

Phosgene (COCl₂)
CAS 75-44-5; UN 1076

Synonyms include carbonic acid dichloride, carbonic dichloride, carbon oxychloride, carbonyl chloride, and chloroformyl chloride.

Persons exposed only to phosgene gas do not pose substantial risks of secondary contamination. Persons whose clothing or skin is contaminated with liquid phosgene (ambient temperature below 47 °F) can secondarily contaminate response personnel through direct contact or off-gassing vapor.

At room temperature, phosgene is a colorless, nonflammable gas with a suffocating odor like new mown hay. However, odor provides insufficient warning of hazardous concentrations. At high concentrations it is mildly irritating.

Below 47 °F, it is a colorless, fuming liquid; contact with the liquid can cause frostbite. In the presence of water (sweat, saliva, tears), the liquid or gas slowly hydrolyzes to hydrochloric acid, which can irritate and damage cells.

Phosgene is absorbed to some extent by the lungs, but not by intact skin. Systemic damage is usually a secondary result of anoxia caused by loss of lung function. It is corrosive to the lungs and intact skin.

Description

Phosgene is a colorless, fuming liquid below 47 °F (8.2 °C) and a colorless, nonflammable gas above 47 °F. At low concentrations, its odor is similar to that of green corn or new mown hay; at high concentrations, its odor can be sharp and suffocating. Phosgene is slightly soluble in water and is hydrolyzed slowly by moisture to form hydrochloric acid. It is soluble in most liquid hydrocarbons. It is shipped as a liquefied, compressed gas. Large quantities of phosgene should be stored in a dry, cool, well-ventilated, and fireproof room. Phosgene is a combustion product of many household products that contain volatile organochlorine compounds. Therefore, it may contribute to the hazards of smoke inhalation in fire victims and firefighters.

Routes of Exposure

Inhalation

Inhalation is the major route of phosgene exposure. The odor threshold for phosgene is 5 times higher than the OSHA PEL. **Thus, odor provides insufficient warning of hazardous concentrations.** Phosgene's irritating quality can be mild and delayed, which may result in a lack of avoidance leading to exposure for prolonged periods. Phosgene is heavier than air and may cause asphyxiation in poorly ventilated, low-lying, or enclosed spaces.

Children exposed to the same levels of phosgene gas as adults may receive larger doses because they have greater lung surface area:body weight ratios and increased minute volumes:weight ratios. In addition, they may be exposed to higher levels than adults in the same location because of their short stature and the higher levels of phosgene gas found nearer to the ground.

Skin/Eye Contact

When phosgene gas contacts moist or wet skin, it may cause irritation and erythema. High airborne concentrations can also cause corneal inflammation and opacification. Direct contact with liquid phosgene under pressure can cause frostbite as well as severe irritation and corrosive effects.

Children are more vulnerable to toxicants affecting the skin because of their relatively larger surface area:body weight ratio.

Ingestion

Ingestion of phosgene is unlikely because it is a gas at room temperature.

Sources/Uses

Phosgene is produced commercially by chlorinating carbon monoxide. It is a combustion or decomposition by-product of most volatile chlorinated compounds; therefore, household substances such as certain solvents, paint removers, and dry-cleaning fluids can produce phosgene when exposed to heat or fire. Phosgene may also be produced during the welding of metal parts that have been cleaned with chlorinated hydrocarbons. Phosgene is used as an intermediate in the manufacture of many chemicals including isocyanates, polyurethane, polycarbonates, dyes, pesticides, and pharmaceuticals.

Standards and Guidelines

OSHA PEL (permissible exposure limit) = 0.1 ppm (averaged over a 8-hour workshift)

NIOSH IDLH (immediately dangerous to life or health) = 2 ppm

AIHA ERPG-2 (emergency response planning guideline) (maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action) = 0.2 ppm

Physical Properties

Description: Colorless gas with musty odor at room temperature; a fuming liquid below 47 °F (8 °C).

