

## Hydrogen Sulfide (H<sub>2</sub>S) CAS 7783-0604; UN 1053

Synonyms include dihydrogen sulfide, sulfur hydride, sulfurated hydrogen, hydrosulfuric acid, “sewer gas,” “swamp gas,” hepatic acid, sour gas, and “stink damp.”

**Persons exposed to hydrogen sulfide pose no serious risks of secondary contamination to personnel outside the Hot Zone. However, fatalities have occurred to rescuers entering the hot zone.**

**Hydrogen sulfide is a colorless, highly flammable and explosive gas produced naturally by decaying organic matter and by certain industrial processes. Hydrogen sulfide has a characteristic rotten-egg odor; however, olfactory fatigue may occur and consequently it may not provide adequate warning of hazardous concentrations.**

**Hydrogen sulfide is well absorbed through the lungs; cutaneous absorption is minimal. Exposure by any route can cause systemic effects.**

### Description

Hydrogen sulfide is a colorless, flammable, highly toxic gas. It is shipped as a liquefied, compressed gas. It has a characteristic rotten-egg odor that is detectable at concentrations as low as 0.5 ppb.

### Routes of Exposure

#### *Inhalation*

Inhalation is the major route of hydrogen sulfide exposure. The gas is rapidly absorbed by the lungs. The odor threshold (0.5 ppb) is much lower than the OSHA ceiling (20 ppm). However, although its strong odor is readily identified, olfactory fatigue occurs at high concentrations and at continuous low concentrations. For this reason, **odor is not a reliable indicator of hydrogen sulfide’s presence and may not provide adequate warning of hazardous concentrations.** Hydrogen sulfide is slightly heavier than air and may accumulate in enclosed, poorly ventilated, and low-lying areas.

Children exposed to the same levels of hydrogen sulfide 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 hydrogen sulfide found nearer to the ground. Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways.

*Skin/Eye Contact* Prolonged exposure to hydrogen sulfide, even at relatively low levels, may result in painful dermatitis and burning eyes. Direct contact with the liquefied gas can cause frostbite. Absorption through intact skin is minimal.

*Ingestion* Because hydrogen sulfide is a gas at room temperature, ingestion is unlikely to occur.

**Sources/Uses** Hydrogen sulfide is produced naturally by decaying organic matter and is released from sewage sludge, liquid manure, sulfur hot springs, and natural gas. It is a by-product of many industrial processes including petroleum refining, tanning, mining, wood-pulp processing, rayon manufacturing, sugar-beet processing, and hot-asphalt paving. Hydrogen sulfide is used to produce elemental sulfur, sulfuric acid, and heavy water for nuclear reactors.

**Standards and Guidelines**

OSHA ceiling = 20 ppm

OSHA maximum peak = 50 ppm (10 minutes, once, no other exposure)

NIOSH IDLH (immediately dangerous to life or health) = 100 ppm

AIHA ERPC-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) = 30 ppm.

**Physical Properties**

*Description:* Colorless gas with odor of rotten eggs

*Warning properties:* Not dependable; characteristic rotten-egg odor detectable at about 0.5 ppb, but olfactory nerve fatigue occurs in 2 to 15 minutes at concentrations over 100 ppm

*Molecular weight:* 34.1 daltons

*Boiling point* (760 mm Hg): -77 °F (-60.3 °C)

*Vapor pressure:* >760 mm Hg at 68 °F (20 °C)

*Gas density:* 1.2 (air = 1)

*Water solubility:* Slightly water soluble (0.4% at 68 °F [20 °C])

*Flammability:* Highly flammable and explosive between 4% and 45% (concentration in air); may travel to a source of ignition and flash back. Burns to produce a toxic gas, sulfur dioxide.

**Incompatibilities**

Hydrogen sulfide reacts with strong oxidizers, strong nitric acid, and metals.



## Health Effects

**Hydrogen sulfide is a mucous membrane and respiratory tract irritant; pulmonary edema, which may be immediate or delayed, can occur after exposure to high concentrations.**

- **Symptoms of acute exposure include nausea, headaches, delirium, disturbed equilibrium, tremors, convulsions, and skin and eye irritation.**
- **Inhalation of high concentrations of hydrogen sulfide can produce extremely rapid unconsciousness and death. Exposure to the liquified gas can cause frostbite injury.**

### Acute Exposure

Hydrogen sulfide's can cause inhibition of the cytochrome oxidase enzyme system resulting in lack of oxygen use in the cells. Anaerobic metabolism causes accumulation of lactic acid leading to an acid-base imbalance. The nervous system and cardiac tissues are particularly vulnerable to the disruption of oxidative metabolism and death is often the result of respiratory arrest. Hydrogen sulfide also irritates skin, eyes, mucous membranes, and the respiratory tract. Pulmonary effects may not be apparent for up to 72 hours after exposure.

