk of the water-softening market is reported to be located in suburban and rural areas where hard water is seldom treated on a large-scale basis. Some major municipalities in western Canada, such as Regina and Calgary, use water softeners extensively as the local water carries high calcium and magnesium concentrations. In 1994, the water treatment market in Canada was flat compared to the market in 1993. The residential water-softening market remained stable at $60 million. Salt sales in this market segment were estimated at about $20 million. The bottled water market continued to be important. Potassium chloride is also being introduced in the water treatment market as a substitute for salt. It is expected that within a few years sodium chloride and potassium chloride will share the water treatment market. Fused salt, which was a popular product for water softening, has been replaced by compacted salt pellets, nuggets and crystals; in some instances, coarse salt is used. Growth in this market is tied to housing starts and local water characteristics. New water treatment devices that do not use salt, such as electromagnetic equipment and catalytic units, have not yet been approved in Canada. As Canada moves out of the current recession, the water-softening market should show marginal growth in 1995.

The North American salt industry is currently investigating the potential of using salt in several cosmetic and body products, a market that has grown significantly in Japan where some body-shampoos can contain up to 50% salt.

TRADE

Imports of salt in 1993 were 1.05 Mt valued at $31.8 million, which in volume was roughly equivalent to 1992, but represented a 10.4% increase in value. During the first nine months of 1994, imports (620 033 t valued at $20.9 million) were down by about 22% when compared with the same period for 1993 (794 568 t valued at $23.9 million). In 1994, the import unit price increased 11.2% to $33.69/t from $30.29/t in 1993. The origin of imports in 1993 was from 21 countries, but mainly from the United States (58%), Mexico (32%), Chile (5%) and the Bahamas (4%), for deliveries in British Columbia (43%), Ontario (40%), Quebec (14%) and the Atlantic provinces (2%).

Exports of salt in 1993 were 3.1 Mt valued at $73.8 million which, when compared to 1992 figures of 2.62 Mt valued at $54.99 million, represented an increase of 18.5% in volume and 34.2% in value. In the first nine months of 1994, exports totalled 2.56 Mt, up 21% from the 2.12 Mt reported for the same period in 1993. The unit value increased by 15.4% from $23.80/t in 1993 to $27.46/t in 1994. Exports of salt products in 1993 were to 14 countries, but principally to the United States, which accounted for 99.3%. Deliveries were shipped mainly from Ontario (63%) and Quebec (33%).

WORLD PRODUCTION

The total world production of salt in 1993 was 190 Mt, which represented a 2.7% increase over 1992. Salt is produced in numerous countries, but the bulk of the production is from about 16 countries, of which the United States is the principal producer. The United States accounted for 20%, while China accounted for 16%, Germany for 7%, Canada for 6%, and India for 5%.

Provisional production figures for 1994 suggested that the level was going to remain the same as that

of 1993. The 1994 production pattern for the major producing countries was similar to 1993's pattern.

United States

Domestic salt production in the United States was estimated to be 39.5 Mt in 1994, down slightly from 39.7 Mt in 1993; the total value was estimated to be in excess of US$900 million. Twenty-seven companies operated sixty-seven plants in fourteen states. Apparent consumption in 1993 was 43.8 Mt, up 11.9% from 39.2 Mt in 1992; the 1994 figure is estimated to be significantly higher at 47.4 Mt. The distribution of salt sold or used by type, in 1993, was brine sales (42%), rock salt (39%), evaporated salt (10%), and solar salt (9%). The chemical industry consumed about 44% of total salt sold, while road and ice control usage accounted for 25%, food and agricultural sectors for 8%, and general industrial for 6%. The 1993 estimated average unit value of salt from brine increased 20% to US$5.22/t and the average unit value for rock salt shipments decreased marginally to US$20.00/t.

Imports from the United States in 1994 were estimated at 9.5 Mt, a strong 62% increase over 1993. The major exporting countries were Canada (44%), followed by Mexico (24%) and the Bahamas (12%). The net import reliance of the United States for 1994 was estimated at 19% of apparent consumption. Exports increased slightly to 0.7 Mt.

