Higher Alcohols (>3 Carbons) and Related Compounds

SUBSTANCE IDENTIFICATION
Found as colorless liquids, singly or in mixtures, with sweet musty odors. Used in additives, paint strippers, hydraulic fluids, emulsifiers, and emollients. Found as solvents in paints, lacquers, coatings, and resins. Chemical intermediate in the manufacture of perfumes and esters. Also used in production of ceramics, latex, textiles, and paper coatings.

ROUTES OF EXPOSURE
Skin and eye contact
Inhalation
Ingestion
Skin absorption

TARGET ORGANS
Primary
Skin
Eyes
Central nervous system
Cardiovascular system
Respiratory system
Hepatic
Metabolism
Secondary
Gastrointestinal system
Renal

LIFE THREAT
CNS depression, respiratory failure, and cardiac arrhythmias.

SIGNS AND SYMPTOMS BY SYSTEM
Cardiovascular: Arrhythmias and hypotension.
CNS: Headache, dizziness, drowsiness, muscle weakness, delirium, CNS depression, coma, seizures, and neurobehavioral changes. Symptoms are more acute with the higher alcohols.
Gastrointestinal: Hemorrhage, nausea, vomiting, and diarrhea.
Eye: Chemical conjunctivitis, corneal damage, lacrimation, blurred vision, and photophobia.
Skin: Symptoms range from irritant dermatitis to partial- or full-thickness burns.
Renal: Kidney damage.
Hepatic: Liver damage.
Higher Alcohols (>3 Carbons) and Related Compounds

Metabolism: Anion gap metabolic acidosis.
Other: Early symptoms may mimic ethanol intoxication. Hypoglycemia.

SYMPTOM ONSET FOR ACUTE EXPOSURE
Immediate
Pulmonary edema possibly delayed

CO-EXPOSURE CONCERNS
Acetone and other ketones
Aromatic hydrocarbons
Other hydrocarbon solvents
Other alcohols

THERMAL DECOMPOSITION PRODUCTS INCLUDE
Carbon dioxide
Carbon monoxide

MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE
Liver disorders
Blood disorders
Skin disorders

DECONTAMINATION
• Wear positive-pressure SCBA and protective equipment specified by references such as the DOT Emergency Response Guidebook or the CANUTEC Initial Emergency Response Guide. If special chemical protective clothing is required, consult the chemical manufacturer or specific protective clothing compatibility charts.
• Delay entry until trained personnel and proper protective equipment are available.
• Remove patient from contaminated area.
• Quickly remove and isolate patient’s clothing, jewelry, and shoes.
• Gently brush away dry particles and blot excess liquids with absorbent material.
• Rinse patient with warm water, 30° C/86° F, if possible.
• Wash patient with Tincture of Green soap or a mild liquid soap and large quantities of water.
• Refer to decontamination protocol in Section Three.

IMMEDIATE FIRST AID
• Ensure that adequate decontamination has been carried out.
• If victim is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask as trained. Perform CPR if necessary.
• Immediately flush contaminated eyes with gently flowing water.
• Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) maintain an open airway and prevent aspiration.
• Keep victim quiet and maintain normal body temperature.
• Obtain medical attention.

BASIC TREATMENT
• Establish a patent airway. Suction if necessary.
• Watch for signs of respiratory insufficiency and assist ventilations if necessary.
• Administer oxygen by nonrebreather mask at 10 to 15 L/min.
• Monitor for shock and treat if necessary (refer to shock protocol in Section Three).
• Monitor for pulmonary edema and treat if necessary (refer to pulmonary edema protocol, Section Three).
Higher Alcohols (>3 Carbons) and Related Compounds

30

- Anticipate seizures and treat if necessary (refer to seizure protocol in Section Three).
- For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport (refer to eye irrigation protocol in Section Three).
- Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal (refer to ingestion protocol in Section Three and activated charcoal protocol in Section Four).

