Chemical Products Synopsis

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SODIUM CHLORATE

FOCUS....Sodium chlorate is used principally by the pulp & paper industry for pulp bleaching. In this application, sodium chlorate is used on-site to generate chlorine dioxide for chemical wood pulp bleaching. Government regulation which phased out the use of elemental chlorine in pulp bleaching in the US resulted in a large increase in sodium chlorate consumption in the 1990s and early 2000s. Historically, chlorine had been the dominant bleaching chemical for wood pulp. The pulp & paper industry now consumes over 95% of annual US sodium chlorate demand. Relatively small volume uses for sodium chlorate are in the production of other chlorates, in uranium mining, in water treatment, for weed control, and a number of other uses.

In the US, the use of elemental chlorine in pulp bleaching was ended by government legislation on April 15, 2001. The use of elemental chlorine resulted in the formation, and subsequent discharge in effluent, of dioxin. Dioxin is considered to be an environmental hazard. Sodium chlorate/chlorine dioxide systems became the replacement of choice in the pulp & paper industry. Other bleaching technologies, such as hydrogen peroxide and ozone, also captured a share of the pulp bleaching market. US demand for sodium chlorate grew rapidly in the 1990s, ahead of the deadline for elimination of the use of elemental chlorine, as this legislation was widely anticipated for many years.

With conversions away from elemental chlorine completed five years ago, US sodium chlorate consumption is now a function of demand growth of the pulp & paper industry and overall economic conditions. Since reaching its peak in 2001, apparent US demand has fluctuated but remained in the range of 1.3 to 1.4 million short tons per year, reflecting the trends of the pulp & paper industry. Apparent US demand increased by 3.3% in 2004 but declined by 4.1% in 2005. Although US sodium chlorate demand has been relatively steady over the past five years, US production has declined steadily since the peak production year of 2000 for economic reasons. In 2005, essentially one-half of US demand for sodium chlorate was supplied from Canada, up from 35% in 2000.

The US and Canadian sodium chlorate markets are commonly considered to be one market. Production of sodium chlorate in Canada far exceeds US production, and typically over one-half of Canadian production is exported to the US. Essentially all US imports of sodium chlorate originate in Canada. Over the past six years, reported production of sodium chlorate in Canada has been (in thousands of short tons): 2000-1220; 2001-1193; 2002-1163; 2003-1244; 2004-1304; 2005-1289.

OUTLOOK....Near term, US demand for sodium chlorate is expected to increase only modestly at best in the next one to two years. Sodium chlorate demand growth will essentially mirror growth in the pulp & paper industry. Long term, sodium chlorate demand is expected to remain flat or decline slowly. Continued trends toward electronic media limits the growth potential for the pulp & paper industry. Additionally, high energy cost may force the closure of some pulp mills in North America, further limiting sodium chlorate demand growth potential. Also in the long term, Southeast Asia and Latin America are expected to become an increasingly important supplier of pulp & paper to world markets.

PRICING....Prices for sodium chlorate have been on the rise since 2003 as evidenced by higher average values of shipments and higher average import values shown below. Prices continue to firm; according to US Census Bureau reports the average value of shipments in the first quarter 2006 was $319.00/short ton (FOB). A general "benchmark" price for sodium chlorate in late 2005 was reported to be in the range of $425.00 per short ton, delivered. Prices have been pressured higher principally by higher electricity and higher other production costs, as well as by tightened supply. With little relief anticipated from higher electricity and energy costs, sodium chlorate prices are expected to remain firm even if demand weakens. Further price increase attempts are likely.

AVERAGE PRICE RANGE - SODIUM CHLORATE
Dollars Per Short Ton - Anhydrous Crystals - Delivered (Trade List) or FOB (Avg. Sales)

	HISTORICAL										* PROJECTED *	
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005 *	2006	2008
Trade List	335	420	435	450	450	450	455	445	445	na *		
Avg. Sales	304	321	392	346	293	301	290	286	296	299 *	325	325
Import Val.	398	279	278	316	286	319	314	305	319	332 *		

List prices are year-end published prices (delivered). Average sales values (FOB) are from Census Bureau reports and are the average value for all producer shipments. Average import values are also calculated from Census Bureau reports. Import values since 2000 are average customs values; prior years are average CIF (customs, insurance, freight) values.