The main event in the U.S. salt industry in 1994 was the flooding of the Retsof, New-York, rock salt mine which started in mid-March. This flood was apparently due to unusual geologic conditions that led to the failure of several pillars, leaving a way to the water of the overlying aquifer. Despite several attempts to stop it, the mine was filling at a daily rate of about 98 million litres. Surface effects were increasingly visible. By November 1994, Akzo decided to abandon the mine and start a new mine south of Retsof, at Groveland. It is, however, expected that the current mine will still produce until late 1995. The Retsof mine, which is the property of Akzo, is the largest underground room-and-pillar mine in the Western Hemisphere with a production capacity of about 4 Mt/y. The mine started operations in 1885 and has been in operation ever since. The lost capacity was quickly replaced by imports, mainly from Chile, and by increased output from all other U.S. salt producers.

The very severe winter conditions experienced during 1993/94 led to some shortages due to the depletion of de-icing stockpiles at many locations and the difficulties encountered in transportation to re-supply these locations. In order to try to avoid such a situation in the future, the Salt Institute is recommending that major consumers increase their storage capacity so that they carry almost a full year of supply. This could account for a major part of the increase in imports.

Japan

In 1993, Japan produced 1.4 Mt of salt and imported 7.5 Mt, mainly from Australia (52%) and Mexico (43%). Salt in Japan is mostly consumed by the chloralkali industry (64%), in soda ash manufacturing (15%), and by the food processing industry (12%).

Ukraine

In Ukraine, salt-mining companies have been regrouped under an association called Ukrsolprom Concern. This association has a collective capacity of 8 Mt/y, 97% of which is rock salt from either beds or domes. About 65% of Ukranian production is exported, mainly to republics of the former Soviet Union, the Czech and Slovak republics, Hungary, Bulgaria, the former Yugoslavia, and Finland. Prices for bulk salt vary between US$8/t and $32/t. Shipments are usually done by rail.

Europe

Through a share offering, the Dutch company Akzo NV took over Nobel Industries AB of Sweden. The new giant will be known as Akzo Nobel NV. As a result, Akzo Salt is changing its name to Akzo Nobel Salt Inc. and is going to be the company's largest business in North America.

INTERNATIONAL TRADE

Salt is a widespread, low-value bulk commodity. It is relatively easy to extract and transportation represents a significant proportion of the total delivered price. As a consequence, international trade in salt is small relative to world production, i.e., about 20% of total world production. Trade in the Pacific area currently accounts for one half of seaborne movements, followed by North America (24%) and northwestern Europe (20%). Australia is expected to remain the major supplier to Japan, while Mexico will continue to export mainly to Japan and North America. Exports to the European Union are expected to remain minimal as this region is essentially self-sufficient.

PRICES

The price of salt depends on factors such as production methods, purity, scale of operations, transportation costs, and product availability. During those periods when a shortage occurs because of strikes or technical problems, prices for salt will likely rise until alternative sources are found. In peak periods of demand, de-icing rock salt prices may increase if harsh winter conditions persist. Most likely, the replenishment of stocks during such periods will be at higher prices.

The price of salt products for 1994 rose by an average of about 4% when compared to 1993 prices. Rock-salt de-icing grades in bulk delivery sold for $17-$34/t f.o.b. mine and $31-$66/t f.o.b. depot, or $4-$8 per 40-kg bag. Fine-evaporated salt sold for $86-$128/t, or $6-$11 per 40-kg bag. Water-conditioning grades varied between $5 and $10 per 40-kg bag, while domestic salt varied between $16 and $18 per 25-kg bale. Agricultural grades were $3-$10 per 20-kg lick-block, and $4-$11 per 25-kg paper bag.

The price difference for salt between eastern Canada and the prairie provinces was highest for agricultural products; 20-kg lick-blocks were 19-44% higher, and 25-kg stock paper bags were 24-46% higher in the eastern provinces. Ontario has the lowest prices for water-conditioning and domestic salt, while the prairie provinces are enjoying the lowest prices for agricultural salt. Prices on the west coast were comparable to prices in the eastern provinces.

