

## 1,3-Butadiene (C<sub>4</sub>H<sub>6</sub>) CAS 106-99-0; UN 1010

Synonyms include butadiene, buta-1,3-diene, biethylene, biviny, vinylethylene, erythrene,  $\alpha,\gamma$ -butadiene, divinyl, and pyrrolylene.

- **Persons exposed to 1,3-butadiene gas do not pose a significant risk of secondary contamination to response personnel outside the Hot Zone. Persons whose skin or clothing has been contaminated with liquid 1,3-butadiene can secondarily contaminate response personnel by direct contact or through off-gassing vapor.**
- **1,3-Butadiene is a colorless, highly flammable gas at room temperature. The gas is heavier than air and potentially explosive. It has a mild, aromatic, gasoline-like odor that is often an adequate warning to protect against acute overexposure.**
- **The major route of exposure to 1,3-butadiene is inhalation. 1,3-Butadiene escaping its container in liquid or gas form can produce irritation or frostbite injury. Significant dermal absorption is unlikely.**
- **1,3-Butadiene's extreme flammability and potential for explosion is probably of greater health concern than its toxic effects.**

### Description

1,3-Butadiene is a colorless gas with a mild, aromatic, gasoline-like odor. It is non-corrosive but highly flammable. The vapor is heavier than air. 1,3- Butadiene is commercially available as a liquefied gas (under pressure) with a stabilizer added for shipment. Liquid 1,3-butadiene floats and boils on water. Because of 1,3-butadiene's physical properties (e.g., low flashpoint and tendency to polymerize), its fire and explosion potential might be greater concerns (more likely to occur and more dangerous) than its health effects.

### Routes of Exposure

#### *Inhalation*

1,3-Butadiene is a gas at all ambient temperatures; therefore, the most common exposure route for humans is inhalation. 1,3-Butadiene is heavier than air and can collect in poorly ventilated or enclosed spaces and low-lying areas, posing a risk of asphyxiation. Short-term exposure to concentrations of 2,000 to 8,000 ppm has been reported to cause irritation of the mucous membranes of the nose, mouth, and throat. The odor of 1,3-butadiene is discernable at 1 to 1.6 ppm which is slightly lower than the OSHA PEL (1 ppm) and therefore is a generally sufficient warning of acute exposure.

Children exposed to the same levels of 1,3-butadiene vapor as adults may receive larger dose 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 1,3-butadiene vapor found nearer to the ground.

*Skin/Eye Contact*

Exposure to concentrated vapors of liquid 1,3-butadiene can cause mild to moderate irritation of the eyes and upper respiratory tract, and mild irritation of the skin. Direct contact with escaping compressed gas or liquid can cause frostbite injury.

*Ingestion*

Ingestion is unlikely because 1,3-butadiene is a gas at room temperature. No human or animal toxicity information was available for ingested 1,3-butadiene at the time of this review.

**Sources/Uses**

Large amounts (about 3 billion pounds) of 1,3-butadiene are produced each year from petroleum gases. Over 60% of this is used to make styrene/butadiene and polybutadiene rubber, primarily for automotive tires. Smaller percentages are used to produce a component of nylon (12%), styrene-butadiene copolymer latexes (8%), neoprene rubber (2-chloro-1,3-butadiene) (7%), and acrylonitrile/butadiene/styrene (ABS) resins (6%). Most of the remaining 7% is used in the production of rocket propellants and specialty copolymer resins and latexes for paints, coatings, and adhesives; and as an additive to oil lubricants. Nonpolymer applications include the manufacture of agricultural fungicides (Captan and Captofol), sulfolane (an industrial solvent), and anthraquinone dyes.

Small amounts of 1,3-butadiene are found in gasoline, automobile exhaust, cigarette smoke, and wood-fire smoke.

**Standards and Guidelines**

OSHA PEL (permissible exposure limit) = 1 ppm (averaged over an 8-hour workshift).

OSHA STEL (short-term exposure limit) = 5 ppm (15-minute exposure).

NIOSH IDLH (immediately dangerous to life or health) = 2,000 ppm.

AIHA ERPG-2 (maximum airborne concentration below which it is believed that nearly all persons could be exposed for up to 1 hour without experiencing or developing irreversible or other

serious health effects or symptoms that could impair their abilities to take protective action) = 200 ppm.