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

### CNS

CNS injury is immediate and significant after exposure to hydrogen sulfide. At high concentrations, only a few breaths can lead to immediate loss of consciousness, coma, respiratory paralysis, seizures, and death. CNS stimulation may precede CNS depression. Stimulation manifests as excitation, rapid breathing, and headache; depression manifests as impaired gait, dizziness, and coma, possibly progressing to respiratory paralysis and death. In addition, decreased ability to smell hydrogen sulfide occurs at concentrations greater than 100 ppm.

### Respiratory

Inhaled hydrogen sulfide initially affects the nose and throat. Low concentrations ( 50 ppm) can rapidly produce irritation of the nose, throat, and lower respiratory tract. Pulmonary manifestations include cough, shortness of breath, and bronchial or lung hemorrhage. Higher concentrations can provoke bronchitis and cause accumulation of fluid in the lungs, which may be immediate or delayed for up to 72 hours. Lack of oxygen may result in blue skin color.

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 to gas exposure because of increased minute ventilation per kg and failure to evacuate an area promptly when exposed.

*Cardiovascular* High-dose exposures may cause insufficient cardiac output, irregular heartbeat, and conduction abnormalities.

*Renal* Transient renal effects include blood, casts, and protein in the urine. Renal failure as a direct result of hydrogen sulfide toxicity has not been described, although it may occur secondary to cardiovascular compromise.

*Gastrointestinal* Symptoms may include nausea and vomiting.

*Dermal* Prolonged or massive exposure may cause burning, itching, redness, and painful inflammation of the skin. Exposure to the liquified gas can cause frostbite injury.

*Ocular* Eye irritation may result in inflammation (i.e., keratoconjunctivitis) and clouding of the eye surface. Symptoms include blurred vision, sensitivity to light, and spasmodic blinking or involuntary closing of the eyelid.

*Potential Sequelae* Inflammation of the bronchi can be a late development. Survivors of severe exposure may develop psychological disturbances and permanent damage to the brain and heart. The cornea may be permanently scarred.

### **Chronic Exposure**

Hydrogen sulfide does not accumulate in the body. Nevertheless, repeated or prolonged exposure has been reported to cause low blood pressure, headache, nausea, loss of appetite, weight loss, ataxia, eye-membrane inflammation, and chronic cough. Neurologic symptoms, including psychological disorders, have been associated with chronic exposure. Chronic exposure may be more serious for children because of their potential longer latency period.

*Carcinogenicity* Hydrogen sulfide has not been classified for carcinogenic effects.

*Reproductive and  
Developmental Effects*

There is some evidence to suggest that exposure to hydrogen sulfide may be associated with an increased risk of spontaneous abortion. No information was located pertaining to placental transfer of hydrogen sulfide or to excretion of hydrogen sulfide in breast milk. There are no studies of developmental effects in humans exposed to hydrogen sulfide. However, results from animal studies suggest that hydrogen sulfide may be a developmental neurotoxicant. Hydrogen sulfide is not listed in TERIS or in *Shepard's Catalog of Teratogenic Agents*. It is also 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 hydrogen sulfide gas do not pose substantial risks of secondary contamination to personnel outside the Hot Zone. However, personnel could be secondarily contaminated by contacting or breathing vapors from clothing heavily soaked with hydrogen sulfide-containing solution.**

**Hydrogen sulfide is a highly toxic gas that can produce extremely rapid CNS and respiratory depression. It is also an irritant affecting skin and mucous membranes.**

**There is no proven antidote for hydrogen sulfide poisoning. Treatment generally 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 prehospital staff 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*

**Hydrogen sulfide is an extremely rapidly acting, highly toxic gas. Fatalities have occurred to rescuers entering the hot zone.**

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

*Skin Protection:* Chemical-protective clothing is not generally required because hydrogen sulfide gas is not absorbed through the skin, and skin irritation is rare. Direct contact with the liquefied gas can cause frostbite.

Rescuers should have a safety line during rescue operations because of the extremely rapid toxic action of hydrogen sulfide.

### *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.

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**

Patients exposed only to hydrogen sulfide 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 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 who are able may assist with their own decontamination. Remove and double-bag contaminated clothing.

Handle frostbitten skin and eyes with caution. 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 water for 3 to 5 minutes. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Do not irrigate frostbitten eyes. Otherwise, irrigate exposed or irritated eyes with plain water or saline for at least 5 minutes. Eye irrigation may be carried out simultaneously with other basic care and transport. 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, such as measures to reduce separation anxiety if a child is separated from a parent or other adult. If possible, seek assistance from a child separation expert.

