

**Methyl Isocyanate (C<sub>2</sub>H<sub>3</sub>NO)**  
**CAS 624-83-9; UN 2480**

Synonyms include isocyanomethane, isocyanatomethane, methylcarbylamine, and MIC.

- **Persons exposed only to methyl isocyanate gas pose no risk of secondary contamination. Persons whose skin or clothing is contaminated with liquid methyl isocyanate can secondarily contaminate rescuers by direct contact or through off-gassing of vapor.**
- **At temperatures below 39 °C (102 °F), methyl isocyanate is a very flammable colorless liquid that readily evaporates when exposed to air. Gaseous methyl isocyanate is slightly heavier than air.**
- **Although methyl isocyanate has a pungent odor, adverse health effects have been reported at or below the human odor threshold; therefore, odor detection is not a reliable indicator of exposure.**
- **Methyl isocyanate is readily absorbed through the upper respiratory tract. Methyl isocyanate can also be absorbed through the digestive tract or skin.**

**Description**

At temperatures below 39 °C (102 °F), methyl isocyanate is a very flammable liquid that readily evaporates when exposed to air. Gaseous methyl isocyanate is approximately 1.4 times heavier than air. Methyl isocyanate liquid is colorless with a pungent odor. Most people can smell methyl isocyanate vapors at levels as low as 2 to 5 ppm. Methyl isocyanate is handled and transported as a very flammable and explosive liquid.

**Routes of Exposure**

*Inhalation*

Inhalation is the major route of exposure to methyl isocyanate. The vapors are readily absorbed through the lungs. The odor threshold is approximately 100 to 250 times higher than the OSHA PEL-TWA (0.02 ppm). Significant exposures to methyl isocyanate occur primarily in occupational settings. Acute exposure to methyl isocyanate vapors below the odor threshold can be irritating to the eye and respiratory epithelium. Acute exposure to higher vapor concentrations may cause severe pulmonary edema and injury to the alveolar walls of the lung and death. Survivors of acute exposures may exhibit long-term respiratory effects. **Odors of methyl isocyanate may not provide adequate warning of hazardous concentrations** because the Immediately Dangerous to Life or

Health (IDLH) limit is only 3 ppm and the threshold for detection of methyl isocyanate vapors ranges from 2 to 5 ppm in humans. Significant exposure to methyl isocyanate vapors would most likely be the result of accidental release of methyl isocyanate to the air such as occurred in Bhopal, India in 1984, where the primary effect was pulmonary edema with some alveolar wall destruction. Methyl isocyanate is heavier than air; therefore, exposure in poorly ventilated, enclosed, or low-lying areas could result in asphyxiation.

Children exposed to the same levels of methyl isocyanate as adults may receive larger doses because they have relatively greater lung surface area:body weight ratios and higher minute volume: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 methyl isocyanate found nearer to the ground. Children may be more vulnerable to corrosive agents than adults because of the smaller diameter of their airways.

*Skin/Eye Contact*

Direct contact with liquid or concentrated vapors of methyl isocyanate may cause irritation of the skin or eyes and severe ocular damage. Direct skin contact may result in dermal absorption. Significant dermal exposure to methyl isocyanate would not likely occur outside an occupational environment in which methyl isocyanate is stored or used.

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

*Ingestion*

Although unlikely, ingestion of liquid methyl isocyanate could produce severe gastrointestinal irritation.

**Sources/Uses**

Methyl isocyanate is made by reacting methylamine with phosgene. The primary use of methyl isocyanate is as a chemical intermediate in the production of pesticides. It is also used to produce polyurethane foams and plastics.