ADVANCED TREATMENT
- Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or has severe pulmonary edema.
- Positive-pressure ventilation techniques, with a bag-valve-mask device, may be beneficial.
- Monitor cardiac rhythm and treat arrhythmias as necessary (refer to cardiac protocol in Section Three).
- Start an IV with D5W TKO. Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of fluid overload.
- Monitor for signs of hypoglycemia (decreased LOC, tachycardia, pallor, dilated pupils, diaphoresis, and/or dextrose strip or glucometer readings below 50 mg) and administer 50% dextrose if necessary (refer to 50% dextrose protocol in Section Four).
- Treat seizures with diazepam (Valium) (refer to diazepam protocol in Section Four).
- For hypotension with signs of hypovolemia, administer fluid cautiously. Consider vasopressors if patient is hypotensive with a normal fluid volume. Watch for signs of fluid overload (refer to shock protocol in Section Three).
- Consider drug therapy for pulmonary edema (refer to pulmonary edema protocol in Section Three).
- Use proparacaine hydrochloride to assist eye irrigation (refer to proparacaine hydrochloride protocol in Section Three).

INITIAL EMERGENCY DEPARTMENT CONSIDERATIONS
- Useful initial laboratory studies include complete blood count, serum electrolytes, blood urea nitrogen (BUN), creatinine, glucose, urinalysis, and baseline biochemical profile, including serum aminotransferases (ALT and AST), calcium, phosphorus, and magnesium. Determination of anion and osmolar gaps may be helpful. Arterial blood gases (ABGs), chest radiograph, and electrocardiogram may be required.
- Positive end-expiratory pressure (PEEP)-assisted ventilation may be necessary in patients with acute parenchymal injury who develop pulmonary edema or adult respiratory distress syndrome.
- Products may cause acidosis; hyperventilation and sodium bicarbonate may be beneficial. Bicarbonate therapy should be guided by patient presentation. ABG determination, and serum electrolyte consideration.
- Hemodialysis may be beneficial in severe exposures.
- Obtain toxicological consultation as necessary.
Methyl Alcohol and Related Compounds

SUBSTANCE IDENTIFICATION
Found as a colorless liquid with a characteristic pungent odor. Used as a solvent, cleaning agent, antifreeze, denatured alcohol and fuel. Also used in the production of formaldehyde, methyl esters, plasticizers, paints, varnishes, adhesives, inks, dyes, plastics, pharmaceuticals, and softening agents. Chemical agent used in dehydration process of natural gas.

ROUTES OF EXPOSURE
Skin and eye contact
Inhalation
Ingestion
Skin absorption

TARGET ORGANS
Primary
Skin
Eyes
Central nervous system
Gastrointestinal system
Secondary
Cardiovascular system
Respiratory system
Renal
Metabolism

LIFE THREAT
Respiratory failure and circulatory collapse.

SIGNS AND SYMPTOMS BY SYSTEM
Cardiovascular: Mild tachycardia, occasional bradycardia, and cardiovascular collapse.
Respiratory: Rapid and shallow respirations and respiratory failure.
CNS: CNS depression to coma, headache, drowsiness, weakness, vertigo, fatigue, leg cramps, seizures, and chronic neurobehavioral symptoms. Initial symptoms may be those of inebriation.
Gastrointestinal: Nausea, vomiting, and diarrhea. Severe back and abdominal pain.
Eye: Chemical conjunctivitis, blindness secondary to metabolism of methanol to formic acid (formate) toxicity, blurred vision, dilated pupils, photophobia, nystagmus, and sensitivity to tactile pressure on globes and eye movement.
Skin: Irritant dermatitis.
Renal: Kidney damage.
Metabolism: Anion gap metabolic acidosis

SYMPTOM ONSET FOR ACUTE EXPOSURE
Immediate
Visual impairment possibly delayed for 12 to 18 hours
Signs and symptoms of acidosis possibly delayed for 24 hours...
CO-EXPOSURE CONCERNS
Hydrocarbon solvents
Carbon tetrachloride
Other alcohols
Ethylene glycol