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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 properly decontaminated (see <i>Decontamination Zone</i> above). Victims who have undergone decontamination or who have been exposed only to hydrogen sulfide gas 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.
<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). Hydrogen sulfide 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> <p>If frostbite is present, treat by rewarming 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.</p>

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Nitrite therapy (found in the cyanide antidote kit) has been suggested as a therapy for hydrogen sulfide exposure. Amyl nitrite is given by inhalation (for 30 seconds every minute until an intravenous line is established) followed by intravenous sodium nitrite (**300 mg over absolutely no less than 5 minutes**). This may aid recovery by forming sulfmethemoglobin, thus removing sulfide from combination in tissue. It is not necessary to use the sodium thiosulfate component of the cyanide antidote kit. The antidotal efficacy of nitrite therapy is controversial, but is currently recommended if it can be started shortly after exposure. However, there is only anecdotal evidence that nitrite therapy is effective, and victims of hydrogen sulfide poisoning have survived without sequelae after supportive care alone. The usefulness of nitrite therapy given beyond the first few minutes after exposure is questionable. Nitrite therapy should not be allowed to interfere with the establishment of adequate ventilation and oxygenation.

*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 regional poison control center for further advice regarding triage of multiple victims.

Patients with evidence of significant exposure (e.g., breathing difficulties, unconsciousness, seizures, or collapse) should be transported to a medical facility for evaluation. Patients who have minor or transient irritation of the eyes or throat may be discharged from the scene after their names, addresses, and telephone numbers are recorded. They should be advised to seek medical care promptly if symptoms develop or recur (see *Patient Information Sheet* below).

## Emergency Department Management

**Hospital personnel away from the scene are not at risk of secondary contamination from patients exposed only to hydrogen sulfide gas; however, personnel can be secondarily contaminated by contacting or breathing vapors from clothing heavily soaked with hydrogen sulfide-containing solution.**

**Hydrogen sulfide is a very rapidly acting, highly toxic gas that can produce rapid CNS and respiratory depression. It is also an irritant affecting skin and mucous membranes.**

**There is no proven antidote for hydrogen sulfide poisoning. Treatment generally consists of support of respiratory and cardiovascular functions.**

### Decontamination Area

Patients who have been decontaminated previously and patients exposed only to hydrogen sulfide gas who have no skin or eye irritation may be transferred immediately to the Critical Care Area. Other patients 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. 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). Hydrogen sulfide 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 should be treated in the conventional manner.

Nitrite therapy (found in the cyanide antidote kit) has been suggested as a therapy for hydrogen sulfide exposure. Amyl nitrite is given by inhalation (for 30 seconds every minute until an intravenous line is established) followed by intravenous sodium nitrite (**300 mg over absolutely no less than 5 minutes**). This may aid recovery by forming sulfmethemoglobin, thus removing sulfide from combination in tissue. It is not necessary to use the sodium thiosulfate component of the cyanide antidote kit. The antidotal efficacy of nitrite therapy is controversial, but is currently recommended if it can be started shortly after exposure. The usefulness of nitrite therapy given beyond the first few minutes after exposure is questionable. There is only anecdotal evidence that nitrite therapy is effective, and victims of hydrogen sulfide poisoning have survived without sequelae after supportive care alone. Nitrite therapy should not be allowed to interfere with the establishment of adequate ventilation and oxygenation.

#### *Basic Decontamination*

Patients who are able may assist with their own decontamination. Remove and double-bag contaminated clothing and personal belongings,

Handle frostbitten skin and eyes with caution. Place frostbitten skin in warm water, about 108 °F (42 °C). 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 5 minutes, preferably under a shower. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Do not irrigate frostbitten eyes. Otherwise, irrigate exposed eyes for at least 5 minutes. Remove contact lenses if easily removable without additional trauma to the eye. An ophthalmic anesthetic may be necessary to alleviate blepharospasm, and lid retractors may be required to allow adequate irrigation under the eyelids. Continue irrigation while transporting the patient to the Critical Care Area.

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**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 smaller diameter of their airways. Establish intravenous access in seriously symptomatic patients. 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 symptoms. 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). Hydrogen sulfide 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 for 24 hours, repeating appropriate tests and chest examinations as needed. Follow-up as clinically indicated.

