Acrylonitrile (CH_2=CHCN)
CAS 107-13-l; UN l093

Synonyms include AN, cyanoethylene, propenenitrile, VCN, vinyl cyanide, carbacryl, fumigain, and ventox.

- **Persons whose clothing or skin are contaminated with liquid acrylonitrile can secondarily contaminate response personnel by direct contact or through off-gassing vapor.**
- **Acrylonitrile is a clear, colorless or slightly yellow liquid that is highly volatile and toxic. Acrylonitrile vapor is heavier than air. It has a pungent odor of onion or garlic that does not provide adequate warning of hazardous levels.**
- **Acrylonitrile is poisonous by inhalation, ingestion or skin contact. Within the body acrylonitrile releases cyanide.**

Description

At room temperature, acrylonitrile is a clear, colorless, or slightly yellow liquid. It is very volatile, producing flammable and toxic air concentrations at room temperature and may explode. It is moderately soluble in water and soluble in most organic solvents.

Routes of Exposure

Inhalation

Acrylonitrile vapor is absorbed readily through the lungs, and inhalation is an important route of. **Acrylonitrile's odor does not provide adequate warning of hazardous concentrations.**

The odor threshold is about 10-fold greater than the OSHA permissible exposure limit, so workers can be overexposed to acrylonitrile without being aware of its presence. In addition, olfactory fatigue develops rapidly. CNS symptoms have been caused by exposure to airborne concentrations as low as 16 ppm for 30 minutes. Acrylonitrile is heavier than air and exposure can result in asphyxiation in poorly ventilated, enclosed, or low-lying areas.

Children exposed to the same levels of acrylonitrile 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 acrylonitrile vapor found nearer to the ground.

Skin/Eye Contact

Exposure to acrylonitrile vapor can cause skin and eye irritation. Splashes in the eye may result in corneal injury. Acrylonitrile is absorbed through intact skin, and this can lead to systemic toxicity. Prolonged skin contact with the liquid may cause formation of vesicles and burns, resembling a second degree thermal burn.

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

Ingestion

Acute toxic effects, including fatal systemic poisoning, can result from ingestion.

Sources/Uses

Acrylonitrile, one of the world's most important industrial chemicals, is produced by catalytic reaction of propylene with ammonia. In 1990, U.S. production exceeded 3 billion pounds. It is a raw material in the manufacture of acrylic fibers, styrene plastics, and adhesives. Such fibers and plastics are components of clothing, furniture, appliances, construction materials, motor vehicles, and food packaging. In the past, acrylonitrile was also used as a room fumigant and pediculicide (an agent used to destroy lice).

Standards and Guidelines

OSHA PEL (permissible exposure limit) = 2 ppm (skin) (averaged over an 8-hour workshift).

OSHA STEL (short-term exposure limit) = 10 ppm (over a 15-minute time period).

NIOSH IDLH (immediately dangerous to life or health) = 85 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) = 35 ppm.

Physical Properties

Description: Clear, colorless, or slightly yellow liquid

Warning properties: Inadequate; unpleasant onion or garlic odor at 20 ppm

Molecular weight: 53.0 daltons

Boiling point (760 mm Hg): 171 °F (77 °C)

Freezing point: -116 °F (-82 °C)

Specific gravity: 0.80 (water = 1)

Vapor pressure: 83 mm Hg at 68 °F (20 °C)

Gas density: 1.8 (air = 1)

Water solubility: Water soluble (7% at 68 °F) (20 °C)

Flammability: Flammable and explosive at temperatures >30 °F (-1 °C)

Flammable range: 3% to 17% (concentration in air)

Incompatibilities

Acrylonitrile reacts with strong oxidizers, acids, alkalies, bromine, amines, and copper. Unless inhibited (usually with methylhydroquinone), acrylonitrile may polymerize spontaneously. It may also polymerize when heated or in the presence of strong alkalies.