THERMAL DECOMPOSITION PRODUCTS INCLUDE
Carbon dioxide
Carbon monoxide

MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE
Preexisting retinal disease
CNS disorders
Liver disorders

DECONTAMINATION
- Wear positive-pressure SCBA and protective equipment specified by references such as the DOT Emergency Response Guidebook or the CANUTEC Initial Emergency Response Guide. If special chemical protective clothing is required, consult the chemical manufacturer or specific protective clothing compatibility charts.
- Delay entry until trained personnel and proper protective equipment are available.
- Remove patient from contaminated area.
- Quickly remove and isolate patient’s clothing, jewelry, and shoes.
- Gently blot excess liquids with absorbent material.
- Rinse patient with warm water, 30° C/86° F, if possible.
- Wash patient with Tincture of Green soap or a mild liquid soap and large quantities of water.
- Refer to decontamination protocol in Section Three.

IMMEDIATE FIRST AID
- Ensure that adequate decontamination has been carried out.
- If victim is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask as trained. Perform CPR as necessary.
- Immediately flush contaminated eyes with gently flowing water.
- Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration.
- Keep victim quiet and maintain normal body temperature.
- Obtain medical attention.

BASIC TREATMENT
- Establish a patent airway. Suction if necessary.
- Watch for signs of respiratory insufficiency and assist ventilations if necessary.
- Administer oxygen by nonrebreather mask at 10 to 15 L/min.
- Monitor for shock and treat if necessary (refer to shock protocol in Section Three).
- Anticipate seizures and minimize all external stimuli. Treat seizures if necessary (refer to seizure protocol in Section Three).
- For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport (refer to eye irrigation protocol in Section Three).
- Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not
drool. Administer activated charcoal (refer to ingestion protocol in Section Three and activated charcoal protocol in Section Four).

**ADVANCED TREATMENT**
- Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest.
- Start an IV with lactated Ringer’s to support vital signs. Watch for signs of fluid overload.
- Treat seizures with diazepam (Valium) (refer to diazepam protocol in Section Four).
- For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload (refer to shock protocol in Section Three).
- Hyperventilation may be beneficial for treating acidosis.
- Use proparacaine hydrochloride to assist eye irrigation (refer to proparacaine hydrochloride protocol in Section Four).

**INITIAL EMERGENCY DEPARTMENT CONSIDERATIONS**
- Useful initial laboratory studies include complete blood count, serum electrolytes, blood urea nitrogen (BUN), creatinine, glucose, urinalysis, and baseline biochemical profile, including serum aminotransferases (ALT and AST), calcium, phosphorus, and magnesium. Determination of anion and osmolar gaps may be helpful. Arterial blood gases (ABGs), chest radiograph, and electrocardiogram may be required.
- Determine methanol and ethanol (ethyl alcohol) blood concentrations.
- Products may cause anion gap acidosis; hyperventilation and sodium bicarbonate may be beneficial. Bicarbonate therapy should be guided by patient presentation, ABG determination, and serum electrolyte considerations.
- Ethanol is an antagonist of methanol metabolism. Ethanol therapy is beneficial as a primary treatment measure, depending on clinical symptoms, acidosis, and methanol blood concentration. Do not delay ethanol administration in symptomatic patients pending blood methanol results. Hemodialysis is necessary for definitive treatment. Patients with blood methanol concentrations >25 mg/dl usually require ethanol treatment and hemodialysis (refer to ethanol protocol in Section Four).
- Obtain toxicological consultation as necessary.

**SPECIAL CONSIDERATIONS**
- If ethanol is co-ingested with methanol, symptoms may be delayed.
- Example of lethal synthesis: methanol is metabolized in the liver by the enzyme alcohol dehydrogenase to the toxic metabolites, formic acid, and formaldehyde. These agents cause the blindness and anion gap metabolic acidosis seen in methanol poisoning.
Aniline and Related Compounds

SUBSTANCE IDENTIFICATION
Found as a colorless-to-brown, oily liquid with a characteristic (fishy) odor. Used as an intermediate in a variety of chemical processes including production of pharmaceuticals, explosives, herbicides, and fungicides. Also found in paints, inks, polishes, dyes, and varnishes.