SUPPLY AND DEMAND....Thousands of Short Tons....100% Basis....Estimated....Domestic US

	HISTORICAL										* PROJECTED *	
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005 *	2006	2008
Capacity	388	416	380	957	1087	1029	1004	862	862	862 *	862	
Production	312	286	327	617	940	873	795	737	746	681 *		
Imports	57	151	386	514	485	546	582	619	654	670 *		
Exports	1	3	3	48	54	36	44	23	23	31 *		
Demand	368	434	710	1083	1371	1383	1333	1333	1377	1320 *	1330	1355

Production, import and export data based on US Census Bureau reports. Capacity figures are year-end estimates. Capacity includes captive producers with integrated $Cl0_2$ plants. Production (and therefore calculated demand) figures are believed to exclude this captive output.

AVAILABILITY....The North American sodium chlorate market has been characterized as balanced to snug. While reported US production in 2005 was 20% below estimated capacity, high production costs are believed to have resulted in production cutbacks. Overall utilization rates in Canada are believed to have approached 100% in 2005. Although little, if any, demand growth is expected in North America over the next several years, and demand may actually decline, the market is expected to remain balanced. High electricity costs have already resulted in the idling or closure of some North American capacity, and further shut downs of smaller, less cost-effective plants are anticipated.

PRODUCERS AND CAPACITIES - SODIUM CHLORATE - THOUSANDS OF SHORT TONS - 2006

UNITED STATES:

PRODUCER	LOCATION	CAPACITY	PRODUCER	LOCATION	CAPACITY
Eka Chemicals	Columbus, MS	219	Kemira	Eastover, SC	90
Eka Chemicals	Moses Lake, WA	63	Kerr-McGee	Hamilton, MS	138
Erco Worldwide	Valdosta, GA	110	Other Integrated	Captive Producers	97
Kemira	Augusta, GA	145			
		TOTAL UNITED STATES	862		

CANADA:

PRODUCER	LOCATION	CAPACITY	PRODUCER	LOCATION	CAPACITY
BC Chemical	Prince George, BC	70	Erco Worldwide	Bruderheim, Alb.	82
Canexus	Beauharnois, Que.	48	Erco Worldwide	Hargrave, Man.	44
Canexus	Brandon, Man.	260	Erco Worldwide	Saskatoon, Sask.	55
Canexus	Bruderheim, Alb.	77	Erco Worldwide	Buckingham, Que.	140
Canexus	Nanaimo, BC	18	Erco Worldwide	N. Vancouver, BC	100
Domtar	Lebel-Sur-Quevi, ON	25	Erco Worldwide	Grand Prairie, Alb.	55
Eka Chemicals	Magog, Que.	165	PCI Canada	Dalhousie, Que.	24
Eka Chemicals	Valleyfield, Que.	125	St. Anne Chem.	Nackawic, NB	11
TOTAL CANADA		1299			

Based on announced capacities and trade estimates. A number of ownership changes have occurred in recent years. In 2005, Kemira acquired Finnish Chemicals. In addition to the two US plants, Finnish Chemicals operated two sodium chlorate plants in Finland. In 2003, Erco Worldwide acquired Albchem Industries. The acquisition included the sodium chlorate plants at Bruderheim, Alb. and Hargrave, Manitoba. In 2005, Nexen spun off its chemical unit. Nexen formed an income trust fund, named Canexus, which acquired the chemical business. In early 2006, Erco Worldwide shut down its 55,000 ton/year sodium chlorate plant at Thunder Bay, Ontario. In mid-2005, Nexen shut down a 55,000 ton per year plant at Amherstberg, Ontario. In late 2004, Nexen completed an expansion of over 70,000 short tons/year at Brandon, Manitoba. This expansion could actually be considered capacity reallocation since the equipment added was moved from Nexen's Taft, LA plant which was shuttered in 2003. Total capacity at Taft, LA had been estimated at 142,000 short tons per year, although some of that capacity was idled in 2002.

