

# SALT

*By Ted Dickson*

*TAK Industrial Mineral Consultancy, Gerrards Cross, UK*

Salt is one of the most basic chemical raw materials, used in large quantities either directly or after conversion to other chemicals, most notably chlorine, caustic soda and soda ash. It is also extensively used for de-icing roads, particularly in the northern hemisphere. Salt is essential to human life and large quantities are used in food throughout the world. The relative proportions of these major uses can vary considerably, with the chemical industry and highway de-icing dominating markets in countries such as the US and some northern European countries, but food grades of salt representing a significant portion of sales in other countries.

## **Production**

There has been considerable revision of figures previously released by the United States Geological Survey (USGS). Production in 2002 had originally been listed as 225 Mt but has been revised downwards and there has been no change in the total figure estimated for 2003. US production for 2002 was revised downwards from 43.9 Mt to 40.3 Mt and Chinese production was revised down from 35 Mt to 32.8 Mt. However, the largest revision was for the 'All Other' category, revised downwards from 48 million to 41.5 Mt, and this after a significant revision upwards for the previous year.

There are numerous difficulties in estimating the amount of salt produced. Whereas the majority of production is from large operations controlled by relatively few companies, there are a large number of smaller operations that would fall within the 'all others' category that, in aggregate, could represent a fairly large tonnage. Another factor that often causes problems with estimates of total production is the amount of salt produced in brine. Often this is captive production by a chemical manufacturer and the final product is not salt but some derivative chemical. Details of the actual amount of salt used are often not revealed by the producer. The USGS reports salt production of over 40 Mt for 2003 but the Salt Institute reported sales of only 30 Mt, a large increase over the previous year, because of increases in highway de-icing salt. However, sales to the chemical industry were only 2.27 Mt and obviously do not include captive consumption of salt, almost all of which will be salt in brine.

Even in a country such as the US, where information tends to be more readily available, estimates of production can be difficult. For example, in the USGS's Mineral Commodity Survey, the estimates for salt are based on replies from only 35% of the companies canvassed. It should also be noted that there can be wide variations in consumption depending on the severity of the winter in countries such as the US. In fact, the *expected* severity of the winter is often more important as local highway departments make purchases, at least partly, based on predictions of the severity of the coming winter (and the

science of weather prediction is by no means exact). In some other countries, obtaining accurate statistics can be difficult and estimates from large producers such as China can be subject to significant changes when better information comes to light. The 'others' category is large and includes estimated production for some significant producers. Some of these could actually have greater production than countries listed individually. For example, Chile has been reported as having production as high as 5 Mt but it is included in the 'others' category.

### **North America**

The US is the largest producer and consumer of salt, producing about 20% of world output and importing a further 12 Mt. The amounts sold or used in the US amounted to 38.6 Mt compared with a production figure of 41.2 Mt, possibly indicating a build-up of stocks of rock salt for highway de-icing. Exports were small, at only 500,000 t, giving an apparent consumption figure of just over 50 Mt, or almost 24% of world demand. With such a large portion of world demand, consumption patterns in the US tend to skew total world production patterns, which can vary very much from region to region.

According to the USGS, about 45% of the salt consumed was used in the chemical industry, and of this, about 89% was salt in brine. This indicates total consumption of around 22.5 Mt. The vast majority of the chemical usage of salt in the US was for production of chlorine and caustic soda. While chlor-alkalis are by far the largest factor in chemicals consumption, on a worldwide basis figures quoted normally include production of soda ash but all North American production of soda ash is now from mined natural deposits, the last Solvay plant that used salt as a raw material having closed some time ago. Highway salt represented 31% of US demand, or approximately 15.5 Mt. In total, these two applications represent about 76% of demand in the US. Other industrial uses include in food (6%), agriculture, including animal feed (4%) and water treatment (2%).

The Salt Institute, which publishes its members' sales figures, gives a different picture (Table 2). These figures do not include captive production, including salt in brine. They do, however, show a very large increase in highway de-icing salt, indicating that there was a particularly harsh winter. Water conditioning also has greater prominence, possibly indicating that a fairly large portion of salt included in the distributor or industrial use categories listed by the USGS may be destined for water-treatment applications. The total figure is roughly the total consumption indicated by the USGS for chemical usage. There is also a considerable difference in figures for highway de-icing salt, with the Salt Institute figure about 2 Mt higher than the USGS figure, although this is a notoriously difficult statistic to estimate.