ROUTES OF EXPOSURE
Skin and eye contact
Inhalation
Ingestion
Skin absorption

TARGET ORGANS
Primary
Skin
Eyes
Cardiovascular system
Blood
Secondary
Central nervous system
Respiratory system
Gastrointestinal system
Hepatic
Renal

LIFE THREAT
Causes methemoglobinemia (i.e., state of relative hypoxia resulting from inability of the red blood cells to carry oxygen). Condition is additive with carbon monoxide, simple asphyxiants, or other cellular metabolic poisons (oxygen “excluder”).

SIGNS AND SYMPTOMS BY SYSTEM
Cardiovascular: Cardiovascular collapse, hypotension, ventricular arrhythmias, and heart block.
Respiratory: Dyspnea and irritation of the respiratory tract.
CNS: CNS depression and coma. Headache, ataxia, vertigo, confusion, lethargy, disorientation, and tinnitus. Seizures are rare.
Gastrointestinal: Corrosive to the GI tract, causing gastritis and hemorrhage.
Eye: Chemical conjunctivitis and corneal damage.
Skin: Severe, bluish-gray-to-black cyanosis secondary to methemoglobinemia.
Renal: Kidney damage.
Hepatic: Liver damage
Blood: Methemoglobinemia and Heinz body hemolytic anemia.
Other: The fetus may be at high risk from methemoglobinemia and resultant hypoxia. Some products may present a human mutagenic risk.
SYMPTOM ONSET FOR ACUTE EXPOSURE
Immediate symptoms of methemoglobinemia possibly delayed up to 4 hours (particularly when skin exposure has occurred)

CO-EXPOSURE CONCERNS
Trauma
Simple asphyxiants
Carbon monoxide
Cellular metabolic poisons

THERMAL DECOMPOSITION PRODUCTS INCLUDE
Ammonia
Carbon dioxide
Carbon monoxide
Nitrogen oxides
Sulfur dioxide

MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE
Central nervous system disorders
Cardiovascular disorders
Liver disorders
Kidney disorders
Bone marrow diseases

DECONTAMINATION
- Wear positive-pressure SCBA and protective equipment specified by references such as the DOT Emergency Response Guidebook or the CANUTEC Initial Emergency Response Guide. If special chemical protective clothing is required, consult the chemical manufacturer or specific protective clothing compatibility charts.
- Delay entry until trained personnel and proper protective equipment are available.
- Remove patient from contaminated area.
- Quickly remove and isolate patient's clothing, jewelry, and shoes.
- Gently blot excess liquids with absorbent material.
- Rinse patient with warm water, 30°C/86°F, if possible.
- Wash patient with Tincture of Green Soap or a mild liquid soap and large quantities of water.
- Refer to decontamination protocol in Section Three.

IMMEDIATE FIRST AID
- Ensure that adequate decontamination has been carried out.
- If victim is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask as trained. Perform CPR if necessary.
- Immediately flush contaminated eyes with gently flowing water.
- Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration.
- Keep victim quiet and maintain normal body temperature.
- Obtain medical attention.

BASIC TREATMENT
- Establish a patent airway. Suction if necessary.
- Watch for signs of respiratory insufficiency and assist ventilations if necessary.
• Administer oxygen by nonrebreather mask at 10 to 15 L/min.
• Monitor for shock and treat if necessary (refer to shock protocol in Section Three).
• Anticipate seizures and treat if necessary (refer to seizure protocol in Section Three).
• For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport (refer to eye irrigation protocol in Section Three).
• Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal (refer to ingestion protocol in Section Three and activated charcoal protocol in Section Four).

