

# CHLORINE



HERE'S

TO YOUR

HEALTH

## THE PUBLIC HEALTH BENEFITS OF CHLORINE

**P**roper chlorination helps ensure safe water right from your tap. Most people know that chlorine makes their swimming pools safe—but that's not all. Chlorinated drinking water protects people from deadly waterborne diseases like cholera and typhoid. And many of the medicines people take to cure



their ailments are made with chlorine-based compounds.

There is little doubt that chlorine improves our quality of life by playing a vital role in protecting human health.

### THE CHLORINE INSTITUTE

Since 1924, the Chlorine Institute has been the center of the chlor-alkali industry's efforts to ensure safety, health and environmental protection. The Institute's members have locations in nearly every state and Canadian province. They account for 99 percent of U.S. and Canadian production of chlorine and related alkali chemicals. That adds up to about 25 million tons of chlorine and caustic soda a year. It's a \$5 billion business, employing more than 30,000 Americans and Canadians.

Every day, we drink tap water without a second thought. However, with one look at the



Did you know that more than 200 million Americans receive chlorinated water daily?

continuing problem of cholera and other water-borne diseases in developing countries, one can understand the importance of water disinfection and appreciate chlorine's

proven role as a water disinfectant in the United States and Canada.

## GOOD HEALTH ON TAP

A chlorinated water supply is safe water at our fingertips. It means that without thinking twice we can drink water from the tap, wash our food, brush our teeth and take a shower.

Chlorine controls the taste, color and smell of our water, too. It helps remove scale from the pipelines used to carry water and helps keep the filters clean. And once in the water, chlorine disinfects all the way to the tap. In fact, no other disinfectant does

so much. And treatment with chlorine costs just pennies a day.

## OTHER HEALTH BENEFITS

Although chlorine's role in safeguarding the water supply is probably its most well-known quality, it does much more to benefit the public health:

- Chlorine helps fight and cure illness and disease.

Pharmaceutical companies rely on chlorine-containing compounds in the production of medicines that treat



Hodgkin's disease, malaria, leukemia and pneumonia.

- Chlorine kills bacteria, making swimming pools clean and safe for families.
- Chlorine is used to make liquid bleach, a disinfectant widely used to maintain hospital, home and food-processing plant cleanliness. In hospitals, liquid bleach also is used as a medicinal aid to prevent bacterial contamination.

## CHLOREP

In the event of a chlorine incident, the industry has developed the Chlorine Emergency Plan (CHLOREP). Some 250 trained teams around the United States and Canada are ready to respond quickly to any chlorine emergency seven days a week, 24 hours a day. All CHLOREP team members are trained experts, equipped with special emergency kits designed to seal leaks in chlorine containers.

### Public Safety

Chlorine industry companies work through the Chlorine Institute to develop and implement stringent safety measures with government agencies such as the U.S. Environmental Protection Agency (EPA), U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT) and their Canadian counterparts.

## CHLOR-ALKALI CHEMICAL USES FROM ADHESIVES TO ZIRCONIUM

|                       |                                     |
|-----------------------|-------------------------------------|
| Adhesives             | Hygienic Packaging                  |
| Aerospace Parts       | Insulation                          |
| Air Conditioning      | Leather Processing                  |
| Aircraft              | Machinery Oils                      |
| Air Pollution Control | Medical Implants                    |
| Aluminum Making       | Medications                         |
| Anesthetics           | Metal Processing                    |
| Antifreeze            | Mining                              |
| Appliance Coatings    | Missiles                            |
| Artificial Joints     | Mothproofing                        |
| Auto Making           | Nuclear Reactors                    |
| Bactericides          | Oil Processing                      |
| Bleaches              | Paints                              |
| Brake Fluids          | Paper Making                        |
| Ceramics              | Perfumes                            |
| Conveyer Belts        | Photographic Film                   |
| Cosmetics             | Pigments                            |
| Crop Protection       | Pipe                                |
| Deodorant             | Plaster                             |
| Detergents            | Plastics                            |
| Disinfectants         | Protective Coatings                 |
| Dispersants           | Rain Gear                           |
| Drinking Water        | Refrigeration                       |
| Dry cleaning          | Rocket Fuels                        |
| Dyes                  | Sanitizing                          |
| Electrical Cable      | Sealants                            |
| Electronics           | Sewage Treatment                    |
| Explosives            | Soft Drinks                         |
| Fire Extinguishers    | Solvents                            |
| Flame Retardants      | Steel Making                        |
| Floor Coverings       | Swimming Pool Treatment             |
| Food Additives        | Synthetic Rubber                    |
| Food Processing       | Textiles                            |
| Fumigants             | Tires                               |
| Gasoline              | Toys                                |
| Germicides            | Transmission Fluid                  |
| Glass Making          | Vitamins                            |
| Hose                  | Wall Coverings                      |
| Household Cleaners    | Wood Preservatives                  |
| Hydraulic Fluids      | Zirconium for Heat-Resistant Metals |

*Chlorine*



THE CHLORINE INSTITUTE, INC.

