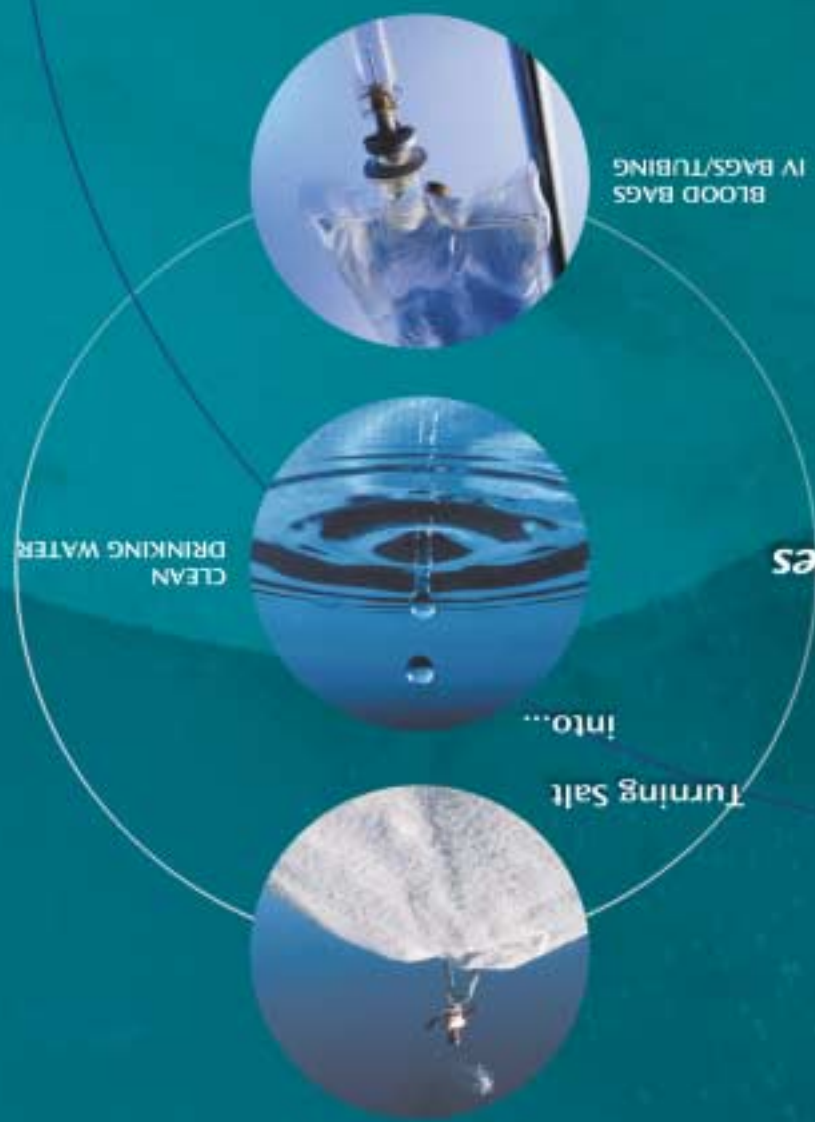


## Chlorine Chemistry's Role in Our Daily Lives



### Vinyl pipe: safe water delivered safely

More than one-third of all vinyl produced is made into pipes, including pipes for municipal water delivery and wastewater removal, culverts and industrial piping systems. Vinyl pipes can have a long useful lifetime of up to 100 years or more, and like most vinyl construction products, require virtually no maintenance.

More important, vinyl pipes help to keep disinfected drinking water safe. They are much more resistant to the formation of microbial and bacterial growth that occurs along the interior walls of water distribution pipes. This activity, known as biofouling or biofilm build-up, can pose a threat to public health and is present in almost every water distribution system. Biofilm build-up occurs to a much greater degree in metal or concrete pipes.

In addition, vinyl pipes help to preserve a precious resource, water. Cast iron and ductile iron pipes are the most susceptible to corrosion and breakage. Weak spots caused by rusting can form in these materials and in some cases penetrate the pipe wall and cause leaks, resulting in water loss, pipe breakage and, potentially, water contamination. A single pipe leaking just 2.2 litres of water per minute equals more than 110,000 litres of lost water each year.

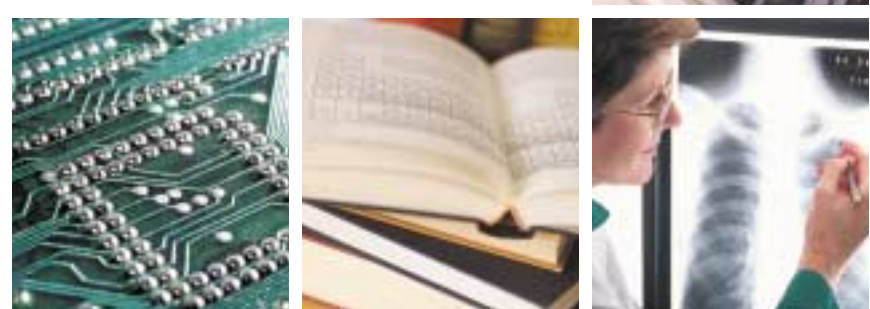
### Vinyl medical products

Vinyl has been the material of choice in the health care industry for over 40 years – over 25 percent of all medical plastics and over 70 percent of all disposable medical applications are made of vinyl. This includes the bags containing life-giving blood, and the tubing and valves that transport it. Intravenous containers, tubing, dialysis equipment, examination gloves, inflatable splints, inhalation masks and thermal blankets are also vinyl products.