**Standards and Guidelines**

OSHA PEL (permissible exposure limit) = 0.02 ppm (averaged over an 8-hour workshift) with a skin notation

NIOSH IDLH (immediately dangerous to life or health) = 3 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) = 0.5 ppm

### Physical Properties

*Description:* Colorless liquid at room temperature; volatile, flammable, explosive in air

*Warning properties:* Pungent odor of methylisocyanate may not be adequate to warn of acute exposure. Most people can detect methyl isocyanate at levels of 2 to 5 ppm (1 ppm is equivalent to 2.35 mg/m<sup>3</sup>)

*Molecular weight:* 57.05 daltons

*Boiling point* (760 mm Hg): 102 °F (39.1 °C)

*Freezing point:* -49 °F (-45 °C)

*Vapor pressure:* 348 mm Hg at 68 °F (20 °C)

*Vapor density:* 1.42 (air = 1.00)

*Water solubility:* 6.7% at 68 °F (20 °C)

*Flammability:* highly flammable

*Flammable Range:* 5.3 % to 26 % (concentration in air)

### Incompatibilities

Methyl isocyanate reacts violently with water. Methyl isocyanate is incompatible with oxidizers, acids, alkalis, amines, iron, tin, and copper.



## Health Effects

- **Methyl isocyanate is irritating and corrosive to the eyes, respiratory tract, and skin. Acute exposure to high vapor concentrations may cause severe pulmonary edema and injury to the alveolar walls of the lung, severe corneal damage, and death. Survivors of acute exposures may exhibit long-term respiratory and ocular effects. Methyl isocyanate may be a dermal and respiratory sensitizer.**
- **Mechanisms of methyl isocyanate-induced toxicity are not known. Persistent respiratory and ocular effects may reflect methyl isocyanate-induced immunologic effects. Methyl isocyanate may cross the placenta and enter a developing fetus. Individuals especially susceptible to the toxic effects of methyl isocyanate include those with existing disorders of the respiratory system or eyes.**

### Acute Exposure

Mechanisms of toxicity have not been clearly elucidated for methyl isocyanate; however, carbamylation of globin and blood proteins may play a role. Persistent respiratory and ocular effects may reflect methyl isocyanate-induced immunologic effects since antibodies specific to methyl isocyanate have been demonstrated in the blood of exposed patients. Methyl isocyanate is highly reactive; therefore, it is not metabolized in the classical sense. The onset of respiratory effects following acute exposure to methyl isocyanate can be immediate in some cases. In others, respiratory injury can evolve over periods of hours or days. Exposure-related deaths sometimes can occur as late as 30 or more days post-exposure, due in part to the development of pneumonia.

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

### Respiratory

Methyl isocyanate vapors are severely irritating and corrosive to the respiratory tract. Symptoms may include cough, chest pain, dyspnea, coma, and death. Irritative respiratory symptoms such as pulmonary edema and bronchial spasms may occur in immediate response to exposure. Methyl isocyanate-induced pulmonary edema may progress to effects such as alveolar wall destruction and pneumonia, which may ultimately lead to respiratory failure and death. Some respiratory effects may progress in severity over a period of hours to days post-exposure. Asthmatic reactions and long-term respiratory effects have been reported.

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

*Ocular/Ophthalmic*

Severe eye irritation can result from exposure to methyl isocyanate vapors or direct contact with the liquid. Symptoms may include immediate eye pain, lacrimation, photophobia, profuse lid edema, and corneal ulcerations. Ocular exposure may result in long-term or permanent eye damage.

*Dermal*

Methyl isocyanate is a skin irritant and may cause chemical burns upon dermal contact at high exposure levels.

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

*Gastrointestinal*

Nausea, vomiting, abdominal pain, and defecation have been reported after acute exposure to methyl isocyanate vapors.

*Potential Sequelae*

Initial irritative symptoms of the respiratory tract may progress to more serious respiratory injury over a period of hours to days following exposure to methyl isocyanate vapors. Compromised lung tissue may be susceptible to bacterial pneumonias. Exposure may result in permanent eye damage. Methyl isocyanate may also be a respiratory and dermal sensitizer. Renal tubular necrosis, reduced liver function, and miscarriage were associated with methyl isocyanate exposure in the Bhopal, India incident.

**Chronic Exposure**

Chronic exposure to methyl isocyanate may result in chronic obstructive lung disease.

*Carcinogenicity  
Reproductive and  
Developmental Effects*

Methyl isocyanate has not been classified for carcinogenicity.

