



Right to Know Hazardous Substance Fact Sheet

Common Name: **CHLORINE**

Synonym: Molecular Chlorine

Chemical Name: Chlorine

Date: August 1998 Revision: November 2007

Description and Use

Chlorine is a yellow-green gas with a strong, irritating odor. It can be a liquid under pressure or cold temperatures. It is used as a bleach and disinfectant in water purification and sewage treatment, and in making other chlorinated chemicals.

▶ ODOR THRESHOLD= 0.2 to 0.4 ppm

The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

Reason for Citation

- ▶ **Chlorine** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of cool water. Continue for at least 30 minutes, occasionally lifting upper and lower lids. Remove contact lenses, if worn, while rinsing. Immediate medical attention is necessary.

Skin Contact

- ▶ Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water. Seek medical attention immediately.

Breathing

- ▶ Remove the person from exposure.
▶ Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
▶ Transfer promptly to a medical facility.
▶ Medical observation is recommended for 24 to 48 hours after breathing overexposure, as pulmonary edema may be delayed.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

CAS Number: 7782-50-5

RTK Substance Number: 0367

DOT Number: UN 1017

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	-	4
FLAMMABILITY	-	0
REACTIVITY	-	0
NONFLAMMABLE GAS STRONG OXIDIZER CYLINDERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- ▶ **Chlorine** can affect you when inhaled and may pass through the skin.
▶ Contact can severely irritate and burn the skin and eyes.
▶ Contact with liquid can cause frostbite.
▶ Exposure can irritate the nose and throat.
▶ Inhaling **Chlorine** can irritate the lungs. Higher exposure may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
▶ **Chlorine** may cause an asthma-like allergy.
▶ Exposure to **Chlorine** can cause headache, dizziness, nausea and vomiting.
▶ Repeated exposure can lead to permanent lung damage.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 ppm**, not to be exceeded at any time.

NIOSH: The recommended airborne exposure limit (REL) is **0.5 ppm**, which should not be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **0.5 ppm** averaged over an 8-hour workshift and **1 ppm** as a STEL (short-term exposure limit).

- ▶ The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- ▶ Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- ▶ For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- ▶ You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- ▶ The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Chlorine**:

- ▶ Contact can severely irritate and burn the skin and eyes with possible eye damage.
- ▶ Contact with liquid can cause frostbite.
- ▶ Exposure can irritate the nose and throat causing coughing and wheezing.
- ▶ Inhaling **Chlorine** can irritate the lungs causing coughing and/or shortness of breath. Higher exposure may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- ▶ Exposure can cause headache, dizziness, nausea and vomiting.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Chlorine** and can last for months or years:

Cancer Hazard

- ▶ While **Chlorine** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard

- ▶ While **Chlorine** has been tested, it is not classifiable as to its potential to cause reproductive harm.

Other Effects

- ▶ **Chlorine** may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, coughing, and/or chest tightness.
- ▶ Repeated exposure may cause bronchitis to develop with cough, phlegm, and/or shortness of breath and may lead to permanent lung damage.
- ▶ Long term exposure can damage the teeth, cause a skin rash, swelling and blisters, and hoarseness or loss of voice.

Medical

Medical Testing

For those with frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- ▶ Lung function tests
- ▶ Check teeth for signs of erosion

If symptoms develop or overexposure is suspected, the following is recommended:

- ▶ Consider chest x-ray after acute overexposure

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- ▶ Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require **expert advice** on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on *Control Banding* at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- ▶ Label process containers.
- ▶ Provide employees with information and training concerning their hazards.
- ▶ Monitor airborne chemical concentrations.
- ▶ Use engineering controls if concentrations exceed recommended exposure levels.
- ▶ Provide eye wash fountains and emergency showers.
- ▶ Wash or shower if skin comes in contact with a hazardous material.
- ▶ Always wash at the end of the workshift.
- ▶ Change into clean clothing if clothing becomes contaminated.
- ▶ Do not take contaminated clothing home.
- ▶ Special training is required to wash contaminated clothing.
- ▶ Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- ▶ Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- ▶ Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA Compressed Gases Standard (29 CFR 1910.101).

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- ▶ Avoid skin contact with **Chlorine**. Wear personal protective equipment made from material which can not be permeated and/or degraded by this substance. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- ▶ Safety equipment manufacturers recommend *Butyl*, *Neoprene* or *Viton®* for gloves and *DuPont Tychem® CPF3*, *CPF4*, *Responder®*, *TK®*, *Reflector®*, and *Kappler Zytron® 300* and *Zytron® 500* as protective materials for clothing.