Vinyl is the material of choice for these applications because it offers a unique combination of properties – it is easily sterilized, flexible without kinking, durable, transparent (so volumes and flows of liquid can be monitored) and dependable.



[www.worldchlorine.com](http://www.worldchlorine.com)

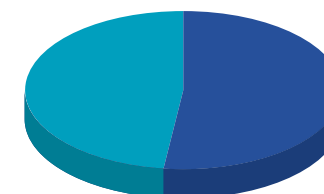


# Chlorine Chemistry's Role in Our Daily Lives

Chlorine is one of the most abundant naturally occurring chemical elements. It also plays an important and significant role in the manufacture of thousands of products we depend on every day. Industrial production of chlorine involves passing an electric current through a solution containing salt and water. (For more details on chlorine's production process, please see the insert *Chlor-Alkali Manufacturing Processes*.)

This simple process transforms the salt, creating almost an equal amount of chlorine gas and sodium hydroxide or caustic soda.

### 1999 Global Demand for Chlorine/Caustic Soda



Caustic soda is widely used by many industries, such as the food, pulp and paper, aluminium, and textiles. (For more details on caustic soda, please see the insert *Chlorine's Important Co-Product: Caustic Soda*.)

Chlorine is used as a disinfectant. And, according to the World Health Organization (WHO), chlorine's use in water treatment has been one of the most significant advances in public health protection. Chlorine plays a key role in controlling bacteria and viruses in water that can cause human illness, as evidenced by the virtual absence of waterborne diseases such as typhoid and cholera in developed countries.

Untreated or inadequately treated drinking water supplies remain the greatest threat to public health in developing countries. Over one-fifth of the world's population does not have access to clean water, and more than one-third lack adequate sanitation.



In these countries, diseases such as cholera, typhoid and chronic dysentery are endemic and, according to WHO, kill thousands of people each day. Chlorination continues to offer the most effective and affordable option for providing safe drinking water for the world's population.

In addition, chlorine (in its more recognized form – bleach), as one of the most effective and economical germ killers, provides significant benefits.

Since it was first used in the maternity wards of a Vienna hospital more than 150 years ago, chlorine has been a powerful weapon against life-threatening infections caused by viruses and bacteria.

One such bacterial infection is Legionnaires' disease, which can be transmitted through air conditioning systems. Chlorine is used to disinfect these systems and rid them of the bacteria. It is widely used in hospitals to prevent contamination of patients' burns and wounds, and to disinfect medical equipment such as kidney dialysis machines.

Chlorine also plays a vital role in reducing foodborne disease from the 'farm to the fork'. The Expert Committee on Food Safety, convened by the World Health Organization and the United Nations Food and Agriculture Organization, states, "... illness due to contaminated food is perhaps the most widespread health problem in the contemporary world and an important cause of reduced economic productivity." Chlorine water solutions of varied strength are routinely used to disinfect crop storage and livestock facilities. In many countries, food processing and preparation

facilities use chlorine solutions to disinfect food surfaces and food contact surfaces.

Global patterns of food distribution and changing consumer demographics are new challenges in the effort to control foodborne illness and reinforce the important role of chlorine in food safety.

### The chlorine tree

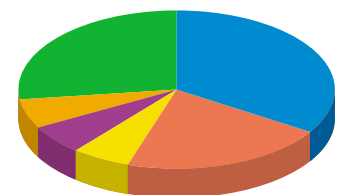
But chlorine's unique properties mean it can be used in numerous and varied ways. Its reactive nature allows it to bond with other chemical elements to form substances that make up, or lead to, products we use every day. It is called the single material on which production of other chemicals most depends. It is involved in over 50 percent of all commercial chemistry, and its myriad uses are displayed on the "chlorine tree". (Please see inside.)

Yet, while chlorine is needed along the way to make chemical processes happen, many of the resultant products don't contain chlorine, such as polyurethanes, polycarbonates and epoxy resins. Because these types of compounds are versatile, lightweight, easily adaptable, strong, durable and save energy, they are used to make a broad range of products from electronics to packaging and automotive to construction.

Polyurethanes, for example, are often used for seats, dashboards, sound insulation, door panels, and foam mattresses. In fact, about 80 percent of the population in Latin America sleep on inexpensive, flexible polyurethane foam. If not for this affordable alternative, a vast majority of the population would continue sleeping on uncomfortable cotton, hay or horsehair mattresses.

Perhaps one of the most critical uses of chlorine chemistry involves our health. Today, about 85 percent of all pharmaceuticals contain or are manufactured using chlorine chemistry, including medicines that treat heart disease, cancer, AIDS and malaria. Chlorine is also essential in helping to produce a wide range of medical equipment, from X-ray and mammography films to medical tubing and blood bags.