Methyl isocyanate is not included in the list of *Reproductive and Developmental Toxicants*, a 1991 report published by the U.S. General Accounting Office that lists 30 chemicals of concern because of widely acknowledged reproductive and developmental consequences. Increased rates of spontaneous abortions and neonatal deaths among victims of the Bhopal accident were observed for months following exposure. However, the precise role of methyl isocyanate in developmental toxicity is difficult to determine. Poor oxygenation resulting from compromised lung

function may be involved. Animal studies indicate that inhalation exposure during gestation may result in decreased numbers of live births and decreased survival during lactation. There was no evidence of a dominant lethal effect in exposed male mice. Genotoxicity testing in animals indicates that methyl isocyanate may have the capacity to affect chromosome structure, but it apparently does not induce gene mutations.



## Prehospital Management

- **Persons exposed only to methyl isocyanate gas pose no risk of secondary contamination to rescuers. Persons whose skin or clothing is contaminated with liquid methyl isocyanate can secondarily contaminate response personnel by direct contact or through off-gassing of vapor.**
- **Methyl isocyanate is irritating to the eyes, respiratory tract, and skin. Early symptoms may include eye irritation, coughing, and shortness of breath. In cases of severe exposure, later symptoms may include vomiting and diarrhea. Acute exposure to high vapor concentrations may cause relatively rapid and severe pulmonary edema, alveolar wall injury, and corneal damage. Initial signs of irritation may progress to vomiting, diarrhea, and death. Survivors of acute exposures may exhibit long-term respiratory and ocular effects. Methyl isocyanate may be a dermal and respiratory sensitizer.**
- **There is no antidote for methyl isocyanate. Treatment consists of removal of the victim from the contaminated area and 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 the rescuers have not been trained in its use, call for assistance from a local or regional hazardous materials (HAZMAT) team or other properly equipped response organization.

### Rescuer Protection

Inhaled methyl isocyanate is a severe respiratory tract irritant. Contamination of the skin can cause irritation or chemical burns. Contamination of the eyes can cause irritation and serious or long-term damage. Methyl isocyanate is absorbed through the skin.

*Respiratory protection:* Positive-pressure, self-contained breathing apparatus (SCBA) with a full facepiece and operated in a positive pressure mode is recommended in response to situations that involve exposure to potentially unsafe levels of methyl isocyanate gas.

*Skin protection:* Chemical protective clothing is recommended because methyl isocyanate can cause skin irritation and burns. Protective eye equipment is recommended to prevent eye contact.

### ABC Reminders

Quickly establish a patent airway, ensure adequate respiration and pulse. Maintain adequate circulation. Provide supplemental oxygen if cardiopulmonary compromise is suspected. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar

and a backboard when feasible. Apply direct pressure to stop any heavy bleeding.

*Victim Removal*

If victims can walk, lead them out of the Hot Zone to the Decontamination Zone. Victims who are unable to walk should be removed on backboards or gurneys. If these are not available, carefully carry or drag victims to safety.

Consider appropriate management of anxiety in victims with chemically-induced acute disorders, especially children who may suffer separation anxiety if separated from a parent or other adult.

**Decontamination Zone**

Patients exposed only to methyl isocyanate gas who have no eye or skin irritation do not need decontamination. They may be transferred immediately to the Support Zone. Other patients will require decontamination as described below.

*Rescuer Protection*

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

*ABC Reminders*

Quickly establish a patent airway, ensure adequate respiration and pulse. Maintain adequate circulation. Provide supplemental oxygen if cardiopulmonary compromise is suspected. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device if necessary. Apply direct pressure to control any heavy bleeding.

*Basic Decontamination*

**Rapid skin decontamination is critical.** Victims who are able may assist with their own decontamination. Remove contaminated clothing and personal belongings and place them in double plastic bags.

Wash exposed skin thoroughly with soap and water. Use caution to avoid hypothermia when decontaminating victims, particularly children or the elderly. Use blankets or warmers after decontamination as needed.

Irrigate exposed eyes with copious amounts of tepid water for at least **15 minutes**. Remove contact lenses if they are easily removable without additional trauma to the eye. If pain or injury is evident, continue irrigation while transferring the victim to the Support Zone.