## Physical Properties

*Description:* colorless gas; colorless liquid when pressurized

*Warning properties:* odor often provides an adequate warning for acute but not chronic exposures. The gas has a mild, aromatic, gasoline-like odor detectable at concentrations ranging from 1 to 1.6 ppm.

*Molecular weight:* 54.09 daltons

*Boiling point* (760 mm Hg): 24.08 °F (-4.4 °C)

*Freezing point:* -164 °F (-108.9 °C)

*Specific gravity:* 0.62 (liquid) at 68 °F (20 °C) (water = 1.00)

*Vapor pressure:* 910 mm Hg at 68 °F (20 °C)

*Gas density:* 1.9 (air = 1 at boiling point of 1,3-butadiene)

*Water solubility:* Negligible solubility in water (735 mg/L at 77 °F [25 °C])

*Flammability:* Flammable at temperatures > -105 °F (-76 °C)

*Flammable range:* 2.0 to 12.0%

## Incompatibilities

1,3-Butadiene is highly reactive and polymerizes easily, especially in the presence of oxygen. Inhibitors (such as tributylcatechol) are normally added to prevent self-polymerization and formation of peroxides. It reacts violently with strong oxidizing agents and can cause fires and explosions. Crude 1,3-butadiene (the dimer, not the monomer) can react with copper and copper alloys to form explosive copper compounds. It breaks down some types of plastics, rubber, and coatings. It polymerizes at elevated temperatures; if polymerization occurs in a container, the process can violently rupture the container. Toxic gases such as carbon monoxide can be released when 1,3-butadiene burns.



## Health Effects

- **Acute, high-level exposure to 1,3-butadiene gas initially can cause eye, nose, throat, and skin irritation. Exposures to very high concentrations of 1,3-butadiene can cause central nervous system (CNS) depression. Signs and symptoms can include blurred vision, nausea, fatigue, headache, vertigo, decreased blood pressure and pulse rate, unconsciousness, and respiratory paralysis.**
- **Acute toxicity of 1,3-butadiene is due to its narcotic effects. 1,3-Butadiene is metabolized to produce two DNA reactive metabolites; butadiene monoepoxide and butadiene diepoxide.**

### Acute Exposure

Acute toxicity of 1,3-butadiene is due to its narcotic effects. 1,3-Butadiene is metabolized to two DNA reactive metabolites: butadiene monoepoxide and butadiene diepoxide. Acute exposure to 1,3-butadiene can cause irritation and (at high concentrations) narcosis. At air concentrations of 1,000 ppm or greater, 1,3-butadiene can cause irritation of the skin, eyes, nose, and throat. Eye irritation, blurred vision, coughing, and drowsiness have been reported after 8-hour exposures to 8,000 ppm.

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

### CNS

In humans, inhalation of very high concentrations of 1,3-butadiene can result in CNS effects including lethargy, headache, drowsiness, fatigue, vertigo, ataxia, unconsciousness, coma, and respiratory depression and death. Humans exposed to 2,000 ppm in air for 7 hours reported hallucinations and distortions in perception. In experimental animal studies, concentrations of 150,000 to 200,000 ppm have produced mild anesthesia. At concentrations of 200,000 to 250,000 ppm, respiratory depression leading to death has been reported within 35 minutes. As air levels approach those high enough to seriously threaten CNS function, however, the far greater danger is from explosion.

### Respiratory

Acute inhalation of 2,000 to 8,000 ppm 1,3-butadiene can cause irritation of the upper respiratory tract. Coughing and bronchospasm can occur, especially in susceptible individuals, such as persons with asthma.