END USES....Sodium chlorate is one of the most widely used chemicals globally. While available crystalline or in a liquid solution of 25% to 50%, crystalline is the most commonly utilized form. Sodium chlorate's major application is in the production of chlorine dioxide for use in wood pulp industry bleaching. Environmental regulations imposed by the EPA cluster rule have greatly stimulated demand to meet elemental chlorine-free (ECF) standards. ECF processes using chlorine dioxide produce environmentally safe, bright white paper products. The process of using sodium chlorate to form chlorine dioxide varies. Chlorine dioxide is formed by the reduction of sodium chlorate on-site at the pulp mills. The "R-8 process" combines sulfuric acid and methanol with sodium chlorate crystals dissolved to form both chlorine dioxide and sodium sulfate. This process actually performs a double duty as the sodium sulfate is used in the pulping process and the chlorine dioxide used for pulp bleaching. Another method is the Lurgi process that uses electrolysis to generate sodium chlorate then uses hydrochloric acid to reduce it to ClO_2. This method produces byproducts of chlorine and hydrogen, which are used to make hydrochloric acid, and also sodium chlorate, which is recycled.

Sodium chlorate has other applications, although these comprise less than 5% of demand. Sodium chlorate's second most consequential use is as an intermediate in the production of the chlorates of other metals such as calcium chlorate for herbicides, potassium chlorate for match heads and explosives, and barium chlorate used in fireworks. It can be found in agriculture, mining, disinfectant use, and in the production of gasoline and steel. As sodium chlorate has a soil sterilant effect, it is used for non-crop weed control such as road ways and ditch maintenance as well as a defoliant for cotton and sunflower production. In mining, it is used to extract uranium from uranium bearing ores and for vanadium. Other areas of usage include leather tanning, manufacturing of dyes, bleaching of textiles, and in the production of oxygen rescue breathing apparatus. In 1995, the US FDA approved use as a substitute for chlorine in poultry processing as an anti-microbial agent. It is also used in the food industry as a sanitizer.

Sodium chlorate can also be used in municipal water treatment systems to replace chlorine in drinking water supplies. This application utilizes sodium chlorite derived from sodium chlorate/chlorine dioxide. Another water treatment application under development is the treatment of ship's ballast water. Eka Chemicals and Ecochlor have worked together to develop a larger market for disinfecting ballast water using chlorine dioxide.

END USE PATTERN - 2006 ESTIMATE

DERIVATIVE	PERCENT
Pulp & Paper	96
Miscellaneous	4

MANUFACTURING.... Sodium chlorate is produced by the electrolysis of an acidic aqueous solution of sodium chloride, or treated brine, with an intermediate of sodium hypochlorite. This electrolyte is fed into a diaphragm-less cellbox of titanium/platinum. When DC current enters the cellbox via busbars from a rectifier, the electrode reactions form chlorine and hydroxide, thus the formation of sodium chlorate. Previously popular was the use of anodes of graphite that were dissipated during production. Today's electrodes of titanium/platinum are referred to as "dimensionally stable" or DSA electrodes. These allow for greater energy efficiency, which is a large portion of production costs. After sodium chlorate is formed in the cell, it is removed as slurry and transported to a table filter for dewatering. The crystals are then dried and stored in large silos awaiting shipment. For a liquefied solution, the sodium chlorate can be produced with a chrome removal system. Purified crystals can also be dissolved to yield the desired form.

ENVIRONMENTAL ASPECTS....Sodium chlorate is extremely reactive with combustible chemicals and can create fire/explosion hazards when contaminated with many dry organic materials. It is toxic when ingested, with 10-30 grams considered lethal. Ventilation, impervious gloves, and chemical safety glasses are recommended for safe handling.