ADVANCED TREATMENT
• Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious.
• Monitor cardiac rhythm and treat arrhythmias as necessary (refer to cardiac protocol in Section Three).
• Start an IV with D5W TKO. Use lactated Ringer’s if signs of hypovolemia are present. Watch for signs of fluid overload.
• Administer 1% solution methylene blue if patient is symptomatic with severe hypoxia, cyanosis, and cardiac compromise not responding to oxygen. DIRECT PHYSICIAN ORDER ONLY (refer to methylene blue protocol in Section Four).
• For hypotension with signs of hypovolemia, administer fluid cautiously. Consider vasopressors if hypotensive with a normal fluid volume. Watch for signs of fluid overload (refer to shock protocol in Section Three).
• Treat seizures with diazepam (Valium) (refer to diazepam protocol in Section Four).
• Use proparacaine hydrochloride to assist eye irrigation (refer to proparacaine hydrochloride protocol in Section Four).

INITIAL EMERGENCY DEPARTMENT CONSIDERATIONS
• Useful initial laboratory studies include complete blood count, serum electrolytes, blood urea nitrogen (BUN), creatinine, glucose, urinalysis, and baseline biochemical profile, including serum aminotransferases (ALT and AST), calcium, phosphorus, and magnesium. Arterial blood gases (ABGs), chest radiograph and electrocardiogram may be required.
• Monitor blood methemoglobin levels and treat with methylene blue if patient is symptomatic and/or has a blood methemoglobin level greater than 30% (refer to methylene blue protocol in Section Four).
• Hyperbaric oxygen may be beneficial in severe exposures as an adjunct to methylene blue treatment as necessary.
• Obtain toxicological consultation if necessary.
Aliphatic Hydrocarbons and Related Compounds

SUBSTANCE IDENTIFICATION
Colorless liquids or gases with fruitlike or etherlike odor. Some gases are odorless, and an odorant is occasionally added. Used as fuels, solvents, anesthetics, refrigerants, and in the manufacturing process of many products.

ROUTES OF EXPOSURE
Skin and eye contact
Inhalation
Ingestion
Skin absorption

TARGET ORGANS
Primary
Skin
Eyes
Central nervous system
Respiratory system
Secondary
Cardiovascular system
Gastrointestinal system
Hepatic
Renal

LIFE THREAT
Cardiac arrhythmias. Asphyxiation or anesthetic properties at high concentrations.

SIGNS AND SYMPTOMS BY SYSTEM
Cardiovascular: Cardiovascular collapse and arrhythmias. May aggravate pre-existing cardiac problem.
Respiratory: Narcotic-like effect may depress respirations. Irritation of the respiratory tract and mucous membranes, chemical pneumonitis, and/or pulmonary edema.
Low-molecular aliphatic chains (methane through butane) may act as simple asphyxiants.
CNS: Excitation, headache, disorientation, dizziness, incoordination, weakness, muscle spasms, paresthesias, seizures. CNS depression and coma due to anesthetic effect or hypoxia, and neurobehavioral changes.
Gastrointestinal: Nausea, excessive salivation, vomiting, and abdominal cramps.
Eye: Irritation, lacrimation, and blurred vision.
Skin: Mild skin irritation, dermatitis, and frostbite.
Renal: Kidney damage and hematuria.
Hepatic: Liver damage.

SYMPTOM ONSET FOR ACUTE EXPOSURE
Immediate
Pulmonary edema possibly delayed
CO-EXPOSURE CONCERNS
Other hydrocarbons
Sympathomimetic agents

THERMAL DECOMPOSITION PRODUCTS INCLUDE
Carbon dioxide
Carbon monoxide

MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE
Central nervous system disorders
Cardiovascular disorders
Liver disorders
Kidney disorders

DECONTAMINATION
- Wear positive-pressure SCBA and protective equipment specified by references such as the DOT Emergency Response Guidebook or the CANUTEC Initial Emergency Response Guide. If special chemical protective clothing is required, consult the chemical manufacturer or specific protective clothing compatibility charts.
- Delay entry until trained personnel and proper protective equipment are available.
- Remove patient from contaminated area.
- Quickly remove and isolate patient’s clothing, jewelry, and shoes.
- Gently blot any excess liquids with absorbent material.
- Rinse patient with warm water, 30° C/86° F, if possible.
- Wash patient with Tincture of Green Soap or a mild liquid soap and large quantities of water.
- Refer to decontamination protocol in Section Three.