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| <i>Dermal</i>                                 | Skin contact with escaping compressed gas or liquid 1,3-butadiene can cause mild to moderate irritation and frostbite. Mixtures of 1,3-butadiene and clay minerals have been reported to cause dermatitis.   |
| <i>Ocular</i>                                 | Exposure to 2,000 to 8,000 ppm 1,3-butadiene gas can cause eye irritation, chemical conjunctivitis, and corneal irritation.  |
| <i>Cardiovascular</i>                         | Bradycardia and hypotension secondary to CNS depression is possible with exposure to very high concentrations (150,000–250,000 ppm) of 1,3-butadiene.  |
| <i>Gastrointestinal</i>                       | Nausea and dryness of the mouth can occur.   |
| <i>Potential Sequelae</i>                     | In survivors, dermal, ocular, and systemic effects of 1,3-butadiene exposure rapidly subside. However, victims who suffer prolonged hypoxia from coma or respiratory arrest can develop multiple organ damage.   |
| <b>Chronic Exposure</b>                       | <p>Cancer is suspected to be the primary adverse effect of chronic exposure to 1,3-butadiene. 1,3-Butadiene metabolites are mutagenic in both germ and somatic cells. The rates of epoxide metabolite formation in different species are thought to be an important factor in the species' responses to 1,3-butadiene. There is some evidence for bone marrow depression and DNA repair deficiencies after long-term exposure of experimental animals to 1,3-butadiene.</p> <p>Chronic exposure may be more serious for children because of their potential longer latency period.</p> |
| <i>Carcinogenicity</i>                        | 1,3-Butadiene has caused multi-site tumors in laboratory mice and rats. The U.S. Department of Health and Human Services (DHHS) has determined that 1,3-butadiene can reasonably be anticipated to be a human carcinogen. In a recent re-evaluation, the International Agency for Research on Cancer (IARC) viewed the human epidemiological evidence for carcinogenicity as limited and retained the Group 2A classification, "probably carcinogenic to humans." The carcinogenic effect if it were to occur would most likely occur following long-term exposure.                    |
| <i>Reproductive and Developmental Effects</i> | No adverse reproductive effects from 1,3-butadiene exposure have been reported for humans. Experimental animal studies have yielded evidence for damage to the testes and ovaries, and for direct toxic effects on the developing young from exposures during gestation. No information was located on whether 1,3-butadiene can cross the placenta or on levels of  |

1,3-butadiene in breast milk. 1,3-Butadiene is not included in *Reproductive and Developmental Toxicants*, a 1991 report published by the General Accounting Office (GAO) that lists 30 chemicals of concern because of widely acknowledged reproductive and developmental consequences.

Special consideration regarding the exposure of pregnant women is warranted, since metabolites of 1,3-butadiene have been shown to be genotoxicants; thus, medical counseling may be warranted for the acutely exposed pregnant woman.





## Prehospital Management

- **Persons exposed only to 1,3-butadiene gas pose no risk of secondary contamination to rescuers. Those whose skin or clothing is heavily contaminated with liquid 1,3-butadiene can secondarily contaminate response personnel by direct contact or through rapidly evaporating gas.**
- **1,3-Butadiene is a gas at all ambient temperatures; therefore, the most common exposure route for humans is inhalation. Very high concentrations (150,000 to 250,000 ppm) of 1,3-butadiene have the potential to cause CNS and respiratory depression. Lower concentrations can cause headache, nausea, coughing, blurred vision, and irritation of the eyes and upper respiratory tract.**
- **There is no specific antidote for 1,3-butadiene poisoning. Treatment is supportive.**

### Hot Zone

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

1,3-Butadiene is very flammable and has a high fire and explosion potential. Responders should eliminate all sources of ignition, including grounding of electrical equipment.

### Rescuer Protection

1,3-Butadiene gas is readily absorbed by inhalation and is a respiratory tract irritant. Contact of skin or eyes with escaping compressed gas or liquid can cause irritation or frostbite injury.

*Respiratory protection:* Positive-pressure, self-contained breathing apparatus (SCBA) is recommended in response situations that involve exposure to potentially hazardous levels of 1,3-butadiene gas.

*Skin protection:* When skin contact with the liquid or escaping compressed gas is expected, wearing chemical-protective clothing is recommended to avoid skin irritation and frostbite. Chemical-protective clothing is not generally required with gas-only exposure because dermal irritation and absorption of 1,3-butadiene gas is minimal.

### 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 should be removed on backboards or gurneys. If these are not available, carefully carry or drag victims to safety.

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 1,3-butadiene gas who have no skin or eye irritation do not need decontamination. They 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 required 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 if necessary.

*Basic Decontamination*

Victims who are able may assist with their own decontamination. If the patient's clothing is wet with 1,3-butadiene, remove and double bag the contaminated clothing and all personal belongings.

