SALT

By Ted Dickson
TAK Industrial Mineral Consultancy, Gerrards Cross UK

Common salt (sodium chloride) is not only essential to human life but is also one of the major and most basic of raw materials for the world's chemical industry. It occurs as the mineral halite in the form of rock salt, which can be mined by either conventional underground methods or by solution mining techniques. Large amounts of salt are also produced by solar evaporation of seawater or salt lake brines. Because of its solubility, it is rare for there to be surface deposits amenable to open-pit mining operations but these do exist in desert areas. Salt can also be produced as a by-product of potash mining operations. Although a low-cost product, trade in salt can be extensive, especially where there are large coastal operations that can be served by bulk ocean-going ships, most notably with shipments from east coast Canada to the US, Mexico to the Pacific Rim, and Australia to the Pacific Rim.

Production is widespread, but the largest producing regions tend to be those with major chemicals industries and northern hemisphere countries that experience harsh winters. Consumption patterns can vary widely. For example, in the US the chemicals industry, and primarily the chloralkali industry accounts for about 42% of demand and in 2001 highway deicing accounted for a further 36% with food processing only consuming 3% of the total production. On a worldwide basis chloralkalis consume about the same proportion as the US. However, the soda ash industry takes a further 16%, whereas the US soda ash industry is totally based on natural mined material with the last Solvay soda ash plant closing many years ago. Human consumption of salt on a worldwide basis is estimated to be about 23% of demand and de-icing only 8% as large areas of the world do not have any demand for de-icing applications.

Salt Production

(Mt, includes salt in brine)

Country	2001	2000
US	45.1	45.6
China	32.0	31.3
Germany	15.8	15.7
India	14.5	14.5
Canada	12.5	11.9
Mexico	8.6	8.9
Australia	8.0	8.8
France	7.1	7.0
Brazil	7.0	6.0
UK	5.7	5.8
Poland	4.5	4.2
Italy	3.6	3.6
Spain	3.3	3.0
Russia	3.0	3.2
Ukraine	2.4	2.4
All Other	41.0	41.9
Totals	**214.0**	**214.0**

As the production table shows, total world production of salt is estimated by the United States Geological Survey (USGS) to have remained stable in 2001, although there were variations from country to country. Salt is produced in all regions of the world and there is recorded output in as many as 120 countries. In some cases there are many very small operations that, in aggregate, amount to considerable production and it can be difficult to estimate output from these. However, the majority of production comes from large-scale operations and a few large companies tend to dominate the markets.

North America

The US is the largest producer of salt, with production amounting to 45.1 Mt or more than 20% of world production. With a large chemical industry and a considerable portion of the country subject to cold winters, the country has two very significant consumers of salt. The chemical industry consumed 42% of demand in 2001 and the highway de-icing sector accounted for a further 36% of demand.

Consumption in the chemical industry fell from the previous year's figure of 44% and, with the decline in production, this amounts to somewhere in the region of 1 Mt less in 2001 compared with 2000. By far the largest use for salt in chemicals is in the chloralkali industry, and in the case of the US, specifically in the production of chlorine and caustic soda. Other chemicals only account for about 2% of the total salt consumption and it should be noted that there has been no production of soda ash via the Solvay process in the US for many years now. Consumption of chloralkalis declined in the US during 2001, partly due to a general economic downturn. One longer-term factor is that paper pulp manufacturers are tending to move towards oxygenated bleaching, replacing chlorine bleaching, which is seen to be more sound environmentally.

There was an increase in the consumption of salt in the highway de-icing sector. In percentage terms there was an increase from 31% to 36% a rise of more than 2 Mt. Consumption of salt in highway de-icing is very variable as it is a function of the severity of the weather. Stocks of salt held were reduced to very low levels after high demand in the 2000-2001 winter, and salt producers announced that they were able to get significant increases in contract prices of as much as 14% during the year. While this may sound a very high increase, it follows a number of years when there were mild winters and it was difficult to get any increases in contract prices.

Canadian production can be quite variable because of the severity but variability of winters that it experiences. In fact, Canada has the highest per capita consumption of salt in the world thanks to its use on winter roads in a country with a very large land area relative to its population. These are discrepancies between the figures released by the USGS and those from Natural Resources Canada (NRC). According to NRC, production sold or used by producers in 2001 amounted to 13.64 Mt, an increase from 12.16 Mt in the previous year and more than 1 Mt higher in each case than the USGS figures. Production rose in 2001, despite the loss of a significant consumer with the closure of the Amherstburg soda ash plant of General Chemical Group during the year. The plant had a 500,000 t/y capacity, which would have required about 850,000 t of salt at full capacity. Supplies to customers are being replaced with natural soda ash from Wyoming. Amherstburg was the last Solvay process soda ash plant in North America, and all production now is from natural mined deposits in Wyoming or from lake brines in California. Winter usage of salt in 2000/01 and in the later part of 2001 boosted overall sales.

Mexico is a large producer and exporter of salt, with some solar salt operations on the west coast aimed primarily at export markets in the US and Asia. However, further developments in this region are unlikely following the cancellation of a project in 2000 because of environmental concerns.

