Hydrogen Cyanide (HCN)
CAS 74-90-8; UN 1051

Synonyms include formonitrile. Aqueous solutions are referred to as hydrocyanic acid and prussic acid.

Persons whose clothing or skin is contaminated with cyanide-containing solutions can secondarily contaminate response personnel by direct contact or through off-gassing vapor.

Hydrogen cyanide is a colorless or pale-blue liquid at room temperature. It is very volatile, readily producing flammable and toxic concentrations at room temperature. Hydrogen cyanide gas mixes well with air, and explosive mixtures are easily formed.

- **Hydrogen cyanide has a distinctive bitter almond odor, but some individuals cannot detect it and consequently, it may not provide adequate warning of hazardous concentrations.**

Hydrogen cyanide is absorbed well by inhalation and can produce death within minutes. Substantial absorption can occur through intact skin if vapor concentration is high or with direct contact with solutions, especially at high ambient temperatures and relative humidity. Exposure by any route may cause systemic effects.

Description

At temperatures below 78 °F, hydrogen cyanide is a colorless or pale-blue liquid (hydrocyanic acid); at higher temperatures, it is a colorless gas. Hydrogen cyanide is very volatile, producing potentially lethal concentrations at room temperature. The vapor is flammable and potentially explosive. Hydrogen cyanide has a faint, bitter almond odor and a bitter, burning taste. It is soluble in water and is often used as a 96% aqueous solution.

Routes of Exposure

Inhalation

Hydrogen cyanide is readily absorbed from the lungs; symptoms of poisoning begin within seconds to minutes. The odor of hydrogen cyanide is detectable at 2–10 ppm (OSHA PEL = 10 ppm), but **does not provide adequate warning of hazardous concentrations**. Perception of the odor is a genetic trait (20% to 40% of the general population cannot detect hydrogen cyanide); also, rapid olfactory fatigue can occur. Hydrogen cyanide is lighter than air.

Children exposed to the same levels of hydrogen cyanide as adults may receive larger doses because they have greater lung surface area:body weight ratios and increased minute volumes:weight ratios.

Skin/Eye Contact

Exposure to hydrogen cyanide can cause skin and eye irritation. More importantly, skin or eye absorption is rapid and contributes to systemic poisoning. After skin exposure, onset of symptoms may be immediate or delayed for 30 to 60 minutes. Most cases of toxicity from dermal exposure have been from industrial accidents involving partial immersion in liquid cyanide or cyanide solutions or from contact with molten cyanide salts, resulting in large surface-area burns.

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

Ingestion

Ingestion of hydrogen cyanide solutions or cyanide salts can be rapidly fatal.

Sources/Uses

Hydrogen cyanide is manufactured by oxidation of ammonia-methane mixtures under controlled conditions and by the catalytic decomposition of formamide. It may be generated by treating cyanide salts with acid, and it is a combustion by-product of nitrogen-containing materials such as wool, silk, and plastics. It is also produced by enzymatic hydrolysis of nitriles and related chemicals. Hydrogen cyanide gas is a by-product of coke-oven and blast-furnace operations.

Hydrogen cyanide is used in fumigating; electroplating; mining; and in producing synthetic fibers, plastics, dyes, and pesticides. It also is used as an intermediate in chemical syntheses.

Standards and Guidelines

OSHA PEL (permissible exposure limit) (ceiling) = 10 ppm (skin) (averaged over 15 minutes)

NIOSH IDLH (immediately dangerous to life or health) = 50 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) = 10 ppm

Physical Properties

Description: Colorless gas or colorless or pale-blue liquid

Warning properties: Almond odor at >l ppm; inadequate warning for acute or chronic exposure

Molecular weight: 27.03 daltons

Boiling point (760 mm Hg): 78 °F (25.6 °C)

Freezing point: 8 °F (-13.4 °C)

Specific gravity: 0.69 (water = 1)

Vapor pressure: 630 mm Hg at 68 °F (20 °C)

Gas density: 0.94 (air = 1)

Water solubility: Miscible with water

Flammability: Flammable at temperatures > 0 °F (-18 °C)

Flammable range: 5.6% to 40% (concentration in air)

Incompatibilities

Hydrogen cyanide reacts with amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, caustic substances, and ammonia. Hydrogen cyanide may polymerize at 122 °F to 140 °F.

Health Effects

Hydrogen cyanide is highly toxic by all routes of exposure and may cause abrupt onset of profound CNS, cardiovascular, and respiratory effects, leading to death within minutes.

