

This fact sheet answers the most frequently asked health questions (FAQs) about chlorine. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS:** Chlorine gas is not usually detected in the environment. Exposure to chlorine can occur following an accident, such as a leak or spill from a chlorine tank or the improper use of swimming pool chemicals. Exposure to low levels of chlorine gas can result in nose, throat and eye irritation. Chlorine gas is too reactive to be detected in environmental media at hazardous waste sites. Any chlorine gas released at these sites would be quickly converted to other substances.

### What is chlorine?

Chlorine is a gas with a very irritating odor. It is used in the production of thousands of products. It is also used for water disinfection, although the chlorine itself is quickly transformed into other chemicals at the beginning of the process.

A common misconception is that elemental chlorine (Cl<sub>2</sub>) is present in chlorinated water. During water chlorination, elemental chlorine gas may be added to the water at first; however, the chlorine is quickly transformed into other chemicals, which actually disinfect the water. Hypochlorous acid and sodium hypochlorite are two of these chemicals that disinfect the water.

The term "free chlorine" in drinking water usually refers to the amount of hypochlorous acid and hypochlorite in the water. It is important to recognize that these compounds are different from molecular chlorine even though the terminology is often used interchangeably.

### What happens to chlorine when it enters the environment?

- Chlorine is very unstable and reacts with a variety of chemicals and water when it is released into the environment.
- Chlorine is broken down by sunlight within a matter of several minutes.
- Chlorine dissolves in water and is converted into chloride and hypochlorous acid.

- If chlorine is spilled into water or onto soil or if it is released from a tank into the air, the chlorine will evaporate very quickly forming a greenish-yellow cloud that is heavier than air and can be carried by the wind several miles from the source.

### How might I be exposed to chlorine?

- Because chlorine is so reactive, it is not normally detected in the environment except for very low levels in the air above seawater.
- You may be exposed through breathing, skin contact, and eye contact if an accident involving chlorine takes place nearby, such as a liquid chlorine spill, a leak from a chlorine tank, or a leak from a facility that produces or uses chlorine.
- You may also be exposed to chlorine if you mix household chemicals such as toilet cleaner with bleach. Mixing household cleaners containing ammonia with bleach may also release dangerous chemicals into the air.
- You may be exposed to chlorine gas through the improper use of swimming pool chemicals.
- People who work in places where chlorine is made or used may be exposed to low levels over a period of time.

### How can chlorine affect my health?

Exposure to low levels of chlorine can result in nose, throat, and eye irritation. At higher levels, breathing chlorine gas may result in changes in breathing rate and coughing, and damage to the lungs.

ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>

In general, people who suffer from respiratory conditions such as allergies or hay fever, or who are heavy smokers, tend to experience more severe effects than healthy subjects or nonsmokers.

Drinking small amounts of hypochlorite solution (less than a cup) can produce irritation of the esophagus. Drinking concentrated hypochlorite solution can produce severe damage to the upper digestive tract and even death. These effects are most likely caused by the caustic nature of the hypochlorite solution and not from exposure to molecular chlorine.

Spilling hypochlorite solution on the skin can produce irritation. The severity of the effects depends on the concentration of sodium hypochlorite in the bleach.

### How likely is chlorine to cause cancer?

The Department of Health and Human Services (DHHS) the International Agency for Research on Cancer (IARC), and the Environmental Protection Agency (EPA) have not classified chlorine as to its human carcinogenicity.

### How can chlorine affect children?

Short-term exposures (minutes) to high concentrations of chlorine affect children in the same manner they affect adults, but children may be more sensitive. We do not know what the effects could be in children following longer-term, low-level exposure to chlorine gas or hypochlorite solution.

We do not know whether exposure to chlorine gas during pregnancy can result in damage to unborn babies because there are no studies of pregnant women or pregnant animals exposed to chlorine gas.

### How can families reduce the risks of exposure to chlorine?

❑ Do not mix bleach with other household cleaners such as toilet cleaners because chlorine gas can be released to the air. Do not mix bleach with household cleaners containing ammonia because dangerous chemicals can be released to the air.

❑ Always store household chemicals in their original labeled containers out of reach of young children to prevent accidental poisonings. Never store household chemicals in containers children would find attractive to eat or drink from, such as old soda bottles.

❑ Chlorine gas can also be released to the air when chemicals used to chlorinate swimming pools are mishandled. If you have a swimming pool at home, read the labels of the chlorination products carefully and do not let children play with these products.

### Is there a medical test to determine whether I've been exposed to chlorine?

There are no medical tests to determine whether you have been exposed specifically to chlorine.

Chlorine is transformed in the body into chloride ions, which are normal components of the body. An enormous amount of chlorine has to be inhaled or ingested in order to detect a significant increase in chloride ions in the blood.

### Has the federal government made recommendations to protect human health?

EPA established an environmental air limit of 0.5 ppm. Exposure to higher levels could result in discomfort and irritation. Dependent on the concentration, these effects may be reversible when exposure ends.

OSHA set a legal limit of 1 ppm chlorine in air as a ceiling limit. At no time should a worker's exposure exceed this limit.

EPA established a maximum contaminant level (MCL) and maximum residual disinfectant level (MRDL) of 4 mg/L for free chlorine in drinking water.

### References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Chlorine (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