In cases of ingestion, **do not induce emesis**. If the victim is not symptomatic, consider administering activated charcoal at a dose of 1 g/kg (infant, child, and adult dose). A soda can and straw may be of assistance when offering charcoal to a child. However, the effectiveness of activated charcoal in binding methyl isocyanate has not been demonstrated.

If the victim is conscious and able to swallow, consider giving 4 to 8 ounces of water.

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.

*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 methyl isocyanate gas pose no serious risk of secondary contamination to rescuers. In such cases, Support Zone personnel require no specialized protective gear.

*ABC Reminders*

Quickly establish 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, if available.

*Additional Decontamination*

Continue irrigating exposed skin and eyes, as appropriate.

In cases of ingestion, **do not induce emesis**. If the victim is not symptomatic, consider administering charcoal at a dose of 1 g/kg (infant, child, and adult dose). A soda can and straw may be of assistance when offering charcoal to a child. However, the effectiveness of activated charcoal in binding methyl isocyanate has not been demonstrated.

If the victim is conscious and able to swallow, consider giving 4 to 8 ounces of water if it has not been given previously.

*Advanced Treatment*

Treat cases of respiratory compromise with respiratory support using protocols and techniques available and within the scope of training. Some cases may necessitate procedures such as endotracheal intubation or cricothyrotomy by properly trained and equipped personnel.

Treat patients who have bronchospasm with oxygen, aerosolized bronchodilators such as albuterol, and/or steroids according to established protocol.

In cases of non-cardiogenic pulmonary edema, which may be delayed in onset, maintain adequate ventilation and oxygenation. Early use of mechanical ventilation and positive-end-expiratory pressure (PEEP) may be required. To minimize barotrauma and other complications, use the lowest amount of PEEP possible while maintaining adequate oxygenation. Consider drug therapy for pulmonary edema.

Patients who are comatose, hypotensive, or having seizures or cardiac arrhythmias should be treated according to advanced life support (ALS) protocols.

If evidence of shock or hypotension is observed begin fluid administration. For adults with systolic pressure less than 80 mmHg, bolus perfusion of 1,000 mL/hour intravenous saline or lactated Ringer's solution may be appropriate. Higher adult systolic pressures may necessitate lower perfusion rates. For children with compromised perfusion administer a 20 mL/kg bolus of normal saline over 10 to 20 minutes, then infuse at 2 to 3 mL/kg/hour. Consider vasopressors if patient is hypotensive with a normal fluid volume.

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

If methyl isocyanate 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 who have histories or evidence suggesting significant exposure (e.g., altered behavior, respiratory distress, or chemical burns) should be transported to a medical facility for evaluation. Patients who have a history of chronic pulmonary disease should be clinically evaluated for airflow obstruction.

Patients who have mild symptoms of respiratory or eye irritation should be clinically evaluated because onset of pulmonary edema may be delayed for up to 72 hours post-exposure and eye injury may need to be treated topically for inflammation or secondary infection. Patients who have symptoms of transient skin, nose, or eye irritation may be discharged from the scene after their names, addresses, and telephone numbers are recorded. They should be advised to rest and to seek medical care promptly if symptoms develop or recur (see *Patient Information Sheet* below).



## Emergency Department Management

- **Persons exposed only to methyl isocyanate gas pose no risk of secondary contamination to rescuers. Persons whose skin or clothing is contaminated with liquid methyl isocyanate can secondarily contaminate response personnel by direct contact or through off-gassing of vapor.**
- **Methyl isocyanate is irritating to the eyes, respiratory tract, and skin. Acute exposure to high vapor concentrations may cause severe pulmonary edema and injury to the alveolar walls of the lung, severe corneal damage, and death. Survivors of acute exposures may exhibit long-term respiratory and ocular effects. Methyl isocyanate may be a dermal and respiratory sensitizer.**
- **There is no antidote for methyl isocyanate. Treatment consists of removal of the victim from the contaminated area and support of respiratory and cardiovascular functions.**

### Decontamination Area

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

Be aware that use of protective equipment by the provider may cause anxiety, particularly 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 toxins 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 the airways, breathing, and circulation. Provide supplemental oxygen if cardiopulmonary compromise is suspected. Treat cases of respiratory compromise with respiratory support using protocols and techniques available and within the scope of training. Some cases may necessitate procedures such as endotracheal intubation or cricothyrotomy by properly trained and equipped personnel.