- **Exposure to lower concentrations of hydrogen cyanide may produce eye irritation, headache, confusion, nausea, and vomiting followed in some cases by coma and death.**

Hydrogen cyanide acts as a cellular asphyxiant. By binding to mitochondrial cytochrome oxidase, it prevents the utilization of oxygen in cellular metabolism. The CNS and myocardium are particularly sensitive to the toxic effects of cyanide.

Acute Exposure

In humans, cyanide combines with the ferric ion in mitochondrial cytochrome oxidase, preventing electron transport in the cytochrome system and bringing oxidative phosphorylation and ATP production to a halt. The inhibition of oxidative metabolism puts increased demands on anaerobic glycolysis, which results in lactic acid production and may produce severe acid-base imbalance. The CNS is particularly sensitive to the toxic effects of cyanide, and exposure to hydrogen cyanide generally produces symptoms within a short period of time.

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 signs and symptoms usually develop rapidly. Initial symptoms are nonspecific and include excitement, dizziness, nausea, vomiting, headache, and weakness. As poisoning progresses, drowsiness, tetanic spasm, lockjaw, convulsions, hallucinations, loss of consciousness, and coma may occur.

Cardiovascular

Abnormal heartbeat can occur in cases of severe poisoning. Slow heartbeat, intractable low blood pressure, and death may result. High blood pressure and a rapid heartbeat may be early, transient findings.

Respiratory

After systemic poisoning begins, victims may complain of shortness of breath and chest tightness. Pulmonary findings may include rapid breathing and increased depth of respirations. As poisoning progresses, respirations become slow and gasping; a bluish skin color may or may not be present. Accumulation of fluid in the lungs may develop.

Children may be more vulnerable to gas exposure because of relatively increased minute ventilation per kg and failure to evacuate an area promptly when exposed.

Metabolic

An anion-gap, metabolic acidosis occurs in severe poisoning from increased blood levels of lactic acid.

Because of their higher metabolic rates, children may be more vulnerable to toxicants interfering with basic metabolism.

Dermal

Dermal absorption can occur, leading to systemic toxicity. Absorption occurs more readily at high ambient temperature and relative humidity.

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

Ocular

When splashed in the eye, hydrogen cyanide can cause eye irritation and swelling. Eye contact with cyanide salts has produced systemic symptoms in experimental animals.

Potential Sequelae

Survivors of severe exposure may suffer brain damage due to a direct action on neurons, or to lack of oxygen, or possibly due to insufficient blood circulation. Cases of neurologic sequelae such as personality changes, memory deficits, disturbances in voluntary muscle movements, and the appearance of involuntary movements (i.e., extrapyramidal syndromes) have been reported.

Chronic Exposure

Chronically exposed workers may complain of headache, eye irritation, easy fatigue, chest discomfort, palpitations, loss of appetite, and nosebleeds.

Chronic exposure may be more serious for children because of their potential longer life span.

Carcinogenicity

Hydrogen cyanide has not been classified for carcinogenic effects, and no carcinogenic effects have been reported for hydrogen cyanide.

Reproductive and Developmental Effects

No reproductive or developmental effects of hydrogen cyanide have been reported in experimental animals or humans. Hydrogen cyanide 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. Increased levels of thiocyanate in

the umbilical cords of fetuses whose mothers smoked compared to those whose mothers were non-smokers suggests that thiocyanate, and possibly also cyanide, can cross the placenta. No data were located pertaining to hydrogen cyanide in breast milk.

Prehospital Management

Victims exposed only to hydrogen cyanide gas do not pose secondary contamination risks to rescuers, but do not attempt resuscitation without a barrier. Victims whose clothing or skin is contaminated with hydrogen cyanide liquid or solution can secondarily contaminate response personnel by direct contact or through off-gassing vapor. Avoid dermal contact with cyanide-contaminated victims or with gastric contents of victims who may have ingested cyanide-containing materials.

Hydrogen cyanide poisoning is marked by abrupt onset of profound toxic effects that may include syncope, seizures, coma, gasping respirations, and cardiovascular collapse, causing death within minutes. These effects can occur from all routes of exposure.

Victims exposed to hydrogen cyanide require supportive care and rapid administration of specific antidotes.

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

Hydrogen cyanide is a highly toxic systemic poison that is absorbed well by inhalation and through the skin.

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

Skin Protection: Chemical-protective clothing is recommended because both hydrogen cyanide vapor and liquid can be absorbed through the skin to produce systemic toxicity.

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 cyanide gas who have no 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). **However, do not attempt resuscitation without a barrier.**

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

Speed is critical. For symptomatic victims, provide treatment with 100% oxygen and specific antidotes as needed. Treatment should be given simultaneously with decontamination procedures. (For treatment, see *ABC Reminders*, *Advanced Treatment,* and *Antidotes* below).