Europe

Production in Europe is of the same order of magnitude as that in the US. The most recent figures for total production are for 2000 (from the European Salt Producers Association - ESPA), which indicate production of about 25 Mt of crystallised salt and approximately 17 Mt of salt in brine for a total of around 42 Mt. Full year figures for 2001 are not yet available, but it is estimated that salt in brine production fell by as much as 1 Mt because of a decline in chloralkalis production by about 4.5%. Because of mild winters, the use of road de-icing salt also fell, perhaps by as much as 1 Mt. This would indicate total production and

sales in 2001 of approximately 40-41 Mt. The largest producers, as listed in the table, are Germany, France and the UK, all of which have significant outlets, both in chemicals and in road de-icing. Italy and Spain also make the list of largest producers, although their consumption in the de-icing sector is much smaller. Belgian production is known to be large, but is more uncertain, partly because of captive production and consumption by Solvay in its soda ash operations. Production in the Netherlands is not listed separately, but is estimated to be of the order of 5 Mt.

Eastern European production is led by Poland with production of about 4.5 Mt in 2001. Total production in the region is estimated to be of the order of 10-12 Mt, of which about 9.5 Mt will come under the EU figures once it has enlarged with the addition of Poland, Bulgaria, Romania, Turkey and possibly others over the next few years. Further east, Russian production is estimated to have fallen to about 3 Mt in 2001. Ukrainian production remained stable, although more recent figures from the Ukraine indicate that production of rock salt was actually 2.23 Mt in 2001 compared with 2.28 Mt in 2000, slightly less than the estimates from the USGS, which may include some salt in brine. In Russia, Seregovsky Salt works announced plans to build a new plant for the production of 360,000 t/y of high grade salt. The company already has a capacity of about 1.5 Mt/y of salt.

Asia Pacific

In Asia, China is by far the largest producer, second only to the US, with production of about 32 Mt, although estimates from China can vary because of a lack of reliable data. Indian production at an estimated 14.5 Mt is the next largest in Asia. Australia is the other major supplier in the region with production estimated at approximately 8 Mt, down from previous year's levels. Much of the Australian production, especially from the large operations in Western Australia, are aimed at export markets in Asia. Total production for the region is estimated to be over 60 Mt, with smaller but significant production from a number of other countries.

Rest of the World

Brazil is the largest producer in Latin America (excluding Mexico), with production of about 7 Mt in 2001, a significant increase of about 1 Mt over the previous year's estimates. Other countries with significant production include Chile, with extensive developments of production from salars for potash and lithium minerals that have salt as a co-product, and Argentina.

African production of salt is quite modest compared with other regions, the majority of it for use in food processing or direct human consumption. However, it is difficult to estimate total output because of the presence of a large number of sometimes very small operations, which in aggregate produce considerable quantities. Total production is estimated to be several millions of tonnes.

Corporate Activity

There has been considerable consolidation of the industry in recent years, and further changes in ownership occurred during the year.

The largest transaction was the purchase of IMC's salt and sulphate of potash operations by an investment company Apollo Management LP. The company is now being operated as Compass Minerals Group. It is the second largest producer of salt in North America and the third largest in the world. It operates a total of 12 operations, mainly in the US, but also the Goderich mine in Ontario, which is the largest rock salt operation in the world, and Salt Union's operations in the UK. Total value put on the acquisition was US$640 million.

Cargill Inc., the largest producer of salt in the US and the world, sold its 3 Mt/y salt operation at Port Hedland in Western Australia to Dampier Salt, for an initial payment of US$95 million and up to US$15 million in future payments depending upon future performance of the operations. Dampier already produced about 5 Mt of salt from two operations in Australia one at Dampier to the West of Port Hedland and another at Lake Macleod about 500 km along the Western Australian coast to

the south. Dampier, which is owned by Rio Tinto (64.9%) and three Japanese companies Marubeni (20.5%), Nissho Iwai (10.1%) and Itochu (4.5%), exports much of its product for use in the chemicals industry of Southeast Asia. Total capacity of the Japanese companies' operations is now about 9 Mt.

Israel Chemicals recently acquired Cleveland Potash in the UK from Anglo American plc for US$45 million. While primarily a producer of potash, Cleveland's Boulby mine also produces about 500,000 t/y of salt, mainly used for road de-icing. Through Dead Sea Works and Iberpotash, Israel Chemicals is already a major producer of potash and other salts from operations in Israel and Spain.

Outlook

Where salt is used on roads for deicing purposes, it can be very difficult to predict consumption on a year-by-year basis. However, with growing infrastructure there has been a long-term increase of about 1% per year in this sector. This is likely to continue, despite environmental concerns, as there is no alternative at the moment that is economically viable. For even longer term predictions, some would say that global warming may result in a decreased requirement for de-icing applications.

Chlorine and caustic soda are key building blocks for the chemical industry. However, there are environmental concerns about the use of chlorine and these pose some threat to salt consumption in the future. One example is the shift by many paper-pulping operations to the use of non-chlorine bleaching methods. While there may be some reduction of the use of chlorine, with a resultant impact on salt consumption in the more mature markets of Europe and North America, there is likely to be some growth in other regions, particularly Asia and possibly Latin America. It is notable that Euro Chlor (the European chlorine producers' association) points out that 55% of the chemical industry in Europe depends on chlorine-based materials at some point in the process and it is evident that chlorine will remain a key raw material.

Environmental concerns are also raised in respect of some of the solar salt operations. An operation in Mexico has been shelved because of environmental concerns. There have been indications that Cargill may consider closing its operations on San Francisco Bay in the face of environmental opposition, although it is believed that there will be significant tax incentives offered by the US Government to compensate.