Treat patients who have bronchospasm with oxygen, aerosolized bronchodilators such as albuterol, and/or steroids according to established protocol.

Children may be more vulnerable to corrosive agents than adults because of the smaller diameter of their airways.

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

In cases of non-cardiogenic pulmonary edema, which may be delayed in onset, maintain adequate ventilation and oxygenation. Mechanical ventilation and positive-end-expiratory pressure (PEEP) may be required. To minimize barotrauma and other complications, use the lowest amount of PEEP possible while maintaining adequate oxygenation. Consider drug therapy for pulmonary edema. Keep in mind that the use of steroids to prevent or treat chemical pneumonitis and pulmonary edema is controversial.

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

#### *Basic Decontamination*

Patients who are able may assist with their own decontamination.

Because methyl isocyanate can cause burns, ED staff should don chemical-resistant jumpsuits (e.g., of Tyvek or Saranex) or butyl rubber aprons, rubber gloves, and eye protection if the patient's clothing or skin is wet. After the patient has been decontaminated, no special protective clothing or equipment is required for ED personnel.

Quickly remove contaminated clothing while gently washing the skin with soap and water. Double-bag the contaminated clothing and personal belongings. Handle burned skin with caution.

Wash exposed skin thoroughly with soap and water. If pain or injury is evident, continue irrigation while transferring the victim to the Critical Care Area. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed or irritated eyes with copious amounts of tepid water for at least **15 minutes**. Remove contact lenses if easily removable without additional trauma to the eye. If pain or injury is evident, continue irrigation while transferring the victim to the Critical Care Area.

In cases of ingestion, **do not induce emesis**. If the victim is not symptomatic, consider administering activated charcoal at a dose of 1 g/kg (infant, child, and adult dose). A soda can and straw may be of assistance when offering charcoal to a child. However, the effectiveness of activated charcoal in binding methyl isocyanate has not been demonstrated.

If the victim is conscious and able to swallow, consider giving 4 to 8 ounces of water.

### **Critical Care Area**

Be certain that appropriate decontamination has been carried out.

#### *ABC Reminders*

Evaluate and support the airways, breathing, and circulation as in *ABC Reminders* above. Establish intravenous access in seriously ill patients. Continuously monitor cardiac rhythm.

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

#### *Inhalation Exposure*

Administer supplemental oxygen by mask to patients who have respiratory complaints. Treat patients who have bronchospasm with aerosolized bronchodilators such as albuterol and/or steroids.

In cases of non-cardiogenic pulmonary edema, which may be delayed in onset, maintain adequate ventilation and oxygenation. Monitor arterial blood gases and/or pulse oximetry. If a high FIO<sub>2</sub> is required to maintain adequate oxygenation, mechanical ventilation and positive-end-expiratory pressure (PEEP) may be required. To minimize barotrauma and other complications, use the lowest amount of PEEP possible while maintaining adequate oxygenation. Consider drug therapy for pulmonary edema. Keep in mind that the use of steroids to prevent or treat chemical pneumonitis and pulmonary edema is controversial. Antibiotics should be used as indicated to control infection. Damaged lower respiratory tissue might be more susceptible to infection.

#### *Skin Exposure*

If concentrated methyl isocyanate is in contact with the skin, chemical burns may result; treat as thermal burns.

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

#### *Eye Exposure*

Continue irrigation for at least **15 minutes**. Test visual acuity. Examine the eyes for corneal damage and treat appropriately.

Immediately consult an ophthalmologist for patients who have suspected severe corneal injuries.

*Ingestion*

**Do not induce emesis.** Consider endoscopy to evaluate the extent of gastrointestinal-tract injury. Extreme throat swelling may require endotracheal intubation or cricothyrotomy. Gastric lavage is useful in certain circumstances to remove caustic material and prepare for endoscopic examination. Consider gastric lavage with a small nasogastric (NG) 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.