OUTLOOK

In 1995, domestic production and consumption of salt is forecast to remain stable. Imports of salt are likely to remain at the 1994 level as no further closures are forecast in the chloralkali sector. Rock salt prices are expected to increase by about 4%, and the price of value-added products should perform differently according to the product.

Despite environmental pressures, de-icing salt will continue to be the major de-icing agent because of its low price. The optimization of spreading rates, in combination with the search for adequate abrasive mixtures, will continue to be evaluated. The mild 1994/95 winter should stabilize demand and probably increase stocks in both the eastern United States and Canada.

As part of its restructuring, the pulp and paper sector is expected to continue its conversion away from the use of chlorine in its bleaching process, but at a slower rate. Chlorine consumption in Canadian mills has decreased by about 65% over the past decade and is expected to reach 90% by the turn of the century. The pulp and paper industry, the major consumer of chloralkali, is expected to have an even better year than 1994, which was a turn-around year for the industry with demand increasing sharply and prices following. Operating rates should be at close to full capacity. Demand in the chloralkali sector is forecast to grow at a marginal rate of 1-2%, while consumption is expected to continue to decline in the pulp and paper sector. (It is believed that less than 15% of the chlorine consumed in North America is used to bleach pulp.) These declines will be offset by an anticipated continued growth in the PVC sector in which sales of chlorine will register an annual increase of 4-5%. PVC output should continue to grow in 1995, mainly because of strength in the export market, especially in Asia. Canadian demand for PVC is not expected to increase significantly as the Canadian housing market is still displaying weaknesses due to the Canadian debt situation and the political question of Quebec's future. In 1995, chlorine prices should either display some stability or decrease slightly. Caustic soda prices, however, are expected to continue the recovery started in 1994, mainly due to increased demand.

In North America, the consumption of sodium chlorate is forecast to continue to grow at a rate of 11-13%/y. In Canada, the sodium chlorate industry experienced strong growth of about 13% in 1994 and is expected to enjoy similar growth in 1995. However, no new facility is currently planned for 1995.

Sales of salt in the fisheries and food industries are expected to continue their decline, but for different reasons. The current state of the Canadian fisheries is such that demand for salt in this sector is, for all purposes, reduced to a minimum. A plateau is expected to be reached shortly in this industry as further reductions in fish quotas are not expected. In the food industry, demand for salt is also expected to diminish as this industry continues to reduce its salt requirements due to increasing public concern about sodium intake. Salt substitutes are expected to make sustained gains in this market.

A new but restricted market is currently being investigated by the industry. This market comes from a Japanese fashion to use salt in many cosmetic and body-care products. The ageing but wealthy population of baby-boomers could be a good target for this new industry.

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 December 31, 1994.

TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2501.00	Salt (including table salt and denatured salt) and pure sodium chloride, whether or not in aqueous solution; seawater				
2501.00.10	Table salt made by an admixture of other ingredients when containing 90% or more of pure sodium chloride	3.7%	2.5%	Free	Free
2501.00.90	Other	Free	Free	Free	Free

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

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

Item No.		1993		1994p	
		(tonnes)	($000)	(tonnes)	($000)
SHIPMENTS					
	By type				
	Mined rock salt	8 073 435	189 371	8 905 318	202 834
	Fine vacuum salt	817 859	81 136	843 590	84 142
	Salt content of brines used or shipped	2 101 711	9 552	1 930 515	7 765
	Total	10 993 005	230 059	11 679 423	294 741
	By province				
	Nova Scotia	x	x	x	x
	New Brunswick	x	x	x	x
	Quebec	x	x	x	x
	Ontario	6 581 976	164 613	6 818 655	166 930
	Saskatchewan	539 944	26 714	608 121	27 835
	Alberta	1 283 642	16 265	1 315 959	16 134
	Total	10 993 005	280 059	11 679 423	294 741
IMPORTS					
2501.00	Salt[1]				
	United States	606 961	24 368	602 793	26 013
	Mexico	334 388	5 282	313 351	4 208
	Bahamas	41 432	772	14 742	324
	France	4 970	207	1 392	159
	Netherlands Antilles	3 385	270	1 548	139
	Other countries	59 960	933	6 305	354
	Total	1 051 096	31 832	940 131	31 197
	By province of clearance				
	Newfoundland	7 623	171	7 959	233
	Prince Edward Island	–	–	–	–
	Nova Scotia	9 621	185	6 978	119
	New Brunswick	151	12	307	44
	Quebec	143 804	3 712	109 248	3 460
	Ontario	416 475	18 006	392 594	19 202
	Manitoba	7 734	340	14 279	438
	Saskatchewan	4 457	353	2 085	207
	Alberta	12 542	1 019	19 426	872
	British Columbia	448 689	8 031	387 255	6 617
	Total	1 051 096	31 832	940 131	31 197
EXPORTS					
2501.00	Salt[1]				
	United States	3 077 680	73 536	3 636 268	97 197
	Saudi Arabia	240	64	560	172
	St. Pierre and Miquelon	753	76	860	87
	Jamaica	65	23	141	51
	Barbados	211	28	405	50
	Other countries	349	80	440	105
	Total	3 079 298	73 807	3 638 674	97 662