Health Effects

- **Acrylonitrile is irritating to the skin, eyes, and respiratory tract.**
- **Toxic effects range from headache, fatigue, dyspnea, nausea and vomiting to asphyxiation, lactic acidosis and cardiovascular collapse.**
- **Toxic effects are due primarily to the bioreactivity of acrylonitrile with cellular proteins and to its epoxide intermediate that is mutagenic and genotoxic.**
- **Toxicity is also due to the release of cyanide during the metabolism of acrylonitrile.**

Acute Exposure

Some, but not all, of the toxicity of acrylonitrile may be due to the metabolic release of cyanide, which inhibits numerous enzymes, including cytochrome oxidase, resulting in cellular asphyxiation. Toxicity not related to cyanide formation is due to the formation of reactive vinyl groups and epoxide intermediates which can deplete glutathione stores and cause liver damage. The onset of symptoms due to cyanide release may be delayed 4 to 12 hours.

Children do not always respond to chemicals in the same way that adults do. In addition, children of different ages (e.g., *in utero*, infants, toddlers, older children) may have different responses to certain chemical exposures, and thus, different protocols for managing their care may be needed.

CNS

CNS signs and symptoms can evolve rapidly or be delayed. Initial symptoms are usually nonspecific and include irritability, dizziness, nausea, vomiting, headache, and weakness in the arms and legs. As poisoning progresses, CNS signs include drowsiness, tetanic spasm, lockjaw, convulsions, hallucinations, loss of consciousness, and coma. Brain damage from lack of oxygen may develop.

Cardiovascular

Depression of the cardiovascular system can occur as a result of cyanide liberated from acrylonitrile. Initial tachycardia is followed by bradycardia (the ECG may show ischemic changes); dysrhythmias, hypotension and peripheral vascular collapse may follow.

Respiratory

Acute inhalation exposure can irritate the mucous membranes of the respiratory tract. Sneezing, tearing, chest discomfort, and cough can result. Victims may complain of shortness of breath and chest tightness. Pulmonary symptoms may include rapid

breathing and increased depth of respirations. As poisoning progresses, respiration becomes slow, shallow, and gasping. Cyanosis may occur, and pulmonary edema develops in fatal cases.

Children may be vulnerable because of relatively increased minute ventilation as well as failure to evacuate an area promptly when exposed.

Metabolic

An anion-gap, acid-base imbalance occurs in severe poisoning, caused by disruption of cellular metabolism and production of lactic acid.

Hepatic

Acrylonitrile may cause liver dysfunction characterized by jaundice, malaise, anorexia, and leukocytosis. Liver dysfunction is compounded by depletion of glutathione stores.

Dermal

Acrylonitrile causes skin irritation and blisters. Prolonged skin contact with the liquid may cause formation of vesicles and burns, resembling a second degree thermal burn. Intolerable itching of the skin with no demonstrable dermatitis has been reported in workers.

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

Ocular

High concentrations of gaseous acrylonitrile can cause eye irritation and lacrimation. Splash contact causes only transient disturbances usually without long-term corneal damage.

Potential Sequelae

No information is available for acrylonitrile, but survivors of severe acute cyanide poisoning may develop delayed neurologic sequelae.

Chronic Exposure

Chronic exposures to acrylonitrile have been associated with liver damage. Chronic exposure may be more serious for children because of their potential longer latency period.

Carcinogenicity

The Department of Health and Human Services has determined that acrylonitrile may reasonably be anticipated to be a carcinogen. IARC has determined that acrylonitrile is possibly carcinogenic to humans (Group 2B) based on sufficient evidence of carcinogenicity in experimental animals and inadequate evidence for carcinogenicity in humans. ACGIH classifies it as an A_2 suspected human carcinogen. In animals, chronic exposure can cause tumors of the mammary gland, gastrointestinal tract, and CNS. Increased rates of lung and prostate cancer have been

documented in some groups of chronically exposed workers, but not in others.