Warning properties: Detectable odor following brief emergency releases; odor threshold 0.4 to 1.5 ppm; slightly irritating in high concentration. **Odor provides inadequate warning of harmful concentrations.**

Molecular weight: 98.9 daltons

Boiling point: (760 mm Hg): 47 °F (8 °C)

Freezing point: -198 °F (-127 °C)

Specific gravity: 1.43 (liquid at 32 °F)

Vapor pressure: 1,215 mm Hg at 68 °F (20 °C)

Gas density: 3.48 (air = 1)

Water solubility: Slight

Flammability: Nonflammable gas

Incompatibilities

Phosgene reacts with moisture (water or alcohols). In water, it slowly decomposes to hydrochloric acid and carbon dioxide. When heated to decomposition, it will produce toxic and corrosive fumes. Phosgene reacts violently with various chemicals (e.g., alkalis, ammonia, amines, copper, aluminum); it attacks many metals in the presence of water and can also attack plastic and rubber.

Health Effects

Phosgene is an irritant to the skin, eyes, and respiratory tract; there may be minimal irritation immediately after exposure, but delayed damage may be severe.

Common initial symptoms include mild irritation of the eyes and throat, with some coughing, choking, feeling of tightness in the chest, nausea and occasional vomiting, headache, and lacrimation.

Phosgene poisoning may cause respiratory and cardiovascular failure, which results from low plasma volume, increased hemoglobin concentration, low blood pressure, and an accumulation of fluid in the lungs. Secondary systemic damage is the result of anoxia.

Acute Exposure

Phosgene directly reacts with amine, sulfhydryl, and alcohol groups in cells, thereby adversely affecting cell macromolecules and cell metabolism. Direct toxicity to the cells leads to an increase in capillary permeability, resulting in large shifts of body fluid, decreasing plasma volume. In addition, when phosgene hydrolyzes, it forms hydrochloric acid, which can also damage surface cells and cause cell death in the alveoli and bronchioles. Hydrochloric acid release into the mucosa triggers a systemic inflammatory response. Phosgene stimulates the synthesis of lipoxigenase-derived leukotrienes, which attract neutrophils and causes their massive accumulation in the lungs; this contributes to the development of pulmonary edema. Following phosgene exposure, a patient may be free of symptoms for 30 minutes to 48 hours before respiratory damage becomes evident; the more severe the exposure, the shorter the latency. If the initial concentration of phosgene was high, rapid onset of direct cytotoxicity and enzymatic poisoning may ensue. Because phosgene is not very water soluble and hydrolysis tends to be slow, victims inhaling low concentrations of the gas may experience no irritation or only mild irritation of the upper airway. Lack of irritation allows victims to inhale the gas more deeply into the lungs and for prolonged periods.

Children do not always respond to chemicals in the same way that adults do. Different protocols for managing their care may be needed.

Respiratory

Inhaling low concentrations of phosgene may cause no signs or symptoms initially, or symptoms may be due only to mild irritation of the airways; these symptoms (dryness and burning of the throat and cough) may cease when the patient is removed from exposure.

However, after an asymptomatic interval of 30 minutes to 48 hours, in those developing severe pulmonary damage, progressive pulmonary edema develops rapidly with shallow rapid respiration, cyanosis, and a painful paroxysmal cough producing large amounts of frothy white or yellowish liquid. Inadequate, labored respiration, during which abnormal chest sounds are evident, may be accompanied by increased distress and apprehension. Insufficient oxygenation of arterial blood, and massive accumulation of fluid in the lungs may be accompanied by cardiovascular and hematological signs.

Exposure to phosgene has been reported to result in Reactive Airway Dysfunction Syndrome (RADS), a chemically- or irritant-induced type of asthma.

Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways. Children may also be more vulnerable because of increased minute ventilation per kg and failure to evacuate an area promptly when exposed.

Cardiovascular

Cardiovascular collapse may occur if the patient is severely hypovolemic and hypoxemic from accumulation of fluid in the lungs. Destruction of red blood cells in the pulmonary circulation can cause capillary plugging that leads to strain on the right side of the heart and death.

Dermal

If the skin is wet or moist, contact with phosgene vapor can cause irritation and redness of the skin. Contact with liquid phosgene under pressure can result in frostbite.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants affecting the skin.

Ocular

High vapor concentrations cause tearing and increased presence of blood in the eye. Contact with liquid phosgene may result in clouding of the cornea and delayed perforation.

Hematologic

In severe cases, phosgene may cause hemolysis that results in the plugging of pulmonary capillaries.