- ▶ Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with special clothing designed to prevent the freezing of body tissues.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- ▶ Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- ▶ Where the potential exists for exposure over **0.5 ppm**, use a NIOSH approved full facepiece respirator with an acid gas cartridge which is specifically approved for **Chlorine**. Increased protection is obtained from full facepiece powered-air purifying respirators.
- ▶ If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Chlorine**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- ▶ Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- ▶ Where the potential exists for exposure over **5 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- ▶ Exposure to **30 ppm** is immediately dangerous to life and health. If the possibility of exposure above **30 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- ▶ **Chlorine** is a nonflammable gas.
- ▶ Cylinders may vent rapidly or explode when heated.
- ▶ Use water spray to keep fire-exposed containers cool.
- ▶ DO NOT USE WATER directly on the source of the **Chlorine** leak.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Chlorine** is leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Ventilate area of leak to disperse the gas.
- ▶ Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- ▶ DO NOT USE WATER directly on the source of the **Chlorine** leak.

Handling and Storage

Prior to working with **Chlorine** you should be trained on its proper handling and storage.

- ▶ **Chlorine** will react with WATER to form *Acid solutions* (such as *Hydrogen Chloride*).
- ▶ Explosive compounds are formed or **Chlorine** reacts explosively with ACETYLENE; ETHER; FLUORINE COMPOUNDS; TURPENTINE; ALCOHOLS; HYDROGEN; FINELY DIVIDED METALS; AMMONIA; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); and MANY OTHER CHEMICALS.
- ▶ **Chlorine** is a STRONG OXIDIZER which can ignite ORGANICS and COMBUSTIBLES (wood, paper and oil).
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from SUNLIGHT and temperatures over 125°F (52°C).

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These include: Right to Know Information Resources, Public Presentations, General References, Industrial Hygiene Information, Surveys and Investigations, and Medical Evaluation.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: <http://www.nj.gov/health/eoh/rtkweb>

***The Right to Know Hazardous Substance Fact Sheets
are not intended to be copied and sold
for commercial purposes.***

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or Lower Explosive Limit, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or Upper Explosive Limit is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Chemical Name: **CHLORINE**

Synonym: Molecular Chlorine

CAS No: 7782-50-5

Molecular Formula: Cl₂

RTK Substance No: 0367

Description: Yellow-green gas with strong irritating odor. Can be a liquid under pressure or cold temperatures.

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health 0 - Fire 0 - Reactivity DOT#: UN 1017 ERG Guide #: 124 Hazard Class: 2.3 (Poison Gas)	Nonflammable Gas Cylinders may vent rapidly or explode when heated. Remove gas with fine water spray. DO NOT USE WATER DIRECTLY ON THE SOURCE OF THE LEAK.	Strong Oxidizer Reacts with WATER to form <i>Acid solutions</i> . Forms explosive compounds or reacts explosively with ACETYLENE, ETHER, FLUORINE COMPOUNDS, TURPENTINE, ALCOHOLS, HYDROGEN, FINELY DIVIDED METALS, AMMONIA, STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE), and MANY OTHER CHEMICALS.

SPILL/LEAKS

Isolation Distance: (All Directions):
Small spill - 30 meters (100 feet)
Large spill - 240 meters (800 feet)

Ventilate area to disperse gas.
Stop flow of gas or place leaking cylinder in a safe place.

DO NOT USE WATER DIRECTLY ON THE SOURCE OF LEAK.

Toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	0.2 to 0.4 ppm
Flash Point:	N/A
LEL:	N/A
UEL:	N/A
Vapor Density:	2.5 (air = 1)
Vapor Pressure:	5,025 mm Hg at 68°F (20°C)
Solubility:	Slightly soluble
Ionization Potential:	11.48 eV
Freezing Point:	-150°F (-101°C)
Boiling Point:	-29°F (-34°C)

EXPOSURE LIMITS

OSHA:	1 ppm Ceiling
NIOSH:	0.5 ppm 15-minute Ceiling
ACGIH:	0.5 ppm 8-hr, 1 ppm STEL
IDLH LEVEL:	10 ppm
ERPG 1	1 ppm
ERPG 2	3 ppm
ERPG 3	20 ppm

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Neoprene, Viton®
Coverall:	DuPont Tychem® CPF3, CPF4, Responder®, TK®, Reflector®, Kappler Zytron® 300 and Zytron® 500
Boot:	Neoprene
Respirator:	>0.5 ppm CCR with cartridge for Chlorine or Acid Gas >5 ppm Supplied-air respirator >10 ppm SCBA

HEALTH EFFECTS

Eyes:	Irritation, burns and possible eye damage
Skin:	Irritation, burns
Acute:	Liquid can cause frostbite Nose, throat and lung irritation, coughing (Pulmonary edema) Headache, nausea, vomiting
Chronic:	Cancer - Tested (Not Classifiable). Asthma with shortness of breath, wheezing, coughing and/or chest tightness Damage to teeth, skin blisters and hoarseness

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Immediate medical attention is necessary.
For contact with *liquified gas* quickly flush skin with luke warm water.
Do not rub or reheat area.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer to a medical facility.
Observation is recommended as symptoms may be delayed.