Reproductive and Developmental Effects

According to Shepard's Catalog of Teratogenic Agents, when large doses of acrylonitrile were administered to experimental animals by oral, inhalation, or intraperitoneal routes, teratogenic effects were produced. In humans, there is no documented evidence that acrylonitrile is a reproductive or developmental toxicant. Acrylonitrile is not currently reviewed in the TERIS or Reprotext databases. Acrylonitrile 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.

There is no information regarding whether acrylonitrile can cross the placenta or whether it can accumulate in breast milk and be transferred to nursing infants.

Prehospital Management

- **Victims exposed only to acrylonitrile vapor do not pose secondary contamination risks to rescuers. Victims whose clothing or skin is contaminated with liquid acrylonitrile can secondarily contaminate response personnel by direct contact or through off-gassing vapor.**
- **Acrylonitrile is irritating to the skin, eyes, and respiratory tract. Systemic effects can occur from all routes of exposure and may include dyspnea, CNS and cardiovascular disturbances, and lactic acidosis.**
- **Treatment consists of supportive care. The first priority is to establish adequate ventilation, oxygen and circulation. Cyanide antidotes such as sodium nitrite and sodium thiosulfate as contained in the cyanide antidote kit, have been recommended although their efficacy in human toxicity has not been fully established.**

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

Acrylonitrile is a highly toxic systemic poison that is absorbed well by inhalation, through the stomach, and through the skin. It is also irritating to the skin and eyes on direct contact.

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

Skin Protection: Chemical-protective clothing is recommended because acrylonitrile liquid and vapor can be dermally absorbed and may contribute to systemic toxicity. Direct contact with liquid acrylonitrile can cause skin burns. Cutaneous absorption occurs through contaminated leather and rubber because of excellent penetration properties. Butyl gloves should be worn rather than cotton or latex.

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 proper 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

All victims suspected of ingestion or significant exposure to liquid acrylonitrile require decontamination. Others may be transferred immediately to the Support Zone.

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 palpable 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. Quickly remove and double-bag contaminated clothing and personal belongings. Leather absorbs acrylonitrile; items such as leather shoes, gloves, and belts may require disposal by incineration. Acrylonitrile may also penetrate rubber. Butyl rubber gloves should be worn.

Flush exposed skin and hair with plain water for 2 to 3 minutes. Wash twice with mild soap. Rinse thoroughly with water.

Irrigate exposed or irritated eyes with plain water or saline for at least 15 minutes. Eye irrigation should be carried out simultaneously with other basic care and 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 symptomatic, delay decontamination until other emergency measures have been instituted, including the use of a cyanide antidote kit. (See *Advanced Treatment* below.) If the victim is not symptomatic, administer activated charcoal at 1 gm/kg, usual adult dose 60–90 g, child dose 25–50 g. A soda can and straw may be of assistance when offering charcoal to a child.

Consider appropriate management of chemically contaminated children at the exposure site. Also, provide reassurance to the child during decontamination, especially if separation from a parent occurs. 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 undergone decontamination or have been exposed only to vapor pose no serious risks of secondary contamination. In such cases, Support Zone personnel require no specialized protective gear.

ABC Reminders

Quickly access for a patent airway, ensure adequate respiration and palpable pulse. If trauma is suspected, maintain cervical immobilization and apply a cervical collar and a backboard. (administer supplemental oxygen as required). Establish intravenous access if necessary. Place on a cardiac monitor.

Additional Decontamination

Continue irrigating exposed skin and eyes, as appropriate.

In cases of ingestion, **do not induce emesis**. If the patient is symptomatic, delay decontamination and institute other emergency measures if they have not previously been given, including the use of a cyanide antidote kit (see Advanced Treatment below). If the patient is not symptomatic, administer a slurry of activated charcoal (dose 1 mg/kg) if not already done in the *Decontamination Zone*.

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. Administer 100% oxygen.