Sources: Natural Resources Canada; Statistics Canada.
– Nil; **p** Preliminary; x Confidential.
1 Includes table salt, pure sodium chloride and seawater salt.
Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, SALT SHIPMENTS AND TRADE, 1980-94

	Producers' Shipments					
	Mined Rock	Fine Vacuum	In Brine and Recovered in Chemical Operations	Total	Imports	Exports
			(tonnes)			
1980	4 507 416	781 428	2 134 010	7 422 854	1 151 203	1 637 601
1981	4 371 314	764 037	2 107 243	7 242 594	1 254 992	1 507 710
1982	5 223 073	773 086	1 944 172	7 940 331	1 526 879	1 721 893
1983	5 846 994	714 464	2 040 925	8 602 383	814 250	1 914 629
1984	7 030 664	754 675	2 450 060	10 235 399	1 053 217	2 530 038
1985	6 608 739	805 209	2 670 749	10 084 697	1 255 518	2 263 076
1986	6 867 287	815 044	2 649 515	10 331 846	1 328 298	2 502 518
1987	6 670 863	866 475	2 591 715	10 129 053	1 112 102	1 924 686
1988	7 126 762	783 368	2 777 050	10 687 180	1 202 219	3 030 124
1989	7 548 732	821 284	2 788 395	11 158 411	2 360 432	2 137 321
1990	7 704 499	778 428	2 708 458	11 191 385	2 095 321	1 897 816
1991	8 615 755	799 563	2 455 541	11 870 859	1 202 880	2 783 021
1992	7 912 989	770 370	2 404 667	11 088 026	1 041 424	2 650 921[r]
1993[r]	8 073 435	817 859	2 101 711	10 993 005	1 051 096	3 079 298
1994[p]	8 905 318	843 590	1 930 515	11 679 423	940 131	3 638 674

Sources: Natural Resources Canada; Statistics Canada.
p Preliminary; **r** Revised.

TABLE 3. WORLD SALT PRODUCTION, 1989-94

Countries	1989	1990	1991	1992	1993[r]	1994[e]
			(000 tonnes)			
United States	35 290	36 955	35 895	34 784	38 665	38 600
China[e]	27 985	20 005	25 495	25 000	29 530	30 000
C.I.S.[e]	15 000	14 515	13 995	11 000	11 071	8 789
Germany[1]	16 155	15 085	13 780	13 125	12 607	13 000
Canada	11 160	11 190	10 995	11 088	10 993	11 679
India	9 600	9 500	9 500	9 503	9 502	9 500
France	7 490	7 540	6 500	6 600	6 100	6 300
United Kingdom	5 700	5 700	5 195	6 600	6 200	6 100
Mexico	6 940	7 135	7 595	7 600	7 240	7 500
Australia	7 350	7 440	7 790	8 000	9 000	8 000
Poland	4 665	4 810	3 900	3 900	4 000	4 000
Italy	4 215	4 080	4 000	4 100	3 700	3 700
Other	38 910	39 605	45 480	43 488	41 392	42 832
Total	190 460	183 560	190 120	184 788	190 000	190 000

Sources: Natural Resources Canada; U.S. Bureau of Mines.
e Estimated; **r** Revised.
1 Includes data from the former East and West Germany.