IMMEDIATE FIRST AID
- Ensure that adequate decontamination has been carried out.
- If victim is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask as trained. Perform CPR if necessary.
- Immediately flush contaminated eyes with gently flowing water.
- Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration.
- Keep victim quiet and maintain normal body temperature.
- Obtain medical attention.

BASIC TREATMENT
- Establish a patent airway. Suction if necessary.
- Watch for signs of respiratory insufficiency and assist ventilations if necessary.
- Administer oxygen by nonrebreather mask at 10 to 15 L/min.
- Monitor for pulmonary edema and treat if necessary (refer to pulmonary edema protocol in Section Three).
- Anticipate seizures and treat as necessary (refer to seizure protocol in Section Three).
- For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport (refer to eye irrigation protocol in Section Three).
- Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal (refer to ingestion protocol in Section Three and activated charcoal protocol in Section Four).
• Treat frostbite with rapid rewarming techniques (refer to frostbite protocol in Section Three)

ADVANCED TREATMENT
• Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest.
• Positive-pressure ventilation techniques with a bag-valve-mask device may be beneficial.
• Monitor cardiac rhythm and treat arrhythmias as necessary (refer to cardiac protocol in Section Three).
• Start an IV with D5W TKO. Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of fluid overload.
• Consider drug therapy for pulmonary edema (refer to pulmonary edema protocol in Section Three).
• Treat seizures with diazepam (Valium) (refer to diazepam protocol in Section Four).
• Use proparacaine hydrochloride to assist eye irrigation (refer to proparacaine hydrochloride protocol in Section Four).

INITIAL EMERGENCY DEPARTMENT CONSIDERATIONS
• Useful initial laboratory studies include complete blood count, serum electrolytes, blood urea nitrogen (BUN), creatinine, glucose, urinalysis, and baseline biochemical profile, including serum aminotransferases (ALT and AST), calcium, phosphorus, and magnesium. Arterial blood gases (ABGs), chest radiograph, and electrocardiogram may be required.
• Positive end-expiratory pressure (PEEP)-assisted ventilation may be necessary in patients with acute parenchymal injury who develop pulmonary edema or adult respiratory distress syndrome.
• Obtain toxicological consultation as necessary.

SPECIAL CONSIDERATIONS
• Avoid epinephrine and related beta agonists (unless patient is in cardiac arrest or has reactive airways disease refractory to other treatment) because of the possible irritable condition of the myocardium. Use of these medications may lead to ventricular fibrillation.
**SUBSTANCE IDENTIFICATION**
Found as a colorless liquid with an unpleasant odor. Used as a solvent and in the manufacture of insecticides, polishes, cleaners, inks, putty, cutting fluids, and paint thinners.

**ROUTES OF EXPOSURE**
Skin and eye contact
Inhalation
Ingestion
Skin absorption

**TARGET ORGANS**
*Primary*
Skin
Eyes
Central nervous system
Cardiovascular system
Respiratory system
*Secondary*
Gastrointestinal system
Renal

**LIFE THREAT**
Respiratory failure, pulmonary edema, and tachycardia.

**SIGNS AND SYMPTOMS BY SYSTEM**
*Cardiovascular*: Tachycardia and arrhythmias.
*Respiratory*: Respiratory tract irritant that can cause coughing, choking, and dyspnea. Aspiration pneumonia and pulmonary edema possible from direct pulmonary effect or absorption after systemic poisoning.
*CNS*: Headache, confusion, excitement, hyperreflexia and ataxia, followed by decreased level of consciousness and coma. Seizures.
*Gastrointestinal*: Mucous membrane irritation with burning pain, nausea, vomiting, diarrhea, and abdominal pain.
*Eye*: Chemical conjunctivitis and corneal burns.
*Skin*: Irritant dermatitis and cyanosis (if respiratory complications are present).
*Renal*: Kidney damage.