If the victim is not symptomatic, consider administering activated charcoal at a dose of 1 g/kg (infant, child, and adult dose). A soda can and straw may be of assistance when offering charcoal to a child. However, the effectiveness of activated charcoal in binding methyl isocyanate has not been demonstrated.

Consider giving 4 to 8 ounces of water to alert patients who can swallow, if not done previously.

*Antidotes and  
Other Treatments*

There is no antidote for methyl isocyanate. Treatment is supportive of respiratory and cardiac functions.

*Laboratory Tests*

Routine laboratory studies include chest radiography and pulse oximetry (or ABG measurements).

**Disposition and  
Follow-up**

Consider hospitalizing symptomatic patients who have evidence of respiratory or cardiac distress or significant chemical burns.

*Delayed Effects*

Acute exposure to high concentrations of methyl isocyanate may result in delayed onset of pulmonary edema and risk of secondary infection of the lungs or eyes.

*Patient Release* Patients who become totally asymptomatic in terms of pulmonary complaints in a 72-hour observation period are not likely to develop complications. They may be released and advised to rest and to seek medical care promptly if symptoms develop (see the *Methyl Isocyanate—Patient Information Sheet* below). Cigarette smoking can exacerbate pulmonary injury and should be discouraged for 72 hours after exposure.

*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.

Follow-up evaluation of respiratory function should be arranged for severely exposed patients. Patients who have skin or corneal lesions should be reexamined within 24 hours.

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

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



## **Methyl Isocyanate (C<sub>2</sub>H<sub>3</sub>NO ) Patient Information Sheet**

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

### **What is methyl isocyanate?**

Methyl isocyanate is a very flammable liquid that readily evaporates when exposed to air. Methyl isocyanate liquid is colorless with a pungent odor. The primary use of methyl isocyanate is as a chemical intermediate in the production of pesticides. It is also used to produce polyurethane foams and plastics. It is shipped and handled as a flammable and explosive liquid in a special container.

### **What immediate health effects can be caused by exposure to methyl isocyanate?**

Methyl isocyanate vapors are severely irritating and corrosive to the respiratory tract and eyes. Symptoms may include cough, chest pain, shortness of breath, watery eyes, eye pain (particularly when exposed to light), profuse lid edema, and corneal ulcerations. Respiratory symptoms such as pulmonary edema and bronchial spasms may occur in immediate response to exposure or develop and progress in severity over a period of hours to days post-exposure. Acute exposure to very high concentrations may be quickly fatal due to respiratory failure. Methyl isocyanate is a skin irritant and may cause chemical burns upon dermal contact.

### **Can methyl isocyanate poisoning be treated?**

There is no antidote for methyl isocyanate, but its effects can be treated. Persons who have inhaled large amounts of methyl isocyanate would most likely need to be hospitalized. Persons who have come into direct skin or eye contact with methyl isocyanate liquid or vapors may need to be treated for chemical burns or serious eye injury.

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

A single exposure from which a person recovers quickly may not result in long-term health effects. However, some respiratory and eye damage may persist for a long time after exposure to methyl isocyanate. The chemical may also be a dermal and respiratory sensitizer, causing reactive responses upon subsequent exposures.

### **What tests can be done if a person has been exposed to methyl isocyanate?**

Specific tests for the presence of methyl isocyanate in blood or urine are not generally useful. If a severe exposure has occurred, blood analyses, x-rays, and breathing tests might show whether the lungs have been injured.

### **Where can more information about methyl isocyanate be found?**

More information about methyl isocyanate 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 might be required to contact your employer and the Occupational Safety and Health Administration (OSHA), or the National Institute for Occupational Safety and Health (NIOSH). Ask the person who gave you this form for help locating these telephone numbers.

### Follow-up Instructions

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

- Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:
  - ▼ eye, nose, throat irritation
  - ▼ coughing or wheezing
  - ▼ difficulty breathing or shortness of breath
  - ▼ chest pain or tightness
  - ▼ nausea, vomiting, diarrhea, or stomach pain

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 \_\_\_\_\_