



# HAZARDOUS MATERIALS EXPOSURE GUIDE

# PATIENT TREATMENT STEPS

PLEASE LOOK TO THE APPROPRIATE SECTION FOR DETAILED INSTRUCTIONS.

## 1. DECONTAMINATE AND COLLECT INFORMATION

## 2. TREAT THE PATIENT FOR CHEMICAL EXPOSURES

## 3. COLLECT BLOOD AND URINE SPECIMENS

Collect specimens per your institution's normal protocols for medical management. For unusual exposures, please contact MDH with questions about specimen collection.

*This document is a reference and is not intended to replace medical advice. Specific exposures may require individual recommendations and should be managed with the help of the Poison Control Center. Healthcare workers should avoid becoming contaminated and use appropriate personal protective equipment per their institutional plans.*

Produced by the Minnesota Department of Health 2018



For treatment questions:  
Poison Control Center  
800-222-1222  
[www.mnpoison.org](http://www.mnpoison.org)



For specimen questions:  
Minnesota Department of Health  
612-282-3750  
[www.health.mn.gov/hazmat](http://www.health.mn.gov/hazmat)



[www.health.mn.gov/mls](http://www.health.mn.gov/mls)

# SUPPORTIVE TREATMENTS

THE FOLLOWING SIX SUPPORTIVE TREATMENT STEPS ARE CRITICAL TO ALL TOXIC EXPOSURES.



## 1. AIRWAY BREATHING

PROVIDE OXYGEN

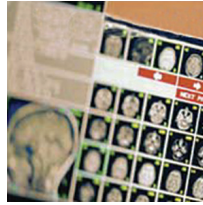
- Assess for respiratory distress (includes stridor, cough, or wheezing)
- Treat with bronchodilators as needed
- Control airway (e.g. intubate) as needed for respiratory failure, anticipated progression of symptoms, or coma



## 2. CIRCULATION

SUPPORT BLOOD PRESSURE WITH IV NORMAL SALINE

- Medications are rarely needed to maintain blood pressure after toxic exposures. Consult with Poison Control and consider central venous monitoring for persistent hypotension.



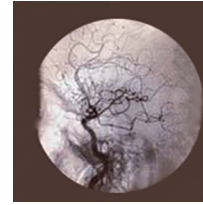
## 3. SEIZURES

CONTROL SEIZURES WITH BENZODIAZEPINES



## 4. POISON CONSULT

CONSULT WITH POISON CONTROL FOR ALL EXPOSURES  
1-800-222-1222



## 5. ORGANS

CONSIDER POTENTIAL FOR END-ORGAN DAMAGE BASED UPON AGENT

- Cardiac
- Pulmonary
- Hepatic
- Renal
- CNS
- Hematologic
- Dermatologic



## 6. DISEASE

CONSIDER CONTRIBUTION OF UNDERLYING DISEASE TO SYMPTOMS OR POTENTIAL FOR COMPLICATIONS

- Cardiac (e.g. ischemia)
- Pulmonary (e.g. asthma)
- Renal
- Hepatic
- Hematologic (e.g. underlying anemia/hemoglobinopathy)

# DECONTAMINATION BASIC STEPS



## DECONTAMINATION OF MERCURY

CONSULT POISON CONTROL FOR ADVICE PRIOR TO DECONTAMINATION.

## DECONTAMINATION OF SOLID METAL SALTS

CONSULT POISON CONTROL FOR ADVICE PRIOR TO DECONTAMINATION.

## DECONTAMINATION OF RADIOLOGIC MATERIALS

CONSULT POISON CONTROL FOR ADVICE PRIOR TO DECONTAMINATION. OBTAIN APPROPRIATE COUNTERS/MONITORING EQUIPMENT.

## DECONTAMINATION OF PURE GAS EXPOSURE

CONSULT POISON CONTROL FOR ADVICE PRIOR TO DECONTAMINATION.

FOR ALL OTHER EXPOSURES, THREE STEPS SHOULD BE FOLLOWED TO PERFORM BASIC DECONTAMINATION.



# 1.

Cut or otherwise remove contaminated clothing. Usually this will remove 90% or more of the contaminant.



# 2.

Seal clothing in a bag.








# 3.

Use soap and water to wash the affected area(s). Contain wastewater if possible.