Handle frostbitten skin and eyes with caution. Place frostbitten skin in warm water, about 108 °F (42 °C). If warm water is not available, wrap the affected part gently in blankets. Let the circulation reestablish itself naturally. Encourage the victim to exercise the affected part while it is being warmed.

Flush exposed skin and hair with plain water for 2 to 3 minutes, then wash with mild soap. Rinse thoroughly with water.

Do not irrigate frostbitten eyes. Otherwise, irrigate exposed eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If pain or injury is evident, continue irrigation while transferring the victim to the Support Zone.

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| <i>Transfer to Support Zone</i>   | As soon as basic decontamination is complete, move the victim to the Support Zone.   |
| <b>Support Zone</b>               | 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 1,3-butadiene gas pose no serious risk of secondary contamination to rescuers. In such cases, Support Zone personnel require no specialized protective gear.  |
| <i>ABC Reminders</i>              | 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. Ensure adequate respiration and pulse; administer supplemental oxygen as required and establish intravenous access if necessary. Place on a cardiac monitor.   |
| <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. Also 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). 1,3-Butadiene 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 have seizures or cardiac dysrhythmias should be treated according to advanced life support (ALS) protocols.</p> <p>If frostbite injury is present, treat by rewarming in a water bath at a temperature of 102 to 108 °F (40 to 42 °C) for 20 to</p> |

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*Transport to Medical Facility*

30 minutes and continue until a flush has returned to the affected area.

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

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

**Multi-Casualty Triage**

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

Patients with evidence of significant exposure, such as respiratory difficulties or symptoms of CNS depression, should be transported to a medical facility for evaluation. Others may be discharged at the scene after their names, addresses, and telephone numbers are recorded. Those discharged should be advised to seek medical care promptly if symptoms develop (see *Patient Information Sheet* below).

## Emergency Department Management

- **Patients exposed only to 1,3-butadiene gas pose no risk of secondary contamination to rescuers. Patients whose skin or clothing is contaminated with liquid 1,3-butadiene could potentially contaminate hospital personnel by contact with rapidly evaporating gas. The gas is highly flammable; therefore, decontamination should be conducted in a well-ventilated area and all sources of ignition should be eliminated.**
- **1,3-Butadiene is a gas at all ambient temperatures and is not absorbed well through the skin; therefore, the most common exposure route for humans is inhalation. Very high concentrations of 1,3-butadiene have the potential to cause CNS and respiratory depression. Lower concentrations can cause irritation of the eyes and upper respiratory tract, coughing, blurred vision, nausea, and headache.**
- **There is no specific antidote for 1,3-butadiene. Treatment is supportive.**

### Decontamination Area

Previously decontaminated patients and those exposed only to 1,3-butadiene gas who have no skin or eye irritation may be transferred immediately to the Critical Care Area. Others require decontamination as described below.

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

### *ABC Reminders*

Evaluate and support airway, breathing, and circulation. 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. Also 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). 1,3-Butadiene 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 are having seizures or ventricular arrhythmias should be treated in the conventional manner.

#### *Basic Decontamination*

1,3-Butadiene gas or liquid should no longer be present on the patient. Nevertheless, if further decontamination is needed, patients who are able and cooperative may assist with their own decontamination. Remove contaminated clothing and all personal belongings and place them outside in a well ventilated area (due to a potential fire or explosion hazard).

Handle frostbitten skin and eyes with caution. Place frostbitten skin in warm water, about 108 °F (42 °C). If warm water is not available, wrap the affected part gently in blankets. Let the circulation reestablish itself naturally. Encourage the victim to exercise the affected part while it is being warmed.

Flush exposed skin and hair with plain water for 2 to 3 minutes, then wash with mild soap. Rinse thoroughly with water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Do not irrigate frostbitten eyes. Otherwise, flush exposed or irritated eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable. If pain or injury is evident, continue irrigation while transferring the victim to the Critical Care Area.

#### **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. Establish intravenous access in seriously 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 or CNS depression. Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical

exposures may pose additional risks. Also 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). 1,3-Butadiene 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.

#### *Skin Exposure*

Escaping compressed gas or liquid 1,3-butadiene can cause frostbite injury. If a victim has frost bite, treat by rewarming affected areas in a water bath at a temperature of 102 to 108 °F (40 to 42 °C) for 20 to 30 minutes and continue until a flush has returned to the affected area.