Most hematologic changes (e.g., hemolysis, methemoglobinemia, bone marrow suppression, and anemia) can be detected by standard blood tests.

Hepatic In cases of high exposures, phosgene may be directly cytotoxic to the liver, causing necrosis and loss of function.

Renal In cases of high exposures, phosgene may be directly cytotoxic to the kidneys, causing necrosis and loss of function.

Gastrointestinal Nausea and vomiting may occur following exposure to phosgene.

Potential Sequelae If the patient survives the initial 48 hours after exposure, recovery is likely. Sensitivity to irritants may persist, causing bronchospasm and chronic inflammation of the bronchioles. Pulmonary tissue destruction and scarring may lead to chronic dilation of the bronchi, lobular emphysema, regions of atelectasis, and increased susceptibility to infection.

Exposure to phosgene has been reported to result in Reactive Airway Dysfunction Syndrome (RADS), a chemically- or irritant-induced type of asthma.

Chronic Exposure

A group of workers who were exposed daily to high levels of phosgene showed an increase in mortality and morbidity from inflammation of the lungs, chronic inflammation of the bronchioles, destruction of alveoli, and impaired pulmonary function. Chronic exposures to low levels of phosgene may lead to chronic pneumonitis, which may resolve or lead to pulmonary edema.

Chronic exposure may be more serious for children because of their potential longer latency period.

Carcinogenicity Phosgene has not been classified for carcinogenic effects.

Reproductive and Developmental Effects No information was found pertaining to reproductive or developmental hazards caused by phosgene exposure. Phosgene is not included in *Reproductive and Developmental Toxicants*, a 1991 report published by the U.S. General Accounting Office (GAO) that lists 30 chemicals of concern because of widely acknowledged reproductive and developmental consequences.

Prehospital Management

Victims exposed only to phosgene gas do not pose substantial risks of secondary contamination to personnel outside the Hot Zone. Victims whose clothing or skin is contaminated with liquid phosgene (ambient temperature below 47 °F) can secondarily contaminate response personnel through direct contact or off-gassing vapor.

Rescue personnel should use breathing apparatus and chemical protective clothing if there is a possibility of exposure to unsafe levels of phosgene.

Phosgene is a severe pulmonary irritant. However, serious pulmonary effects may be delayed up to 48 hours.

Systemic effects are largely a secondary effect of anoxia resulting from pulmonary injury. Phosgene is also irritating to the eyes and skin.

There is no antidote for phosgene. Treatment consists of support of respiratory and cardiovascular functions.

Hot Zone

Rescuers should be trained and appropriately attired before entering the Hot Zone. If the proper equipment is not available, or if rescuers have not been trained in its use, assistance should be obtained from a local or regional HAZMAT team or other properly equipped response organization.

Rescuer Protection

Phosgene is a severe respiratory tract irritant and skin irritant; contact with the liquid will cause frostbite.

Respiratory Protection: Positive-pressure-demand, self-contained breathing apparatus (SCBA) is recommended in response situations that involve exposure to potentially unsafe levels of phosgene.

Skin Protection: Chemical-protective clothing is recommended because phosgene gas can cause skin irritation and burns. NIOSH recommends protective suites made from Responder™ (Kappler Co.), Tychem 10000™ (DuPont Co.), or Teflon™ (DuPont Co.).

ABC Reminders

Quickly access for a patent airway, ensure adequate respiration and pulse. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible.

Victim Removal

If victims can walk, lead them out of the Hot Zone to the Decontamination Zone. Victims who are unable to walk may be

removed on backboards or gurneys; if these are not available, carefully carry or drag victims to safety.

Victims should be kept warm and quiet; any activity subsequent to exposure may increase the likelihood of death.

Consider appropriate management of chemically contaminated children, such as measures to reduce separation anxiety if a child is separated from a parent or other adult.

Decontamination Zone

Victims exposed only to phosgene gas who have no evidence of skin or eye irritation may be transferred immediately to the Support Zone. Other patients will require decontamination as described below.

Rescuer Protection

If exposure levels are determined to be safe, decontamination may be conducted by personnel wearing a lower level of protection than that worn in the Hot Zone (described above).

ABC Reminders

Quickly access for a patent airway, ensure adequate respiration and pulse. Stabilize the cervical spine with a collar and a backboard if trauma is suspected. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device if necessary.