*Victims exposed to cholinergic/nerve agent vapor should receive decontamination.*

# EXPOSURE GUIDE

	AGENT:	EXAMPLES:	TOXICITY:	SIGNS/SYMPOMS:
	ASPHYXIANTS CHEMICAL	<ul style="list-style-type: none"> <li>• Cyanide • Hydrogen sulfide</li> <li>• Carbon monoxide</li> <li>• Methylene chloride (Metabolized to CO in body)</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical interferes with oxygen use by body tissue</li> </ul>	<ul style="list-style-type: none"> <li>• Cyanosis • Methemoglobinemia</li> <li>• Severe acidosis • Tachypnea</li> </ul>
	ASPHYXIANTS SIMPLE	<ul style="list-style-type: none"> <li>• Nitrogen • Carbon dioxide</li> <li>• Methane • Natural gas</li> </ul>	<ul style="list-style-type: none"> <li>• Hypoxemia due to oxygen displacement in an enclosed environment</li> </ul>	<ul style="list-style-type: none"> <li>• Anxiety • Tachycardia • Collapse • Coma • Death</li> </ul>
	CHOLINERGICS	<ul style="list-style-type: none"> <li>• Nerve agents • Pesticides</li> <li>• <b>Organophosphates:</b> Diazinon, Malathion</li> <li>• <b>Carbamates:</b> Sevin</li> </ul>	<ul style="list-style-type: none"> <li>• Acetylcholinesterase inhibition causing uncontrolled persistent nerve stimulation</li> </ul>	<p style="text-align: center;">("DUMBELS" mnemonic)</p> <ul style="list-style-type: none"> <li>• <b>D</b>iarrhea • <b>U</b>rination • <b>M</b>iosis</li> <li>• <b>B</b>radycardia, Bronchorrhea, Bronchospasm • <b>E</b>mesis</li> <li>• <b>L</b>acrimation • <b>S</b>alivation, Secretion, Sweating</li> </ul>
	CORROSIVES	<ul style="list-style-type: none"> <li>• <b>Acids:</b> Hydrochloric, Nitric, Sulfuric, Hydrofluoric (HF)</li> <li>• <b>Alkalies:</b> Sodium hydroxide, Potassium hydroxide</li> <li>• <b>Oxidizers:</b> White phosphorus</li> </ul>	<ul style="list-style-type: none"> <li>• Tissue damage</li> <li>• <b>Acids:</b> Surface</li> <li>• <b>Alkalies:</b> Deep</li> <li>• <b>Oxidizers:</b> Thermal and chemical burns</li> </ul>	<ul style="list-style-type: none"> <li>• Local pain • Respiratory, oral, ocular involvement</li> <li>• Esophageal burns</li> <li>• <b>Alkalies:</b> May have no initial symptoms</li> </ul>
	HYDROCARBONS & HALOGENATED HYDROCARBONS	<ul style="list-style-type: none"> <li>• Gasoline • Toluene • Lamp oil</li> <li>• Carbon tetrachloride</li> <li>• Refrigerants</li> </ul>	<ul style="list-style-type: none"> <li>• Agent-specific toxic effects</li> <li>• Myocardial &amp; CNS depressants + risk of dysrhythmias with adrenergic drugs</li> </ul>	<ul style="list-style-type: none"> <li>• Somnolence • Agitation</li> <li>• Vomiting • Hypoxia</li> <li>• Severe GI burns possible</li> <li>• Tachycardia, dysrhythmias</li> </ul>
	IRRITANT GASES	<ul style="list-style-type: none"> <li>• Ammonia • Chlorine • Phosgene</li> </ul>	<ul style="list-style-type: none"> <li>• Respiratory tract irritation</li> <li>• High water solubility= upper airways</li> <li>• Low water solubility= lower airways</li> </ul>	<ul style="list-style-type: none"> <li>• Airway irritation • Stridor</li> <li>• Airway swelling • Eye irritation</li> <li>• Immediate/delayed pulmonary edema • Coughing, wheezing</li> </ul>



# ASPHYXIANTS CHEMICAL

EXAMPLES: CYANIDE | HYDROGEN SULFIDE | CARBON MONOXIDE | METHYLENE CHLORIDE

## TOXICITY

Chemically interferes with use of oxygen by body tissues.

Closed space exposures



**SIGNS AND SYMPTOMS**  
Anxiety, tachycardia, eventual syncope, coma, and death if not removed from exposure environment.



Peripheral or central cyanosis or 'chocolate brown' blood may indicate methemoglobinemia. Consult Poison Control.



Tachypnea  
Cyanide – severe acidosis.



Methylene chloride produces carbon monoxide in body.