#### *Eye Exposure*

Ensure that adequate eye irrigation has been completed. Test visual acuity. Examine the eyes for conjucorneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have a suspected corneal injury.

#### *Ingestion Exposure*

Ingestion of 1,3-butadiene is highly unlikely because it is gaseous at room temperatures and a liquid only when kept under pressure.

#### *Antidotes and Other Treatments*

There is no specific antidote for 1,3-butadiene poisoning. Treatment is supportive.

#### *Laboratory Tests*

The diagnosis of acute 1,3-butadiene toxicity is primarily clinical based on respiratory distress or symptoms of CNS depression. Routine laboratory studies for symptomatic patients should include CBC, glucose, electrolytes, liver enzymes, and kidney function tests. Chest radiography and pulse oximetry (or ABG measurements) are recommended in cases of severe inhalation exposure.

1,3-Butadiene and its major metabolites, the epoxides (mono- and di-) and the mercapturic acid derivatives of the epoxides, are rapidly eliminated from the body through the lungs and kidney, respectively. Any testing should be performed shortly after exposure. Breath levels of the epoxides and urine levels of mercapturic acids are not clinically useful, but they can be used to document an exposure.

**Disposition and  
Follow-up**

Consider hospitalizing patients who have persistent or progressive symptoms, ventricular ectopy, or who might have been exposed to extremely high levels of 1,3-butadiene.

*Delayed Effects*

Patients who experience significant CNS depression should be observed until complete recovery is evident, preferably for 24 hours or longer.

*Patient Release*

Patients who have not experienced alterations in mental status or respiratory difficulty may be discharged. Patients who initially exhibited mild symptoms, but who become asymptomatic during 6 to 8 hours of observation, may also be discharged. These patients should be advised to rest and to seek medical care promptly if symptoms develop or recur (see the *1,3-Butadiene—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.

After significant exposures, CBC, liver enzymes, and kidney function tests are recommended in cases of severe cardiopulmonary compromise. Patients who have skin or corneal injury should be re-examined within 24 hours.

**Reporting**

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

Other persons might still be at risk in the setting where this incident occurred. If the incident occurred in the workplace, discussing it with company personnel might 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.



## **1,3-Butadiene**

### **Patient Information Sheet**

This handout provides information and follow-up instructions for persons who have been exposed to 1,3-butadiene.

#### **What is 1,3-butadiene?**

1,3-Butadiene is shipped and handled as a liquefied compressed gas in a special container. At room temperatures, it is a gas with a mild, gasoline-like odor. It is used to make synthetic rubber, tires, and plastics.

#### **What immediate health effects can be caused by exposure to 1,3-butadiene?**

Inhaling 1,3-butadiene can cause irritation of the nose, eyes, mouth, and throat. Typical symptoms include sore throat, runny nose, burning eyes, and cough. Exposure to very high concentrations can cause headache, nausea, blurred vision, drowsiness, fatigue, vertigo, coma, and death. If the skin or eyes come in contact with liquid 1,3-butadiene, frostbite can occur.

#### **Can 1,3-butadiene poisoning be treated?**

There is no specific antidote for 1,3-butadiene, but its effects can be treated and most exposed persons recover well. Persons who have inhaled large amounts of 1,3-butadiene might need to be hospitalized.

#### **Are any future health effects likely to occur?**

A small single exposure from which a person quickly recovers is not likely to cause any delayed or long-term effects. There are no reported human reproductive health effects, but some animal studies have shown developmental defects after long-term exposure. Medical evaluation is recommended for such patients. Chronic, long-term exposure might also cause cancer; 1,3-butadiene is considered a probable human carcinogen.

#### **What tests can be done if a person has been exposed to 1,3-butadiene?**

Specific tests for the presence of 1,3-butadiene and its breakdown products in the breath and urine are not widely available and must be performed shortly after exposure. These tests are not generally useful to your doctor.

#### **Where can more information about 1,3-butadiene be found?**

More information about 1,3-butadiene 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 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:

- shortness of breath
- coughing, wheezing, or chest tightness
- increased pain or discharge from injured eyes
- signs of skin infection, increased redness, pain, or pus-like discharge from injured skin

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 \_\_\_\_\_