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). Acrylonitrile 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 water, repeat every 20 minutes as needed cautioning for myocardial variability.

Patients who are comatose, hypotensive, or have seizures or cardiac dysrhythmias should be treated according to advanced life support (ALS) protocols. These patients may be seriously acidotic; under medical control, consider giving them 1 ampule of sodium bicarbonate (pediatric dose: 1 mEq/kg may be appropriate).

If massive exposure is suspected or if the patient is severely symptomatic with hypotension, infuse intravenous saline or lactated Ringer's solution. For adults, bolus 1,000 mL/hour if blood pressure is under 80 mm Hg; if systolic pressure is over 90 mm Hg, an infusion rate of 150 to 200 mL/hour is sufficient. For children with compromised perfusion administer 20 mL/kg of normal saline or Ringer's lactate delivered over 10 to 20 minutes, then at a 2 to 3 mL/kg/hour infusion rate.

Antidotes

When possible, treatment with cyanide antidotes should be given under medical-base control to unconscious victims with known or strongly suspected acrylonitrile 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 (0.2 mL) 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. A new perle is crushed and inhaled for 30 seconds every minute until intravenous sodium nitrite is given.

Infuse sodium nitrite intravenously as soon as possible. The usual adult dose is 10 to 20 mL of a 3% solution infused over no less than 5 minutes to produce a 20% methemoglobin level in adults. Children should receive 0.33 mL/kg of the 3% solution at an infusion rate of 2.5 mL/minute, up to a maximum of 10 mL. Administer sodium nitrite doses to children on the basis of body weight, since fatal methemoglobinemia has occurred in children dosed at adult rates. Monitor blood pressure during administration, and slow the rate of infusion if hypotension develops.

Immediately after sodium nitrite infusion, administer sodium thiosulfate intravenously. The usual adult dose is 50 mL (12.5 g) of a 25% solution infused at a rate of 3 to 5 mL/minute; the

average pediatric dose is 1.65 mL/kg (412.5 mg/kg) up to 50 mL. If symptoms reappear or persist within 1 hour, readminister sodium nitrite and sodium thiosulfate at 50% of the initial dose.

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 acrylonitrile has been ingested, prepare the ambulance in case the victim vomits toxic material. Have ready several towels and open plastic bags to quickly soak 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 who have evidence of substantial exposure and all persons with acrylonitrile ingestion ,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 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 from the vomitus of victims who have ingested acrylonitrile. Patients do not pose serious contamination risks after contaminated clothing is removed and the skin is thoroughly washed.**
- **Acrylonitrile is irritating to the skin, eyes, and respiratory tract. Systemic effects can (occur from all routes of exposure and may include dyspnea, CNS and cardiovascular disturbances, and lactic acidosis.**
- **Treatment consists of supportive measures. Cyanide antidotes such as sodium nitrite and sodium thiosulfate have been recommended although their efficacy in human acrylonitrile toxicity has not been fully established.**

Decontamination Area

Unless previously decontaminated, all patients suspected of contact with liquid acrylonitrile and all victims with skin or eye irritation require decontamination as described below.

Acrylonitrile is absorbed through the skin. Don butyl rubber gloves and apron before treating patients who are wet with liquid acrylonitrile. Acrylonitrile readily penetrates most rubbers and barrier fabrics or creams, but butyl rubber provides good skin protection.

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: weight ratio, children are more vulnerable to toxicants absorbed through the skin. Also, emergency room personnel should examine children's mouths for ulceration or irritation 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 secure an airway. Symptomatic patients should be placed on supplemental oxygen.

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). Acrylonitrile 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 water, repeat every 20 minutes as needed cautioning for myocardial variability.

Patients who are comatose, hypotensive, or have seizures or cardiac dysrhythmias should be treated in the conventional manner. Consider dopamine or norepinephrine.