Basic Decontamination

Victims should be kept warm and quiet; any activity subsequent to exposure may increase the likelihood of death.

Victims who are able may assist with their own decontamination. If the exposure involved liquid phosgene (ambient temperature below 47 °F [8 °C]) and if clothing is contaminated, remove and double-bag the clothing.

Flush exposed skin and hair with plain water for 3 to 5 minutes. Wash thoroughly with soap and water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed or irritated eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If a corrosive material is suspected or if pain or injury is evident, continue irrigation while transferring the victim to the Support Zone.

Consider appropriate management of chemically contaminated children at the exposure site. Provide reassurance to the child during decontamination, especially if separation from a parent occurs.

<i>Transfer to Support Zone</i>	As soon as basic decontamination is complete, move the victim to the Support Zone.
Support Zone	Be certain that victims have been decontaminated properly (see <i>Decontamination Zone</i> above). Victims who have undergone decontamination or have been exposed only to phosgene gas generally pose no serious risks of secondary contamination. In such cases, Support Zone personnel require no specialized protective gear.
<i>ABC Reminders</i>	Quickly access for a patent airway. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible. Ensure adequate respiration and pulse. Administer supplemental oxygen as required and establish intravenous access if necessary. Place on a cardiac monitor. Watch for signs of airway swelling and obstruction such as progressive hoarseness, stridor, or cyanosis.
<i>Additional Decontamination</i>	Continue irrigating exposed skin and eyes, as appropriate.
<i>Advanced Treatment</i>	<p>In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, perform cricothyroidotomy if equipped and trained to do so.</p> <p>Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Phosgene poisoning is not known to pose additional risk during the use of bronchial or cardiac sensitizing agents.</p> <p>Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.</p> <p>Patients who are comatose, hypotensive, or are having seizures or cardiac arrhythmias should be treated according to advanced life support (ALS) protocols.</p>

Transport to Medical Facility

Only decontaminated patients or patients not requiring decontamination should be transported to a medical facility. “Body bags” are not recommended.

Report to the base station and the receiving medical facility the condition of the patient, treatment given, and estimated time of arrival at the medical facility.

Multi-Casualty Triage

Consult with the base station physician or the regional poison control center for advice regarding triage of multiple victims.

Phosgene has relatively little odor or irritating effects at moderately toxic air concentrations; serious health effects may occur without warning or symptoms. Because serious complications may be delayed up to 48 hours after exposure, all patients who have suspected phosgene exposure should be transported to a medical facility for evaluation.

Emergency Department Management

Patients exposed only to phosgene gas do not pose significant risks of secondary contamination to personnel outside the Hot Zone. Victims whose clothing or skin is contaminated with liquid phosgene (ambient temperature below 47°F) can secondarily contaminate hospital personnel by direct contact or through off-gassing vapor.

Rescue personnel should use breathing apparatus and chemical protective clothing if there is a possibility of exposure to unsafe levels of phosgene.

Phosgene is a severe pulmonary irritant. However, serious pulmonary effects may be delayed up to 48 hours.

Systemic effects are largely a secondary effect of anoxia resulting from pulmonary injury. Phosgene is also irritating to the eyes and skin.

There is no antidote for phosgene. Treatment consists of support of respiratory and cardiovascular functions.

Decontamination Area

Unless previously decontaminated, all patients suspected of contact with phosgene liquid and all victims with skin or eye irritation require decontamination as described below. Because contact with liquid phosgene may cause burns, don butyl rubber gloves and apron and eye protection before treating patients. All other patients may be transferred immediately to the Critical Care Area.

Be aware that use of protective equipment by the provider may cause fear in children, resulting in decreased compliance with further management efforts.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants affecting the skin. Also, emergency room personnel should examine children's mouths because of the frequency of hand-to-mouth activity among children.

Victims should be kept warm and quiet; any activity subsequent to exposure may increase the likelihood of death.

ABC Reminders

Evaluate and support airway, breathing, and circulation. Children may be more vulnerable to corrosive agents than adults because of the smaller diameter of their airways. In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, surgically create an airway.

Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Phosgene poisoning is not known to pose additional risk during the use of bronchial or cardiac sensitizing agents.