**SYMPTOM ONSET FOR ACUTE EXPOSURE**
Immediate
Pulmonary edema symptoms possibly delayed

**CO-EXPOSURE CONCERNS**
Other hydrocarbon solvents

**THERMAL DECOMPOSITION PRODUCTS INCLUDE**
Acrid fumes and irritating smoke
Carbon dioxide
Carbon monoxide
**MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE**
- Respiratory system disorders
- Skin disorders

**DECONTAMINATION**
- Wear positive-pressure SCBA and protective equipment specified by references such as the DOT Emergency Response Guidebook or the CANUTEC Initial Emergency Response Guide. If special chemical protective clothing is required, consult the chemical manufacturer or specific protective clothing compatibility charts.
- Delay entry until trained personnel and proper protective equipment are available.
- Remove patient from contaminated area.
- Quickly remove and isolate patient’s clothing, jewelry, and shoes.
- Gently blot excess liquids with absorbent material.
- Rinse patient with warm water, 30°C/86°F, if possible.
- Wash patient with Tincture of Green Soap or a mild liquid soap and large quantities of water.
- Refer to decontamination protocol in Section Three

**IMMEDIATE FIRST AID**
- Ensure that adequate decontamination has been carried out.
- If victim is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask as trained. Perform CPR if necessary.
- Immediately flush contaminated eyes with gently flowing water.
- Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration.
- Keep victim quiet and maintain normal body temperature.
- Obtain medical attention.

**BASIC TREATMENT**
- Establish a patent airway. Suction if necessary.
- Watch for signs of respiratory insufficiency and assist ventilations if necessary.
- Administer oxygen by nonrebreather mask at 10 to 15 L/min.
- Monitor for pulmonary edema and treat if necessary (refer to pulmonary edema protocol in Section Three).
- Anticipate seizures and treat if necessary (refer to seizure protocol in Section Three).
- For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport (refer to eye irrigation protocol in Section Three).
- Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool (refer to ingestion protocol in Section Three).

**ADVANCED TREATMENT**
- Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest.
- Positive-pressure ventilation techniques with a bag-valve-mask device may be beneficial.
- Monitor cardiac rhythm and treat arrhythmias if necessary (refer to cardiac protocol in Section Three).
- Start an IV with D5W TKO. Use lactated Ringer’s if signs of hypovolemia are present. Watch for signs of fluid overload.
Consider drug therapy for pulmonary edema (refer to pulmonary edema protocol in Section Three).

Treat seizures with diazepam (Valium) (refer to diazepam protocol in Section Four).

Use proparacaine hydrochloride to assist eye irrigation (refer to proparacaine hydrochloride protocol in Section Four).

INITIAL EMERGENCY DEPARTMENT CONSIDERATIONS

Useful initial laboratory studies include complete blood count, serum electrolytes, blood urea nitrogen (BUN), creatinine, glucose, urinalysis, and baseline biochemical profile including serum aminotransferases (ALT and AST), calcium, phosphorus, and magnesium. Arterial blood gases (ABGs), chest radiograph, and electrocardiogram may be required.

Positive end-expiratory pressure (PEEP)-assisted ventilation may be necessary in patients with acute parenchymal injury who develop pulmonary edema or adult respiratory distress syndrome.

Obtain toxicological consultation as necessary.

SPECIAL CONSIDERATIONS

Avoid epinephrine and related beta agonists (unless patient in cardiac arrest or has reactive airways disease refractory to other treatment) because of the possible irritable condition of the myocardium. Use of these medications may lead to ventricular fibrillation.