The amount of salt used by the chemical industry in the US is expected to decline in the medium to long term. There have already been reductions as a result of the elimination of chlorine bleaching of paper by many manufacturers, and other environmental concerns may well mean a reduction in demand for chlor-alkalis. There may also be pressure from the movement

of some of the US manufacturing base to offshore locations to take advantage of lower costs. The US economy showed strong growth in 2003, further ahead, fuel costs could limit further growth, and not only in the US.

The USGS estimates Canadian production at 12.3 Mt in 2003, unchanged from the preceding year. However, National Resources Canada reported production of over 13.7 Mt including just over 1 Mt of salt in brine and 922,000 t of vacuum salt. A significant portion of the rock salt produced is exported to the US, mainly for use in road de-icing but also for chemical and other uses. Many of the Canadian producers are either near coastal locations where large-scale ocean freight can be used, or near the US border where shipments can be made to neighbouring states – the northern US states consume most of the de-icing salt. Traditionally, more than 40% of salt imports into the US are derived from Canada, which would represent a total of around 5 Mt/y.

Mexico is another major source of US imports. Total production is reported by the USGS at 8 Mt in 2003 (2002: 7.5 Mt). Much of this fall may be due to lower exports to the US. Mexico's main US sales are to the Pacific coast, where there has been some reduction in requirements because of lower demand from paper mills for chlorine. However, there are also significant exports to the Far East, although there is competition from other sources including Australia. Primarily, the exports are from the very large solar salt operations in Baja California of Eportadora de Sal, which have a capacity of about 7 Mt/y.

### **Europe**

The EU salt industry is quite mature and there was not expected to have been much variation in either supply or demand in 2003. Total Western European salt demand was estimated to have been around 41 Mt, little changed from the previous year, although there were declines recorded for both Germany and Poland. Demand from the chemical industry was believed to have been fairly steady, with some countries experiencing reasonable economic growth, but output by the manufacturing industry as a whole was reasonably steady. The main factor influencing demand is the severity of the winter, and the impact on demand for de-icing salt. USGS figures do not include some large producers such as the Netherlands and Belgium. In Belgium, demand from the chemicals industry is large, with significant volumes consumed captively by Solvay in the production of soda ash. There is also production of soda ash in other European countries, giving a rather different pattern to consumption of salt in chlor-alkalis than in the US. PVC is the main driver of the industry in Europe as the paper industry had switch from the use of chlorine bleaching some years ago. Strength in the construction industries of a number of European countries may lead to increases in demand, although in some countries such as Germany, the construction industry is still relatively weak.

Enlargement of the EU will add some large salt producers, notably Poland, although it is unlikely to result in any overall change in production or consumption unless the enlargement results in better economic conditions

leading to increased demand from major consumers such as the chemicals industry.

Akzo has announced the expansion of its Hengelo plant in the Netherlands to a capacity of 400,000 t/y. Construction is well under way and is expected to be completed by the end of 2004, with commissioning sometime early in 2005. On completion, it will be the largest vacuum salt operation in the world. However, as mentioned in the 2003 edition of *MAR*, Akzo has also announced the closure of its plant at Stade in Germany, hence the aggregate increase in capacity is small.

As part of what has been a continuing phase of rationalisation, Kali und Salz and Solvay formed a joint venture, European Salt Co (Esco), 62%-owned by Kali und Salz and 38% by Solvay, although Solvay retained some of its own salt-in-brine operations for use as feedstock for its soda ash production. The merger was approved by the EU competition authorities, as although there are only a few large companies dominating salt production in Europe – Akzo, Südsalz, Salin Du Midi (owned by Morton of the US) and Slat Union (owned by the Compass Group) – the market is still seen as competitive, even with the newly-merged company. In a more recent development, Kali und Salz will take over complete control of the venture during 2004, leaving Solvay with only its captive production.