TABLE 4. CANADIAN SALIENT STATISTICS ON SALT

Company	Location/ Initial Production	Employment 1992	Employment 1993	Annual Production Capacity 1990	1991	1992	1993	1994	Remarks
				(000 t/y)					
Albchem Industries Ltd.	Bruderheim, Alta./1991	10[a]	10[a]	–	29	29	29	29	Brining to produce sodium chlorate.
Canadian Occidental Petroleum Ltd.	Bruderheim, Alta./1991	5[a]	5[a]	–	26	26	28	28	Brining to produce sodium chlorate.
Canadian Salt Company Limited, The	Pugwash, N.S./1959	204[b]	206[b]	1 200	1 200	1 200	1 200	1 200	Rock salt mining to a depth of 305 m.
	Pugwash, N.S./1962			110	110	110	110	110	Dissolving rock salt fines for vacuum pan evaporation.
	Îles-de-la-Madeleine, Que./1982	174	184	1 500	1 500	1 500	1 500	1 500	Rock salt mining to a depth of up to 273 m.
	Ojibway, Ont./1955	231	245	2 500	2 500	2 500	2 500	2 500	Rock salt mining at a depth of 300 m.
	Windsor, Ont./1892	116	118	150	150	150	170	170	Brining, vacuum pan evaporation.
	Belle-Plaine, Sask./1969	28	28	170	170	170	170	170	Producing fine salt from by-product brine from nearby potash operation.
	Lindbergh, Alta./1968	62	61	140	140	140	140	140	Brining, vacuum pan evaporation.
Subtotal		815	842						
Central Canada Potash Ltd.	Colonsay, Sask./1992	9	9	–	–	100	300	328	By-product rock salt from potash operation.
Dow Chemical Canada Inc.	Fort Sask., Alta./1968	3[a]	3[a]	1 400	1 400	1 400	1 400	1 400	Brining to produce caustic soda and chlorine.
General Chemical Canada Ltd.	Amherstburg, Ont./1919	6[a]	6[a]	690	690	690	690	690	Brining to produce sodium carbonate.
International Minerals & Chemical Corporation (Canada) Limited	Esterhazy, Sask./1962	3	8	120	120	120	120	150	By-product rock salt from potash mine for use in snow and ice control.
Nusalt	Rocanville, Sask./1990	12	12	100	100	140	140	140	By-product rock salt from potash tailings.
Potash Corporation of Saskatchewan – New Brunswick Division	Sussex, N.B./1980	27	27	450	500	500	550	550	Rock salt produced in association with potash for use in snow and ice control.
Saskatoon Chemicals – a division of Weyerhaeuser Canada Ltd.	Saskatoon, Sask./1968	5[a]	5[a]	70	70	70	75	75	Brining to produce caustic soda, chlorine and sodium chlorate.

Sifto Canada Inc.	Nappan, N.S./1947	72	82	100	100	100	100	100	Brining for vacuum pan evaporation.
	Goderich, Ont./1959	318	319	3 300	3 300	3 300	3 300	3 700	Rock salt mining at a depth of 536 m.
	Goderich, Ont./1880	65	66	120	120	120	120	120	Brining for vacuum pan evaporation.
	Unity, Sask./1949	72	73	180	180	180	180	180	Brining vacuum pan evaporation.
Subtotal		527	540						Fusion plant closed in 1991.
Total		1 422	1 467	13 200	13 405	13 545	13 272	13 280	

Sources: Natural Resources Canada, 1994; company surveys.
– Nil.
[a] Employment part of chemical complex. [b] Includes employment in brining operations at Pugwash.