*Skin Exposure*

If concentrated hydrogen sulfide was in contact with the skin, chemical burns may result; treat as thermal burns. If the liquefied compressed gas is released and contacts the skin, frostbite may result. If a victim has frostbite, 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*

Continue irrigation for at least 5 minutes. Test visual acuity. Examine the eyes for corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have severe corneal injuries.

*Antidotes and  
Other Treatments*

Nitrite therapy (found in the cyanide antidote kit) has been suggested as a therapy for hydrogen sulfide exposure. Amyl nitrite is given by inhalation (for 30 seconds every minute until an intravenous line is established) followed by intravenous sodium nitrite (**300 mg over absolutely no less than 5 minutes**). This may aid recovery by forming sulfmethemoglobin, thus removing sulfide from combination in tissue. It is not necessary to use the sodium thiosulfate component of the cyanide antidote kit. The antidotal efficacy of nitrite therapy is controversial, but is currently recommended if it can be started shortly after exposure. The usefulness of nitrite therapy given beyond the first few minutes after exposure is questionable. There is only anecdotal evidence that nitrite therapy is effective, and victims of hydrogen sulfide poisoning have survived without sequelae after supportive care alone. Nitrite therapy should not be allowed to interfere with the establishment of adequate ventilation and oxygenation.

Hyperbaric oxygen therapy is controversial and based on anecdotal evidence. It may be effective for patients with persistent coma in whom other treatments are unsuccessful.

*Laboratory Tests*

Routine laboratory studies for all symptomatic exposed patients include CBC, blood glucose, and electrolyte determinations. Additional studies for patients exposed to hydrogen sulfide include ECG monitoring and renal-function tests. Chest radiography and pulse oximetry (or ABG measurements) may be helpful in cases of inhalation exposure. If nitrites are used, check methemoglobin levels.

**Disposition and  
Follow-up**

*Delayed Effects*

Patients who are unconscious or hypotensive should be observed closely for complications including post-hypoxic encephalopathy. Because pulmonary edema may be delayed in onset, patients seriously exposed by inhalation should be monitored for 24 hours. If pulmonary edema is suspected, admit patients to an intensive care unit.

*Patient Release*

Asymptomatic patients who have no evidence of pulmonary edema or CNS or respiratory compromise and no signs of eye irritation may be discharged after 4 to 6 hours of observation with instructions to seek medical care promptly if symptoms develop (see the *Hydrogen Sulfide—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 exposed to hydrogen sulfide should be monitored for heart and brain injuries, including evaluation for neurologic deficits.

Patients who have skin or corneal injury should be re-examined within 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.



## **Hydrogen Sulfide Patient Information Sheet**

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

### **What is hydrogen sulfide?**

Hydrogen sulfide is an extremely rapidly acting, highly toxic, colorless gas with a rotten-egg odor. It is produced naturally by decaying organic matter and is released from sewage sludge, liquid manure, sulfur hot springs, and natural gas. It is used in several industries and is a by-product of many industrial processes such as oil refining, mining, and rayon manufacturing.

### **What immediate health effects can result from hydrogen sulfide exposure?**

Even in small amounts, hydrogen sulfide has a strong rotten-egg odor. However, with continued exposure and at high levels, the poison may deaden a person's sense of smell. If the rotten egg odor is no longer noticeable, it may not necessarily mean that exposure has stopped.

After a serious exposure, symptoms usually begin immediately. At low levels, hydrogen sulfide causes irritation of the eyes, nose, and throat. Moderate levels can cause headache, dizziness, nausea, and vomiting, as well as coughing and difficulty in breathing. Higher levels can cause shock, convulsions, coma, and death. Generally, the more serious the exposure, the more severe the symptoms.

### **Can hydrogen sulfide poisoning be treated?**

There is no proven antidote for hydrogen sulfide poisoning, but the effects of hydrogen sulfide can be treated and some exposed persons get well. Persons who have had serious exposures 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. Moderate exposure can cause residual damage and a serious exposure that causes coma or convulsions may damage the brain and heart.

### **What tests can be done if a person has been exposed to hydrogen sulfide?**

Specific tests for the presence of hydrogen sulfide in blood and urine generally are not useful to the doctor. If a severe exposure has occurred, blood and urine analyses and other tests may show whether the brain, nerves, heart, or kidneys have been injured. If hydrogen sulfide was inhaled, blood tests and a chest x-ray may be necessary to determine if the lungs have been injured. Testing is not needed in every case.

### **Where can more information about hydrogen sulfide be found?**

More information about hydrogen sulfide 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, wheezing, difficulty breathing, or shortness of breath
  - chest pain or tightness
  - stomach pain, or vomiting
  - headache
  - increased redness or pain or a pus-like discharge in the area of a skin burn
- 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 \_\_\_\_\_