Victims who are able may assist with their own decontamination. Rapidly remove contaminated clothing while flushing exposed skin and hair with plain water for 2 to 3 minutes, then wash twice with mild soap. Rinse thoroughly with water. Double-bag contaminated clothing and personal belongings. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Irrigate exposed or irritated eyes with plain water or saline for 5 minutes. Continue eye irrigation during other basic care or transport. Remove contact lenses if easily removable without additional trauma to the eye.

In cases of ingestion, **do not induce emesis**. If the victim is alert, asymptomatic, and has a gag reflex, administer a slurry of activated charcoal (administer at 1 gm/kg, usual adult dose 60–90 g, child dose 25–50 g). A soda can and a straw may be of assistance when offering charcoal to a child. **If the victim is symptomatic, immediately institute emergency life support measures including the use of the cyanide antidote kit *(*see *Antidotes* below).**

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.

Transfer to Support Zone

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 *Decontamination Zone* above). Victims who have been decontaminated or who have been exposed only to vapor generally pose no serious risks of secondary contamination to rescuers. In such cases, Support Zone personnel require no specialized protective gear.

ABC Reminders

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.

Patients who rapidly regain consciousness and who have no other signs or symptoms may not require antidotal treatment. Those who remain comatose or develop shock should be treated promptly with the antidotes in the cyanide antidote kit (see *Antidotes* below).

Additional Decontamination

Continue irrigating exposed skin and eyes, as appropriate.

In cases of ingestion, **do not induce emesis**. If activated charcoal has not been administered previously, and the victim is alert, asymptomatic, and has a gag reflex, administer a slurry of activated charcoal (administer at 1 gm/kg, usual adult dose 60–90 g, child dose 25–50 g). A soda can and a straw may be of assistance when offering charcoal to a child. **If the patient is symptomatic, immediately institute emergency life support measures, including the use of a cyanide antidote kit *(*see *Antidotes* below).**

Advanced Treatment

In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, perform cricothyroidotomy if equipped and trained to do so.

Patients who are in shock or have seizures should be treated according to advanced life support (ALS) protocols. These patients or those who have arrhythmias may be seriously

acidotic; consider giving, under medical supervision, each patient 1 mEq/kg intravenous sodium bicarbonate.

Antidotes

When possible, treatment with cyanide antidotes should be given under medical supervision to unconscious victims who have known or strongly suspected cyanide poisoning. Cyanide antidotes—amyl nitrite perles and intravenous infusions of sodium nitrite and sodium thiosulfate—are packaged in the cyanide antidote kit.

Amyl nitrite perles should be broken onto a gauze pad and held under the nose, over the Ambu-valve intake, or placed under the lip of the face mask. Inhale for 30 seconds every minute and use a new perle every 3 minutes if sodium nitrite infusions will be delayed.

If the patient has not responded to oxygen and amyl nitrite treatment, infuse sodium nitrite intravenously as soon as possible. The usual adult dose is 10 mL of a 3% solution (300 mg) infused over **absolutely no less than 5 minutes**; the average pediatric dose is 0.12 to 0.33 mL/kg body weight up to 10 mL infused as above. Monitor blood pressure during sodium nitrite administration, and slow the rate of infusion if hypotension develops.

Next, infuse sodium thiosulfate intravenously. The usual adult dose is 50 mL of a 25% solution (12.5 g) infused over 10 to 20 minutes; the average pediatric dose is 1.65 mL/kg of a 25% solution. Repeat one-half of the initial dose 30 minutes later if there is an inadequate clinical response.

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.

If a cyanide-containing solution has been ingested, prepare the ambulance in case the victim vomits toxic material. Have ready several towels and open plastic bags to quickly clean up and isolate vomitus.

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 hydrogen cyanide exposure, and all patients who have hydrogen cyanide ingestion should be transported to a medical facility for evaluation.

Patients who have only brief inhalation exposure and mild or transient symptoms 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 in an enclosed area can be secondarily contaminated by vapor off-gassing from heavily soaked clothing or skin, or from toxic vomitus. Avoid dermal contact with cyanide-contaminated patients or with gastric contents of patients who may have ingested cyanide-containing materials, Patients do not pose secondary contamination risks after contaminated clothing is removed and the skin is washed.

Hydrogen cyanide poisoning is marked by abrupt onset of profound toxic effects that may include syncope, seizures, coma, gasping respirations, and cardiovascular collapse, causing death within minutes.