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Patients who are comatose, hypotensive, or have seizures or ventricular arrhythmias or renal failure should be treated in the conventional manner.

Basic Decontamination

Victims who are able may assist with their own decontamination. If the exposure involved liquid phosgene (ambient temperature below 47°F [8 °C]) and if clothing is contaminated, remove and double-bag the clothing.

Flush exposed skin and hair with plain water for 3 to 5 minutes. Wash thoroughly with soap and water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed or irritated eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If a corrosive material is suspected or if pain or injury is evident, continue eye irrigation while transferring the patient to the Critical Care Area.

An ophthalmic anesthetic, such as 0.5% tetracaine, may be necessary to alleviate blepharospasm, and lid retractors may be required to allow adequate irrigation under the eyelids.

Critical Care Area

Be certain that appropriate decontamination has been carried out (see *Decontamination Area* above).

ABC Reminders

Evaluate and support airway, breathing, and circulation as in ABC Reminders above. Children may be more vulnerable to corrosive

agents than adults because of the relatively smaller diameter of their airways. Establish intravenous access in seriously ill patients if this has not been done previously. Continuously monitor cardiac rhythm.

Patients who are comatose, hypotensive, or have seizures or cardiac arrhythmias should be treated in the conventional manner.

Inhalation Exposure

Administer supplemental oxygen by mask to patients who have respiratory complaints. Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Phosgene poisoning is not known to pose additional risk during the use of bronchial or cardiac sensitizing agents.

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Observe patients who are in respiratory distress for up to 48 hours and periodically reexamine their chests and order other appropriate studies. Follow up as clinically indicated.

Corticosteroids are suggested for intense inflammation, especially inflammation of the respiratory epithelium. If the patient experienced severe exposure, consider initiating intravenous steroid therapy while the patient is asymptomatic.

Prophylactic antibiotics are not routinely recommended but may be used based on the results of sputum cultures. Pneumonia can complicate severe pulmonary edema and may cause death up to 48 hours after onset of pulmonary edema.

Diuretics are contraindicated. Pulmonary edema due to phosgene inhalation is not hypervolemic in origin; patients tend to be hypovolemic and hypotensive. Dopamine may be required for treatment of hypotension, bradycardia, or renal failure. Initiate fluid resuscitation as needed.

Skin Exposure

If phosgene was in contact with the skin, chemical burns may result; treat as thermal burns.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants affecting the skin.

Eye Exposure

Continue irrigation for at least 15 minutes. Test visual acuity. Examine the eyes for corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have corneal injuries.

*Antidotes and
Other Treatments*

There is no antidote for phosgene. Treatment is supportive.

Laboratory Tests

The diagnosis of acute phosgene toxicity is primarily clinical, based on symptoms of irritation and breathing difficulty. However, laboratory testing is useful for monitoring the patient and evaluating complications. Routine laboratory studies for all exposed patients include CBC, glucose, and electrolyte determinations. ECG monitoring is useful for patients exposed to phosgene. Chest radiography and pulse oximetry (or ABG measurements) are also recommended for severe inhalation exposure. Evidence of pulmonary edema—hilar enlargement, and ill-defined, central-patch infiltrates on chest radiography—is a late finding that may occur 6 to 8 hours after exposure.

Plasma phosgene levels are not clinically useful.

**Disposition and
Follow-up**

Consider hospitalizing all patients who have suspected phosgene exposure. Patients who have respiratory compromise should be admitted to an intensive care unit.

Delayed Effects

Because pulmonary edema may not occur for up to 48 hours after exposure, patients who have known exposure should be observed and reexamined periodically before confirming the absence of toxic effects. Patients who have bronchospasm or pulmonary edema should be watched carefully for signs of impending respiratory failure and should be managed accordingly. Patients who survive for 48 hours usually recover.

Patient Release

Asymptomatic patients who have normal initial examinations and no signs of toxicity after observation for 48 hours may be discharged with instructions to seek medical care promptly if symptoms develop (see the *Phosgene—Patient Information Sheet* below).

Follow-up

Obtain the name of the patient's primary care physician so that the hospital can send a copy of the ED visit to the patient's doctor.