## TREATMENT

**Cyanide:** Remove from environment. Provide airway support and oxygen. Antidotal treatment for confirmed CN exposures or for confined space smoke exposure with acidosis and/or hemodynamic instability/dysrhythmia: Hydroxycobalmin (Cyanokit®) – 70 mg/kg to max 5 grams IV (expect reddened skin and possible hypertension) Sodium nitrite – if hydroxycobalmin unavailable – 1 amp IV over 5-10 minutes (ped 0.2 ml/kg). May repeat x1 at 30 minutes if still unstable. Induces methemoglobinemia, thus expect oxygen situations in 85% range (consider transfer to hospital with hyperbaric oxygen capability). May also be used for symptomatic hydrogen sulfide (HS) exposures. Sodium thiosulfate – given for cyanide poisoning in addition to either of above treatments 1 amp IV over 5 minutes (ped 1.6 mg/kg of 25% preparation)

**Carbon Monoxide:** Consider hyperbaric oxygen for significant exposure (loss of consciousness, cardiac complications, pregnancy, other severe symptoms or prolonged (>5h exposure). Consult HCMC: 612-873-3132

**Methemoglobinemia:** Treatment is methylene blue. Starting dose 1-2mg/kg. Complication may be hemolysis. Contact Poison Control for treatment considerations.



# ASPHYXIANTS SIMPLE

EXAMPLES: NITROGEN | CARBON DIOXIDE | METHANE | NATURAL GAS

## TOXICITY

Asphyxiants displace oxygen in an enclosed atmosphere causing hypoxemia

Toxicity worse in closed spaces (or below grade spaces for gases denser than air)

Compressed liquid gases (e.g. nitrogen and propane) may cause frostbite to skin if in close proximity to source of leaking gas



## SIGNS AND SYMPTOMS

Anxiety



Tachypnea and tachycardia due to hypoxia



Eventual collapse, coma and death if not removed from exposure environment.



## TREATMENT

Remove victim from exposure environment

Administer oxygen

Condition should not deteriorate after removal from exposure environment unless due to underlying disease complications (e.g. cardiac disease)



## TOXICITY

Allows uncontrolled persistent nerve stimulation by poisoning acetylcholinesterase

# CHOLINERGICS

EXAMPLES:

NERVE AGENTS  
ORGANOPHOSPHATES: DIAZINON | MALATHION  
CARBAMATES: SEVIN



## SIGNS AND SYMPTOMS



“D U M B E L S”



Diarrhea



Miosis - Small pupils  
(critical finding!)



Bradycardia,  
Bronchorrhea  
Bronchospasm



Emesis



Lacrimation



Salivation  
Secretion  
Sweating



## TREATMENT

**DECONTAMINATION:** Soap and water wash the patient. Bag and seal clothing to prevent off-gassing. Body fluids may contain high levels of agent in ingestion cases. (Poses threat to rescuers from contact/vapor.)

**INTUBATION, ANTIDOTAL THERAPY:**

**Atropine** 3-5mg per dose IM/IV (0.1mg/kg) repeat as needed to control secretions and allow ventilation.

**Pralidoxime** 1-2g IV or 25mg/kg (not required for carbamate exposure) over 10 min, repeat at 30 min if still critically ill or exhibiting fasciculations, seizures, or weakness.

**Duodote or Mark 1 kit autoinjectors** (2PAM 600 mg/atropine 2 mg) 2 kits/sever poisoning, 1 kit for <10 years old or mild poisoning. (High potential for healthcare worker contamination and toxicity – decontaminate patient and wear personal protective equipment as required.)

**Benzodiazepines** should be given to all severely poisoned patients and for seizures.

Consult Poison Control regarding decontamination and further therapy.





# CORROSIVES

EXAMPLES: ACIDS: HYDROCHLORIC ACID | NITRIC ACID | SULFURIC ACID | HYDROFLUORIC (HF) ACID  
 BASES: SODIUM HYDROXIDE | POTASSIUM HYDROXIDE  
 OXIDIZERS: WHITE PHOSPHORUS

## TOXICITY

Damage to tissues

Alkalies penetrate tissues deeply, acids affect surface tissues (except HF, which can cause deceptively severe burns and hypocalcemia)

Oxidizers cause thermal burns in addition to chemical burns

White phosphorus can cause hemolysis, methemoglobinemia, and hypocalcemia



## SIGNS AND SYMPTOMS



Pain may be minimal early after exposure, especially to alkalies



White phosphorous – anemia from hemolysis, 'chocolate' colored blood from methemoglobinemia



HF - profound pain at exposure site, weakness, muscle twitching/tetany Electrocardiogram changes (long QT, AV block) or dysrhythmia from low calcium



Eye burns - pain, tearing, vision changes

Ingestions may have severe esophageal burns with normal oral exam

## TREATMENT

Irrigate copiously with water. If a chemical alkali is involved, irrigate continuously until the surface pH remains neutral 5 min after last irrigation. For eye irrigation, use topical anesthetic; consider Morgan lens. May require admission for ongoing irrigation. Consult ophthalmology for eye injuries. Oxidizers: consult Poison Control.