Patients exposed to hydrogen cyanide can survive with supportive care and rapid administration of specific antidotes.

Decontamination Area

Previously decontaminated patients and patients exposed only to hydrogen cyanide gas who have no skin or eye irritation may be transferred immediately to the Critical Care Area. Other patients require decontamination as described below.

ED personnel should don butyl rubber gloves and aprons before treating patients who have been exposed to hydrogen cyanide liquid or solutions. (Hydrogen cyanide readily penetrates most rubbers and barrier fabrics or creams, but butyl rubber provides good skin protection for a short period of time.)

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 absorbed through the skin. Also, emergency room personnel should examine children's mouths because of the frequency of hand-to-mouth activity among children.

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.

Patients who are comatose, hypotensive, or have seizures or cardiac dysrhythmias should be treated in the conventional manner. If not previously administered, give sodium bicarbonate

intravenously to these patients. Further bicarbonate therapy should be guided by ABG measurements.

Basic Decontamination

Patients who are able may assist with their own decontamination.

Speed is critical. If the patient is symptomatic, immediately institute emergency life support measures, including the use of the cyanide antidote kit *(*see *Antidotes and Other Treatments* below).

If the patient's clothing is wet with hydrogen cyanide solution, quickly remove contaminated clothing while flushing exposed skin and hair with plain water for 2 to 3 minutes (preferably under a shower), then wash twice with mild soap. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Rinse thoroughly with water. Double-bag contaminated clothing and personal belongings.

Irrigate exposed eyes for at least 5 minutes. Remove contact lenses if easily removable without additional trauma to the eye. Continue irrigation while transporting the patient to the Critical Care Area.

In cases of ingestion, **do not induce emesis**. If activated charcoal has not been administered previously, and the victim is alert, asymptomatic, and has a gag reflex, administer a slurry of activated charcoal (administer at 1 gm/kg, usual adult dose 60–90 g, child dose 25–50 g). A soda can and a straw may be of assistance when offering charcoal to a child. Consider gastric lavage if the patient is conscious and it can be performed shortly after ingestion. Because cyanide absorption from the gut is rapid, the effectiveness of activated charcoal will depend on how quickly after ingestion it can be administered. Isolate gastric washings and vomitus; they may off-gas hydrogen cyanide.

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 ill patients if this has not been done previously. Continuously monitor cardiac rhythm.

Patients who are in shock or have seizures should be treated according to ALS protocols. These patients or those who have

dysrhythmias may be seriously acidotic; consider giving 1 mEq/kg intravenous sodium bicarbonate.

Inhalation Exposure

Inhalation is the primary route of exposure to hydrogen cyanide. Refer to *Antidotes and Other Treatments* below for appropriate clinical treatment of systemic effects.

Skin Exposure

If the skin contacted hydrogen cyanide liquid or cyanide solutions, chemical burns may occur; treat as thermal burns. Watch for signs or symptoms of systemic toxicity, which may be delayed in onset for up to 1 hour.

Eye Exposure

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

Ingestion Exposure

Do not induce emesis.

If the victim is symptomatic, immediately institute emergency life support measures including the use of a cyanide antidote kit *(*see *Antidotes and Other Treatments* below). If the victim is alert, asymptomatic, has a gag reflex, and it has not been done previously, perform gastric lavage and give activated charcoal as soon as possible. Because cyanide absorption from the gut is rapid, the usefulness of activated charcoal will depend on how quickly after ingestion it can be administered.

Administer a slurry of activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g). A soda can and a straw may be of assistance when offering charcoal to a child.

Toxic vomitus or gastric washings should be isolated (e.g., by attaching the lavage tube to isolated wall suction or another closed container).

Antidotes and Other Treatments

Patients who have signs or symptoms of significant systemic toxicity should be evaluated for antidotal treatment. In the United States, antidotes for cyanide include amyl nitrite perles and intravenous infusions of sodium nitrite and sodium thiosulfate, which are packaged in the cyanide antidote kit.

If one dose of the antidotes from the kit has been administered previously by prehospital personnel and inadequate clinical response has occurred, a second dose of one-half the initial amounts may be given 30 minutes after the initial dose. Further

doses should be guided by the patient's clinical condition and not by the percentage of methemoglobin induced. The usual methods of monitoring methemoglobin levels are unreliable in cases of cyanide poisoning and may seriously underestimate the levels of inactive hemoglobin.

Amyl nitrite perles should be broken onto a gauze pad and held under the nose, over the Ambu-valve intake, or placed under the lip of the face mask. Inhale for 30 seconds every minute and use a new perle every 3 minutes if sodium nitrite infusions will be delayed.