Patients may have long term damage to the lungs and increased susceptibility to infection. Sensitivity to irritants may persist, causing bronchospasm, chronic inflammation of the bronchioles and

Reactive Airway Dysfunction Syndrome (RADS), a chemically- or irritant-induced type of asthma.

Patients who have corneal injuries should be reexamined in 24 hours.

Reporting

If a work-related incident has occurred, you may be legally required to file a report; contact your state or local health department.

Other persons may still be at risk in the setting where this incident occurred. If the incident occurred in the workplace, discussing it with company personnel may prevent future incidents. If a public health risk exists, notify your state or local health department or other responsible public agency. When appropriate, inform patients that they may request an evaluation of their workplace from OSHA or NIOSH. See Appendices III and IV for a list of agencies that may be of assistance.

Phosgene Patient Information Sheet

This handout provides information and follow-up instructions for persons who have been exposed to phosgene.

What is phosgene?

At room temperature, phosgene is a colorless gas. At high concentrations, it has a suffocating odor; at low concentrations, it smells like green corn or new mown hay. It is not flammable. Phosgene is used in the manufacture of many chemicals. It is also produced when chlorine-containing chemicals burn or break down.

What immediate health effects can result from exposure to phosgene?

Most exposures to phosgene occur from breathing the gas. Exposure to small amounts usually causes eye, nose, and throat irritation. However, the irritating effects can be so mild at first that the person does not leave the area of exposure. Generally, the higher the exposure, the more severe the symptoms. Extended exposure can cause severe breathing difficulty, which may lead to chemical pneumonia and death. Severe breathing problems may not develop for as long as 48 hours after exposure.

Can phosgene poisoning be treated?

There is no antidote for phosgene, but its effects can be treated, and most exposed persons get well. Persons who have experienced serious symptoms may need to be hospitalized.

Are any future health effects likely to occur?

A single small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. After a serious exposure, some symptoms may take a few days to develop. Some persons who have had serious exposures have developed permanent breathing difficulty and tend to develop lung infections easily.

What tests can be done if a person has been exposed to phosgene?

Specific tests for the presence of phosgene in blood or urine generally are not useful to the doctor. If a severe exposure has occurred, chest x-rays, blood and urine analyses and other tests may show whether the lungs or other organs have been injured. Because effects may take several days to develop, immediate and follow-up testing of lung function should be done in all cases of suspected exposure to phosgene.

Where can more information about phosgene be found?

More information about phosgene can be obtained from your regional poison control center; your state, county, or local health department; the Agency for Toxic Substances and Disease Registry (ATSDR); your doctor; or a clinic in your area that specializes in occupational and environmental health. If the exposure happened at work, you may wish to discuss it with your employer, the Occupational Safety and Health Administration (OSHA), or the National Institute for Occupational Safety and Health (NIOSH). Ask the person who gave you this form for help in locating these telephone numbers.

Follow-up Instructions

Keep this page and take it with you to your next appointment. Follow *only* the instructions checked below.

Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:

- coughing or wheezing
- difficulty breathing or shortness of breath
- increased pain or a discharge from exposed skin or eyes
- chest pain or tightness

No follow-up appointment is necessary unless you develop any of the symptoms listed above.

Call for an appointment with Dr. _____ in the practice of _____.

When you call for your appointment, please say that you were treated in the Emergency Department at _____ Hospital by _____ and were advised to be seen again in _____ days.

Return to the Emergency Department/ _____ Clinic on (date) _____ at _____ AM/PM for a follow-up examination.

Do not perform vigorous physical activities for 1 to 2 days.

You may resume everyday activities including driving and operating machinery.

Do not return to work for _____ days.

You may return to work on a limited basis. See instructions below.

Avoid exposure to cigarette smoke for 72 hours; smoke may worsen the condition of your lungs.

Avoid drinking alcoholic beverages for at least 24 hours; alcohol may worsen injury to your stomach or have other effects.

Avoid taking the following medications: _____

You may continue taking the following medication(s) that your doctor(s) prescribed for you: _____

Other instructions: _____

• Provide the Emergency Department with the name and the number of your primary care physician so that the ED can send him or her a record of your emergency department visit.

• You or your physician can get more information on the chemical by contacting: _____ or _____, or by checking out the following Internet Web sites: _____; _____.

Signature of patient _____ Date _____

Signature of physician _____ Date _____