HF – Calcium replacement (large doses of Ca may be needed), also Mg and K. Topical and IV calcium, may need intra-arterial calcium treatment. Consult Poison Control immediately.

White phosphorus – Calcium replacement and further treatment per Poison Control. Assess for hemolysis, methemoglobinemia and treat as indicated.

Decontaminate, then treat tissue injury as you would treat thermal burns. Assure re-evaluation in 24 hours (or sooner if any worsening or new symptoms/signs).

Consult Poison Control and consider GI consult for ingestions.



# HYDROCARBONS HALOGENATED HYDROCARBONS

EXAMPLES: GASOLINE | TOLUENE | LAMP OIL | CARBON TETRACHLORIDE | REFRIGERANTS

## TOXICITY

CNS and myocardial depressants, but increased risk of dysrhythmias (e.g. VF) with adrenergic drugs (e.g. albuterol, epinephrine, exercise, emotional/excitement reactions)

Certain halogenated hydrocarbons have specific toxic effects (e.g. methylene chloride produces carbon monoxide in the body)



## SIGNS AND SYMPTOMS

Somnolence



Agitation



Emesis



Hypoxia



Some agents may cause severe GI burns - Consult Poison Control.



Inhaled can cause hypoxemia

## TREATMENT

Control flammable and explosive residues on clothing.

Provide supportive treatment; avoid beta-agonists (albuterol, epi, etc.) if possible.

If ocular exposure, irrigate eyes to preclude corneal damage.

Follow ACLS algorithms for ventricular dysrhythmias (e.g. lidocaine, amiodarone), consider consultation or beta-blockade (e.g. esmolol) for refractory or recurrent ventricular dysrhythmia.



# IRRITANT GASES

EXAMPLES: AMMONIA, CHLORINE, PHOSGENE

## TOXICITY

Irritates respiratory tract, but causes no major systemic effects

Make sure HF is not involved (see corrosives)

Ammonia is highly water soluble = immediate upper airway symptoms

Chlorine moderately water soluble = upper and lower airway symptoms

Phosgene is less water soluble = delayed and lower airway symptoms



## SIGNS AND SYMPTOMS

Airway irritation



Stridor

Airway swelling

Eye irritation

Immediate or delayed pulmonary edema

## TREATMENT

Provide supportive airway management (may include intubation, oxygen, bronchodilators, BiPAP).

For eye injuries, administer analgesia and anesthetic eye drops, irrigation.  
**CONTACT POISON CONTROL.**

For exposure to lower solubility agents (e.g. phosgene), observe for 6h for delayed symptoms.

# INFORMATION TO GATHER

**EXPOSED INDIVIDUAL** \_\_\_\_\_

**EXPOSURE DATE & TIME** \_\_\_\_\_

**DURATION OF EXPOSURE** \_\_\_\_\_SECONDS \_\_\_\_\_MINUTES \_\_\_\_\_HOURS \_\_\_\_\_DAYS \_\_\_\_\_WEEKS \_\_\_\_\_MONTHS