Correct acidosis in the patient who has coma, seizures, or cardiac arrhythmias by administering intravenously an ampule of sodium bicarbonate (Dose 1 mEq/kg, maximum 100 mEq, usual adult dose is 1 ampule).

Basic Decontamination

Patients who are able, may assist with their own decontamination. If the patient's clothing is wet with acrylonitrile, quickly remove and double-bag contaminated clothing and personal belongings.

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

Begin irrigation of exposed eyes. Remove contact lenses if easily removable without additional trauma to the eye. Exposed eyes should be irrigated with copious amounts of tepid water for at least 15 minutes. Continue irrigation while transporting the patient to the Critical Care Area.

If the patient has ingested acrylonitrile, **do not induce emesis**. If the patient is alert and able to swallow, administer activated charcoal at 1 gm/kg, usual adult dose 60–90 g, child dose 25–50 g. A soda can and straw may be of assistance when offering charcoal to a child.

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 if it has not been done previously. Place on supplemental oxygen and continuous cardiac monitor.

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

If not previously administered, give one ampule of sodium bicarbonate intravenously to the patient with acidosis (initial dose is 1 mEq/kg); further bicarbonate therapy should be guided by ABG measurements.

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. 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). Acrylonitrile 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 water, repeat every 20 minutes as needed cautioning for myocardial variability.

Skin Exposure

If the skin was in contact with liquid acrylonitrile, chemical burns may occur; treat as thermal burns.

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

Eye Exposure

Ensure that adequate eye irrigation has been completed. Continue irrigation for at least 15 minutes. Test visual acuity. Examine the eyes for corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have severe corneal injuries.

Ingestion Exposure

Do not induce emesis. If the patient is alert administer a slurry of activated charcoal if not done previously (1 gm/kg, usual adult dose 60–90 g). Administer a slurry of activated charcoal. A soda can and straw may be of assistance when offering charcoal to a child.

Consider endoscopy to evaluate the extent of gastrointestinal tract injury. Extreme throat swelling may require endotracheal intubation or cricothyroidotomy. Gastric lavage is useful under certain circumstances to remove caustic material and prepare for endoscopic examination. Consider gastric lavage with a small nasogastric tube if: (1) a large dose has been ingested; (2) the patient's condition is evaluated within 30 minutes; (3) the patient has oral lesions or persistent esophageal discomfort; and (4) the lavage can be administered within 1 hour of ingestion. Care must be taken when placing the gastric tube because blind gastric-tube placement may further injure the chemically damaged esophagus or stomach.

Because children do not ingest large amounts of corrosive materials, and because of the risk of perforation from NG intubation, lavage is discouraged in children unless intubation is performed under endoscopic guidance.

Carefully isolate toxic vomitus; it can cause secondary contamination through off-gassing vapor or direct contact.

Antidotes and Other Treatments

Patients who have signs or symptoms of significant systemic toxicity should be evaluated for treatment. The antidotes 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 in the cyanide antidote 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.

While infusions are being prepared, break amyl nitrite perles on to a gauze pad and hold under the patient's nose or over the Ambu valve intake or place under the lip of the face mask. Use a new perle every 3 minutes if sodium nitrite infusions will be delayed. Infuse sodium nitrite intravenously as soon as possible. The usual adult dose is 10 to 20 mL of a 3% solution infused over no less than 5 minutes; the average pediatric dose is 0.15 to

0.20 mL/kg body weight. Monitor blood pressure during administration, and slow the rate of infusion if hypotension develops. Administer sodium nitrite doses to children on the basis of body weight, since fatal methemoglobinemia has occurred in children dosed at adult rates. Monitor blood pressure during 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 infused over 10 to 20 minutes; the average pediatric dose is 1.65 mL/kg.

Amyl nitrite and sodium nitrite oxidize the ferrous (Fe^{+2}) iron of hemoglobin to methemoglobin (Fe^{+3}). Methemoglobin levels should not exceed 20%. Repeat treatment with nitrite and thiosulfate as required.