TABLE 5. CANADIAN CHEMICAL PLANTS USING SALT AS A MAJOR RAW MATERIAL, DEVELOPMENTS AND PROJECTS IN 1994

Company	Location	Parent Company	Plant Location	Type of Cells	Products	Annual Capacity[r]	Remarks
						(tonnes)	
Akzo Nobel Canada Inc.	Magog, Quebec	Akzo Nobel Industries SV, Netherland	Magog, Quebec	Metal	Sodium chlorate	122 000	
	Valleyfield, Quebec		Valleyfield, Quebec	Metal	Sodium chlorate	113 000	
Albchem Industries Ltd.	Bruderheim, Alberta	Sherritt Gordon Limited, Vencap Equities Alberta Ltd., Alberta	Bruderheim, Alberta	Metal	Sodium chlorate	50 000	Captive production.
B.C. Chemicals Ltd.	Prince George, British Columbia	B.C. Chemicals Ltd., Prince George, B.C.	Prince George, British Columbia	Metal	Sodium chlorate	67 000	
Canadian Occidental Petroleum Ltd.	Calgary, Alberta	Occidental Petroleum Corporation, Los Angeles, CA, U.S.A.	Amherstburg, Ontario	Metal	Sodium chlorate	50 000	
			Brandon, Manitoba	Metal	Sodium chlorate	85 000	
			Bruderheim, Alberta	Metal	Sodium chlorate	50 000	Captive production.
			North Vancouver, British Columbia	Diaphragm	Caustic soda Chlorine	155 000 141 000	
Domtar Inc.			Lebel-sur-Quévillon, Quebec		Sodium chlorate	. .	
Dow Chemical Canada Inc.	Sarnia, Ontario	The Dow Chemical Company, Michigan, U.S.A.	Fort Saskatchewan, Alberta	Diaphragm	Caustic soda Chlorine	524 000 476 000	

TABLE 5. (cont'd)

Company	Location	Parent Company	Plant Location	Type of Cells	Products	Annual Capacity[r] (tonnes)	Remarks
General Chemical Canada Ltd.	Amherstburg, Ontario	General Chemical Corporation, Morristown, New Jersey, U.S.A.	Amherstburg, Ontario	Metal	Calcium chloride Sodium carbonate	450 000 400 000	
Great Lakes Forest Products Limited	Thunder Bay, Ontario	Canadian Pacific Securities Limited, Montréal, Quebec	Dryden, Ontario	Membrane	Caustic soda Chlorine	24 000 22 000	
ICI Canada Inc.	Montréal, Quebec	Imperial Chemical Industries plc (ICI), England	Bécancour, Quebec	Diaphragm	Caustic soda Chlorine	325 000 295 000	Capacity to be increased by 20 000-25 000 t/y.
.			Cornwall, Ontario	Mercury	Caustic soda Chlorine	38 500 35 000	To close in March 1995.
			Dalhousie, New Brunswick	Metal	Sodium chlorate	22 000	
				Mercury	Caustic soda Chlorine	31 000 28 000	
PPG Canada Inc. Industrial Chemical Division	Beauharnois, Quebec	PPG Industries, Inc., Pittsburgh, Penn., U.S.A.	Beauharnois, Quebec	Metal	Sodium chlorate	40 000	
				Membrane	Caustic soda Chlorine	80 000 73 000	
St. Anne Chemicals Company Ltd.	Nackawic, New Brunswick	Parsons & Whittemore, Inc., New York, U.S.A.	Nackawic, New Brunswick	Metal	Sodium chlorate	12 500	Captive production.
				Membrane	Caustic soda Chlorine	10 000 9 000	Captive production.
Saskatoon Chemicals	Saskatoon, Saskatchewan	Weyerhaeuser Canada Ltd., Kamloops, B.C.	Saskatoon, Saskatchewan	Metal	Sodium chlorate	44 000	
				Membrane	Caustic soda Chlorine	36 000 33 000	
Sterling Pulp Chemicals	Islington, Ontario	Sterling Chemical Inc., Texas, U.S.A.	Buckingham, Quebec	Metal	Sodium chlorate	132 000	
			Grande Prairie, Alberta	Metal	Sodium chlorate	45 000	
			Thunder Bay, Ontario	Metal	Sodium chlorate	53 000	
			North Vancouver, British Columbia	Metal	Sodium chlorate	92 000	

Sources: Natural Resources Canada, December 1994; Chemicals Directorate and Investments, Industry, Science and Technology Canada, December 1994.
. . Not available; [r] Revised.