***Since 1924, the Chlorine Institute has been the focal point of the chlor-alkali industry's efforts to ensure safety, health and environmental protection where chlorine is involved. The Institute's members have locations in nearly every state. They account for 99% of U.S. production of chlorine and related chlor-alkali chemicals — about 25 million tons of material worth more than \$5 billion annually. Directly and indirectly, the industry provides more than 30,000 jobs.***



Printed on chlorine-bleached recycled paper.

**Q: WHAT IS CHLORINE?**

**A:** Chlorine — the 17th atomic element — is a greenish-yellow gas at room temperature. Because chlorine is highly reactive, it is found in nature almost entirely in combination with other elements, such as sodium chloride (table salt) and calcium chloride.

Chlorine is produced by passing electricity through a salt water solution. The electric current breaks down the salt water into chlorine and two other very useful products — sodium hydroxide (caustic soda) and hydrogen. The freed chlorine, and its co-products, are then further processed for storage, transportation and use.

**Q: WHAT ARE CHLORINE AND ITS RELATED FAMILY OF CHEMICALS USED FOR?**

**A:** Chlorine and its related family of chemicals are a cornerstone of today's living standard. Chlor-alkali chemicals benefit society in a myriad of ways: purify water and waste water, grow food, make paper and textiles, manufacture plastics and cleaning agents, produce medicines and thousands of other beneficial products.

Chlorine has been called the single material on which the production of other chemicals most depends. The clothes we wear, the food we eat and the medicines that cure illness all depend on chlorine to some extent. A partial list of the many ways that chlorine chemistry helps add quality to our lives is printed on the inside back cover of this booklet.

**Q: IS CHLORINE HAZARDOUS TO HUMAN HEALTH?**

**A:** Not when properly used. Like many widely used materials, chlorine can be harmful if misused or if over-exposure occurs. Exposure to low levels of chlorine, levels normally found in the workplace or the home, are not known to have any adverse health effects.

**Q: WHY IS CHLORINE USED TO DISINFECT DRINKING WATER?**

**A:** Natural sources of water contain many organisms capable of transmitting waterborne diseases. Chlorine eradicates virtually all the bacteria and viruses that cause diseases, such as typhoid fever and cholera.

Chlorine is easy to apply, measure and control, and is effective in low concentrations. Further, chlorine is long-lasting so that it prevents the buildup of disease organisms in the water distribution system from the water purification plant all the way to your tap.

**Q: IS DRINKING WATER DISINFECTED WITH CHLORINE HAZARDOUS TO MY HEALTH?**

**A:** Since 1908, chlorine has been used in the United States to disinfect our drinking water. Existing health data have shown that the potential risks from drinking water disinfected with chlorine are very small compared with the risks associated with drinking untreated water. While trace amounts of some by-products may be formed under certain conditions when chlorine is used to disinfect water, existing data have shown that the potential health risks from these by-products are very small.

A June 1990 evaluation by the World Health Organization's International Agency for Research on Cancer determined that chlorinated drinking water is not a classifiable human carcinogen. Further, the U.S. Environmental Protection Agency (EPA) is sponsoring studies in order to assure that the continued use of chlorine to disinfect our nation's drinking water is conducted properly to minimize the possibility that by-products may harm human health.

**Q: IS IT SAFE TO TRANSPORT CHLORINE?**

**A:** Transporting chlorine safely is of paramount importance to the chlor-alkali industry. Chlorine is commonly shipped in three types of containers — railroad cars that hold 90 tons each, containers that hold one ton, and cylinders that hold 100 or 150 pounds. Rigorous U.S. Department of Transportation specifications govern the construction of these vessels. These containers are subject to continuous inspections and maintenance as needed.

To assure effective response in the event that a chlorine container does leak, the chlor-alkali industry established the Chlorine Emergency Plan — CHLOREP. Formalized 20 years ago, CHLOREP is composed of a network of 250 mutual-aid teams that guard the United States and Canada. The teams respond to any chlorine incident in their area 24 hours a day, seven days a week, regardless of who the chlorine belongs to or who is moving it. CHLOREP can be reached by a toll-free call, 1-800-424-9300.

**Q: WHAT HAPPENS TO CHLORINE WHEN IT IS RELEASED INTO THE AIR?**

**A:** First of all, facilities that make chlorine minimize chlorine gas emissions to the atmosphere through the use of special scrubbing equipment. For chlorine that is released into the air, within a few hours it is converted to hydrogen chloride gas, which is either washed out of the air by rain or settles out under the influence of gravity, with little, if any, environmental effect.