It has been suggested that the hepatotoxic effects of acrylonitrile poisoning may be prevented or diminished by administration of N-acetylcysteine (NAC, Mucomyst). Recommended oral doses of NAC are those usually given for the treatment of acetaminophen overdose (140 mg/kg loading dose, followed by 70 mg/kg every 4 hours for 72 hours). Liver function, serum bilirubin, and prothrombin time should be monitored.

Laboratory Tests

The diagnosis of acute acrylonitrile toxicity is primarily clinical, based on dyspnea and cyanosis. However, laboratory testing is useful for monitoring the patient and evaluating complications. Routine laboratory studies for all exposed patients include CBC, glucose, and electrolyte determinations. Additional studies for patients exposed to acrylonitrile include ECG monitoring, lactate levels, and liver-function tests. Chest radiography and pulse oximetry (or ABG measurements) may be useful for patients exposed through inhalation.

In severe cases, the venous PO_2 may be elevated so that the normal gap between arterial and central venous PO_2 narrows.

After treatment with nitrites, serum methemoglobin levels should be monitored. Increased cyanide and thiocyanate levels have been found in the blood of persons exposed to acrylonitrile; however, they do not correlate with exposure levels. Cyanide and thiocyanate levels may be useful to document exposure.

Disposition and Follow-up

Consider hospitalizing patients who have histories of significant exposure and are symptomatic. Whenever intravenous cyanide antidotes are used, admit the patient to the intensive care unit. Blood methemoglobin levels should be monitored.

Delayed Effects

Acrylonitrile follows first order kinetics, its half life is approximately 8 hours and it is excreted in the urine. Because of continued metabolic release of cyanide, symptoms of severe poisoning may recur and the patient may relapse.

Jaundice may develop 24 hours after exposure and persist for several days.

Patient Release

Patients who remain asymptomatic 12 to 18 hours after exposure may be discharged and urged to seek medical care promptly if symptoms develop (see *Acrylonitrile—Patient Information Sheet* below).

Follow-up

Patients who have serious systemic cyanide poisoning may be at risk for CNS sequelae including Parkinson-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; note incident details and 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.

Acrylonitrile
Patient Information Sheet

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

What is acrylonitrile?
Acrylonitrile is a clear, colorless, or slightly yellow liquid. At room temperature, it readily becomes a vapor. The vapor is flammable and can explode. Acrylonitrile is used to make a variety of fibers and plastics.

What immediate health effects can be caused by exposure to acrylonitrile?
Breathing acrylonitrile can result in a variety of symptoms, including sneezing, tightness in the chest, cough, weakness of the arms and legs, nausea and vomiting, sleepiness, irregular heartbeat, seizures, and fainting. Generally, the more serious the exposure, the more severe the symptoms. In the body, acrylonitrile breaks down to release cyanide. Symptoms can occur from any type of exposure to acrylonitrile including through the skin or by ingestion.

Can acrylonitrile poisoning be treated?
The treatment for acrylonitrile poisoning includes breathing pure oxygen and, in the case of severe exposure, specific antidotes, including those used to treat cyanide poisoning. Persons with serious symptoms may need to be hospitalized.

Are any future health effects likely to occur?
A single small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. After a large exposure, a patient may have brain, heart, or liver damage. Acrylonitrile has caused cancer in laboratory animals, cancer in humans has not been completely established.

What tests can be done if a person has been exposed to acrylonitrile?
Specific tests for the presence of acrylonitrile (or cyanide) in blood and urine generally are not useful to the doctor. If a severe exposure has occurred, blood and urine analysis and other tests may show whether the liver, heart, or nervous system has been injured. Testing is not needed in every case.

Where can more information about acrylonitrile be found?
More information about acrylonitrile 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:

- weakness in the limbs, dyspnea, irritability
- headache, apprehension
- chest discomfort, nausea, vomiting, diarrhea
- burning sensation in the throat

[ ] 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 _____