### **Asia Pacific**

China is by far the largest producer of salt in this region followed by India. However, with large industrial bases and major manufacturing industries, both of these countries consume all of their own salt. By contrast, the third-largest producer, Australia, is a major exporter of salt to the region. The dominant Australian producer, Dampier Salt, has been increasing its capacity in recent years through the acquisition of Cargills' Port Headland operations, and through increases at its Lake Macleod operations. In 2003, Dampier produced a record 7.3 Mt of salt, mostly for export. The company has a capacity to produce up to 9 Mt/y. Other producers in Australia, such as Shark Bay Salt and Cheetham Salt, contribute to a total production of around 10 Mt/y, with relatively minor local consumption. With countries like Japan having limited salt production and relying on imports, salt trade in the Asia Pacific region, rivals the trade levels from Canada and Mexico to the US. Apart from Australia, Mexico is a major contributor exporter to the region, and Chile has now emerged as a significant addition to the trade.

### **Latin America**

Brazil is the largest recorded producer of salt in South America, with production recorded as 6.1 Mt in 2003. However, Chile has emerged as a large supplier in recent years, mainly from salars in the Atacama Desert, where salt is a by-product/co-product of potash and lithium salts operations. As a result, the country has emerged as a significant exporter both to the US and Asia, from production estimated to be around 5 Mt. Elsewhere in South and Central America, production is relatively modest, mainly for local use in food and agricultural applications, in some cases supplemented by imports.

### **Rest of the World**

African production of salt is quite modest, with only a small industrial base requiring chlor-alkalis outside South Africa and some North African countries. There is also little or no need for de-icing salt. Consequently, production tends to be based on many small operations supplying local food and agricultural needs, although there are also imports even from as far away as Europe.

In the Middle East, Israel is the largest producer, with salt operations based on brines from the Dead Sea, a resource that is also tapped by operations in Jordan. There is also modest production in countries such as Iran and Oman, and some production in Iraq but the current status of operations there is unknown. There is plenty of potential for solar evaporation of seawater for salt production in the region, but demand is limited and the development of new operations would need to be linked either to the establishment of significant chlor-alkali production or export markets.

### **Outlook**

Although the salt industry is generally regarded as quite mature there is the prospect of further growth in certain regions, most notably in China and possibly some other Asian countries. This is due to the rapid economic development that is influencing the consumption of a whole variety of raw materials. Developments in the region could, in fact, result in a decline in demand for salt in Europe and North America if a significant number of manufacturing industries in these regions relocate to Asia.

There has been considerable environmental pressure affecting several sectors of the salt industry for many years. This has ranged from objections to chlorine bleaching of paper and other chlorine applications to debates about the amount of salt in food and the potential harm done to the environment by de-icing salt. Although these pressures have not gone away, much of the effect on demand has already been absorbed and there could well be a period of stability for the industry, albeit with some changes possible in the geography of production, with growth in Asia contrasting with stability or decline in Europe and North America. There can be significant variations in demand in these two regions, mainly because of the large and very variable demand for de-icing salt.

Tables following page:

**Table 1: Production, including salt-in-brine (Mt)**

<b>Country</b>	<b>2002</b>	<b>2003</b>
US	40.3	41.2
China	32.8	34
India	14.5	15
Germany	15.7	14
Canada	12.3	12.3
Australia	9.89	10
Mexico	8.5	8
France	7	7
Brazil	5.6	6.1
UK	5.8	5.8
Italy	3.6	3.6
Poland	4.2	3.5
Spain	3.2	3.2
Russia	2.8	3
Ukraine	2.3	2.5
All Other	41.5	41
<b>Totals</b>	<b>210</b>	<b>210</b>

Source: US Geological Survey.

**Table 2: Salt Institute sales figures**

<b>Market</b>	<b>For the year ended December 31, 2002</b>		<b>For the year ended December 31, 2003</b>	
	<b>Mt</b>	<b>US\$ million</b>	<b>Mt</b>	<b>US\$ million</b>
Food Grade	1.38	219.54	1.42	229.47
Agricultural	1.52	91.60	1.45	86.35
Highway	12.15	336.55	17.57	479.43
Chemical	1.98	50.32	2.06	53.54
Water Conditioning	2.92	314.81	2.95	321.57
Major Uses	19.96	1012.83	25.44	1,170.36
<b>Total</b>	<b>22.24</b>	<b>1,175.48</b>	<b>27.77</b>	<b>1,332,205.00</b>

Source: Salt Institute.