**Q: DOES CHLORINE PLAY A ROLE IN DEPLETING THE OZONE LAYER?**

**A:** Scientists have concluded that stratospheric ozone layer damage is caused by certain highly stable compounds, most notably chlorofluorocarbons (CFCs), which contain chlorine. CFCs, which are used in air conditioning and refrigeration, are released on the earth's surface and rise unaltered into the stratosphere. There, the sun's ultraviolet rays break them down, releasing atomic chlorine (Cl), which reacts with and depletes the ozone. CFCs are being phased out and replaced by means of international environmental agreements supported by industry.

**Q: DO CHLORINE DISCHARGES TO WATER HARM PLANTS AND ANIMALS?**

**A:** Chlorine that may be present in discharges to water is controlled to minimize potential effects on aquatic plants and animals. If an excess amount of chlorine is released by accident into a lake, river or stream, it is not likely to cause permanent environmental damage. It may harm aquatic plants and animals until it is diluted to harmless levels.

**Q: IS THERE A RELATIONSHIP BETWEEN CHLORINE AND DIOXIN?**

**A:** All dioxin compounds are made of the elements carbon, chlorine, hydrogen and oxygen. Dioxins are the unintended by-products of incomplete combustion, such as driving cars, incinerating trash, burning wood, smoking, as well as from certain chemical manufacturing processes. Measurements have shown that dioxins are present in the environment throughout the industrial world in very, very small amounts, at parts per trillion (1/1,000,000,000,000) and quadrillion (1/1,000,000,000,000,000).

At the very minute levels detected in the environment, current scientific evidence suggests that dioxin will not cause any adverse human health effects. An October 1990 conference of the world's foremost dioxin experts at the Banbury Conference Center in New York suggested that a safe "no effect" level for exposure to dioxin could be established. In April, the EPA announced that it would reevaluate its current policies regarding the risks of exposure to dioxin in light of recent scientific findings. EPA's evaluation is expected to be completed in mid-1992.

**Q: WHAT IS THE ROLE OF CHLORINE IN THE MAKING OF VINYL PLASTICS?**

**A:** Chlorine is the basic building block for the production of vinyl plastics — PVC, or polyvinyl chloride. Vinyl

plastics are used to make hundreds of industrial and consumer products, many of which have evolved as a replacement for other materials that did not perform as well in a given application, cost more to produce or put a strain on the environment and natural resources.

The majority (90%) of PVC is used in permanent applications — water pipe, insulation and sheathing for electrical wiring, house siding and flooring; the remainder (10%) is used for a variety of packaging products — food wrap and packaging, blood storage bags, detergent and shampoo containers.

**Q: DOES PVC CONTRIBUTE TO INCREASED DIOXIN EMISSIONS WHEN MUNICIPAL SOLID WASTE IS INCINERATED?**

**A:** Extensive tests on the PVC content of municipal solid waste incinerator emissions revealed that the presence or absence of PVC has no effect on incinerator dioxin formation. Rather, incinerator operating conditions, primarily temperature, are the key to controlling dioxin and other emissions. Following incomplete combustion, dioxin may form from the presence of any of a number of sources of chlorine, such as table salt, vegetable matter, wood, paper and textiles that are also present in municipal solid waste.

**Q: DOES PVC LEACH CHLORINE INTO GROUNDWATER WHEN LANDFILLED?**

**A:** Numerous scientific studies have shown that chlorine-based plastic can be disposed of safely in landfills because it remains inert and does not leach chemicals into groundwater. Chlorine forms strong chemical bonds with other elements in the process that results in PVC. In fact, PVC is often used in landfill liners and leachate collection pipes at waste disposal sites.

**Q: IS CHLORINE-BASED PACKAGING RECYCLABLE?**

**A:** Like other plastic materials, chlorine-based packaging is recyclable and is being recycled into a variety of useful products. The chlorine content of PVC-packaging actually holds the key to easier, automated sorting of plastic materials in the recycling process. New automated machines detect chlorine in plastic materials and allow for easier, automatic sorting.

***For more information about these topics or any other questions you have about chlorine, please call the Chlorine Institute at 202-775-2790.***

## **CHLORINE CHEMISTRY: HELPING NATURE ADD QUALITY TO LIFE**

Most people are aware that chlorine purifies water and that chlorine-based chemicals disinfect around the house and bleach clothes. What you may not know is that chlorine and the related alkali chemicals benefit society in thousands of other ways — the foods we eat...medicines that cure illness...the newspapers we read...the cars we drive and airplanes we fly. Here are some of the many ways that chlorine chemistry helps nature add quality to life.

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| Aircraft              | Machinery Oils                      |
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| Hydraulic Fluids      |                                     |
| Hygienic Packaging    |                                     |

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