### Chlorine Chemistry's End Uses



\*such as propylene oxide, epichlorohydrin, polycarbonate

### Vinyl, a major product

One of the major products of chlorine chemistry is polyvinyl chloride, known as PVC or vinyl. Invented in the United States in the early 1920s, it was first used for insulated wire, raincoats and shower curtains. As vinyl's versatility and flame-resistant properties became more widely known, dozens of new, innovative uses were developed and manufacturing plants established. Today, vinyl is the second largest selling plastic in the world.

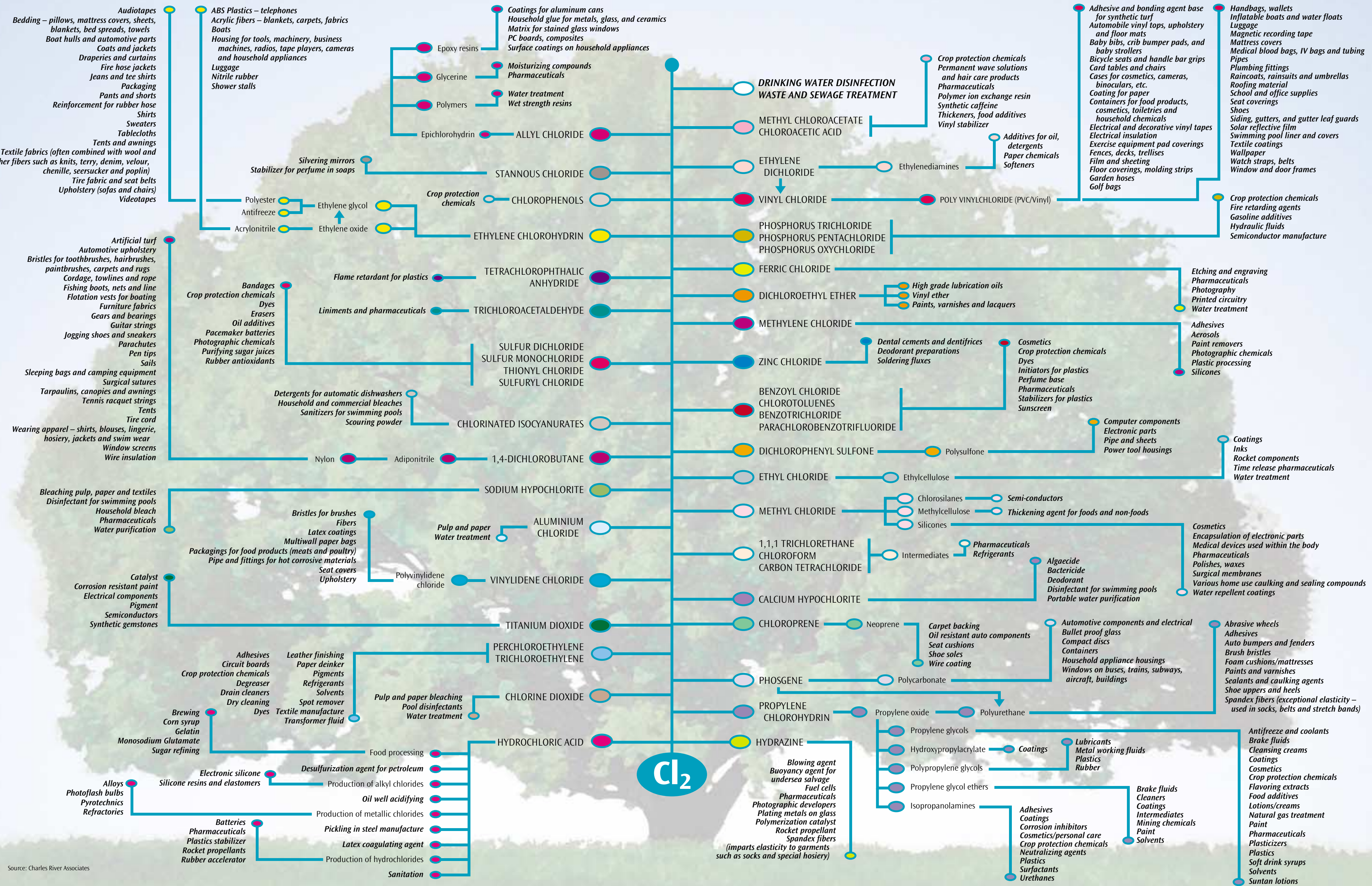


Vinyl products – such as wire and cable, siding, windows and doors – are a staple of the construction industry because they are easy to maintain, long lasting, attractive and economical. In fact, vinyl is the material of choice for European window frames because of low maintenance. In North America, vinyl is the material of choice for siding, decking, railings and house trim because it neither rots nor requires painting. Vinyl piping transports water to thousands of homes and industries because it is resistant to corrosion, microbial growth and leakage.

(continued on back)

# Products of the Chlorine Tree

Chlorine is one of the most abundant naturally occurring chemical elements. It also plays an important and significant role in the manufacture of thousands of products we depend on every day.



Source: Charles River Associates