If the patient has not responded to oxygen and amyl nitrite treatment, infuse sodium nitrite intravenously as soon as possible. The usual adult dose is 10 mL of a 3% solution (300 mg) infused over **absolutely no less than 5 minutes**; the average pediatric dose is 0.12 to 0.33 mL/kg body weight up to 10 mL infused as above. Monitor blood pressure during sodium nitrite administration, and slow the rate of infusion if hypotension develops.

Next, infuse sodium thiosulfate intravenously. The usual adult dose is 50 mL of a 25% solution (12.5 g) infused over 10 to 20 minutes; the average pediatric dose is 1.65 mL/kg of a 25% solution. Repeat one-half of the initial dose 30 minutes later if there is an inadequate clinical response.

Amyl nitrite and sodium nitrite oxidize the ferrous iron of hemoglobin to methemoglobin. Methemoglobin levels should not exceed 20%. Repeat treatment with nitrite and thiosulfate as required.

The efficacy of hyperbaric oxygen in cyanide poisoning is unproven. It has been reported to be useful in severe cases of smoke inhalation combined with exposure to hydrogen cyanide and carbon monoxide.

Laboratory Tests

The diagnosis of acute cyanide toxicity is primarily a clinical one (based on rapid onset of CNS toxicity and cardiorespiratory collapse). Laboratory testing is useful for monitoring the patient and evaluating complications. Routine laboratory studies for all exposed patients include CBC, blood glucose, and electrolyte determinations. Additional studies for patients exposed to hydrogen cyanide include ECG monitoring, determinations of serum lactate, chest radiography, and pulse oximetry (or ABG measurements).

In severe poisonings, venous blood is oxygenated and has a bright red color. Elevated venous PO_2 and venous percent O_2 saturation occurs, narrowing the gap between arterial and central venous PO_2 or percent O_2 saturation.

After treatment with nitrites, serum methemoglobin levels may be monitored. However, the usual methods of monitoring methemoglobin levels are unreliable in cases of cyanide poisoning and may seriously underestimate the levels of inactive hemoglobin. Alternative methods exist, but may not be available. Whole blood cyanide tests generally require several hours and cannot be used to guide emergency treatment. However, blood cyanide levels may be useful in documenting exposure.

Disposition and Follow-up

Consider hospitalizing patients who have histories of significant exposure and are symptomatic. Whenever infusions from the cyanide antidote kit are used, the patient should be admitted to the intensive care unit.

Delayed Effects

Patients who have ingested hydrogen cyanide solutions or patients who have direct skin or eye contact should be observed in the Emergency Department for at least 4 to 6 hours.

Patient Release

Patients who remain asymptomatic 4 to 6 hours after exposure may be discharged with instructions to seek medical care promptly if symptoms develop (see the *Hydrogen Cyanide—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.

Survivors of a serious exposure should be evaluated for ischemic damage to the brain and heart. Patients who have serious systemic cyanide poisoning may be at risk for CNS sequelae including Parkinsonian-like syndromes; they should be monitored for several weeks to months.

Patients who have corneal injuries should be reexamined 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 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 Cyanide
Patient Information Sheet

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

What is hydrogen cyanide?
At room temperature, hydrogen cyanide is a volatile, colorless-to-blue liquid (also called hydrocyanic acid). It rapidly becomes a gas that can produce death in minutes if breathed. Hydrogen cyanide is used in making fibers, plastics, dyes, pesticides, and other chemicals, and as a fumigant to kill rats. It is also used in electroplating metals and in developing photographic film.

What immediate health effects can be caused by exposure to hydrogen cyanide?
Breathing small amounts of hydrogen cyanide may cause headache, dizziness, weakness, nausea, and vomiting. Larger amounts may cause gasping, irregular heartbeats, seizures, fainting, and even rapid death. Generally, the more serious the exposure, the more severe the symptoms. Similar symptoms may be produced when solutions of hydrogen cyanide are ingested or come in contact with the skin.

Can hydrogen cyanide poisoning be treated?
The treatment for cyanide poisoning includes breathing pure oxygen, and in the case of serious symptoms, treatment with specific cyanide antidotes. Persons with serious symptoms will 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, a patient may have brain or heart damage.

What tests can be done if a person has been exposed to hydrogen cyanide?
Specific tests for the presence of cyanide 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 or heart has been injured. Testing is not needed in every case.

Where can more information about hydrogen cyanide be found?
More information about hydrogen cyanide 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:

- difficulty breathing, shortness of breath, or chest pain
- confusion or fainting
- increased pain or a discharge from your eyes
- increased redness, 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 _____