**PATIENT ARRIVAL DATE & TIME** \_\_\_\_\_

**ROUTE OF EXPOSURE**    **INHALATION**    CONTACT\_\_\_\_\_    INGESTION\_\_\_\_\_    COMBINATION\_\_\_\_\_

OTHER \_\_\_\_\_

**WHERE EXPOSURE OCCURED**    CLOSED SPACE\_\_\_\_\_    OUTSIDE\_\_\_\_\_    COMBINATION\_\_\_\_\_

OTHER \_\_\_\_\_

**NAME & PHONE NO. OF FIRST RESPONDER** \_\_\_\_\_

**CHEMICAL NAME OF SUSPECTED SUBSTANCE** \_\_\_\_\_

**IS SAMPLE AVAILABLE FOR TESTING?**    YES\_\_\_\_\_    NO\_\_\_\_\_

**SUBSTANCE PROPERTIES**    POWDER\_\_\_\_\_    LIQUID\_\_\_\_\_    SOLID\_\_\_\_\_    GAS\_\_\_\_\_

ODOR\_\_\_\_\_    COLOR\_\_\_\_\_    VOLUME SPILLED\_\_\_\_\_

**DESCRIBE DECONTAMINATION PROVIDED AT THE SITE OF EXPOSURE** \_\_\_\_\_

\_\_\_\_\_

**PRE-HOSPITAL CARE** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



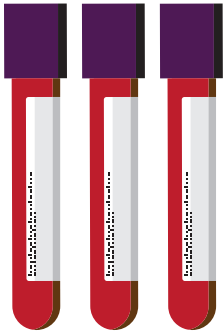
# BLOOD SPECIMEN

Collect specimens from each person involved in an unusual chemical-exposure event. Please consult with the Minnesota Department of Health 612-282-3750

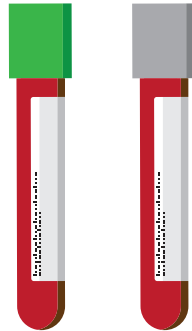
- PEDIATRIC:** COLLECT URINE ONLY UNLESS OTHERWISE DIRECTED BY THE CDC. (SEE URINE SPECIMEN CARD)
- ADULT:** FOR EACH PATIENT, COLLECT SAMPLES IN THE FOLLOWING ORDER:
1. COLLECT A MINIMUM OF **12 mL** OF BLOOD IN PURPLE-TOP EDTA TUBES.
  2. COLLECT **3 mL** OF BLOOD IN ONE GREEN OR GREY-TOP TUBE.
  3. COLLECT AT LEAST **25 mL** OF URINE IN A SCREW-CAP URINE CUP. (SEE URINE SPECIMEN CARD)

## COLLECT

1. FIRST DRAW  
**PURPLE TOP TUBES**  
(DO NOT USE GEL SEPARATORS)  
COLLECT A MINIMUM OF 12 mL



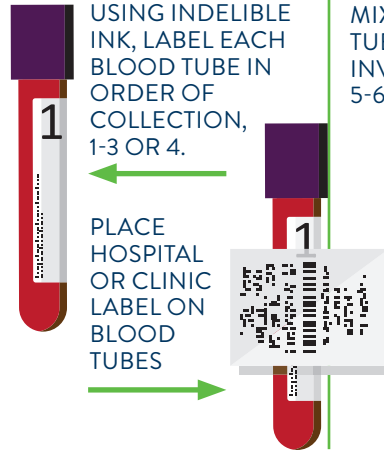
2. THEN DRAW  
**GRAY OR GREEN TOP TUBES**  
(DO NOT USE GEL SEPARATORS)  
COLLECT 3-7 mL IN ONE TUBE



## LABEL

USING INDELIBLE INK, LABEL EACH BLOOD TUBE IN ORDER OF COLLECTION, 1-3 OR 4.

PLACE HOSPITAL OR CLINIC LABEL ON BLOOD TUBES



## MIX

MIX EACH TUBE BY INVERTING 5-6 TIMES.

## STORE

STORE BLOOD SAMPLES AT 4-8°C  
DO NOT FREEZE.



# URINE SPECIMEN

Collect specimens from each person involved in an unusual chemical-exposure event. Please consult with the Minnesota Department of Health 612-282-3750

## PEDIATRIC:

COLLECT URINE ONLY UNLESS OTHERWISE DIRECTED BY THE CDC.

## ADULT:

IN ADDITION TO THE BLOOD TUBES (SEE BLOOD SPECIMEN CARD), COLLECT AT LEAST **25 mL** OF URINE IN A SCREW CAP URINE CUP FOR EACH PATIENT.

## COLLECT

MINIMUM **25 mL** SPECIMEN  
COLLECT IN A SCREW-CAP URINE CUP



## LABEL

LABEL THE URINE CUP WITH THE APPROPRIATE HOSPITAL/CLINIC LABEL AS SHOWN.

INDICATE HOW THE SAMPLE WAS COLLECTED IF METHOD WAS OTHER THAN "CLEAN CATCH".



## STORE

FREEZE URINE SPECIMENS AT -70C.  
IF -70C IS NOT AVAILABLE, PLACE IN THE COLDEST LOCATION AVAILABLE.  
RAPID FREEZING IS RECOMMENDED.

