INTERIM GUIDANCE DOCUMENT
Initial clinical management of chemically-contaminated patients
This document will expire on 31 October 2013

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Introduction

This guidance is aimed at healthcare workers who may receive chemically-exposed patients at their healthcare facilities.

The guidance follows the case management flowchart on the next page.

It provides questions to guide the identification of contaminated patients, recommendations on personal protection, procedures for decontamination, guidance for triage and identification of categories of exposure, and treatment regimens.

Users should study the contents of this document carefully.

Clinical work in this field should be accompanied with complete and practical training for chemically contaminated environments.
Initial management of patients flowchart

Patient presentation to healthcare facility

Has the patient been exposed to chemicals?

YES

Protect yourself and other personnel

UNKNOWN

NO

Follow standard treatment procedures. Observe for possible delayed symptoms

YES

Decontaminate

Triage

Maintain airway, breathing and circulation (ABC) & Follow treatment protocols for toxic chemicals exposure.
Decide whether patient has been exposed to chemicals

Patients may have been exposed to chemicals through inhalation, contact with the skin or eyes or by ingestion. **Contaminated persons and patients showing signs of exposure should be decontaminated, then triaged and treated in the healthcare facility.** Trauma injuries and other medical complications may also be present.

**Before the patient enters the healthcare facility:**

To minimize continued harm to the patient and others, the first step for all first responders and healthcare workers is to **apply personal protective measures**, including the wearing of appropriate gloves, masks, and gowns, before collecting exposure history, commencing physical examination and treatment. Ask the following questions:

1. **What is the history of exposure of the patient?**
   a. Where was the patient? When did they start experiencing symptoms? What did they experience first? Were others experiencing similar symptoms?
   b. Take a family / patient / witness / first responder report
   c. Use contextual information (e.g. health authorities, law enforcement etc.)

2. **Can you observe any signs of chemicals on or around the patient?**
   a. Dust, powder or liquid droplets on body surface
   b. Dust, powder or liquid droplet on clothes, discoloration of clothes, in some instances scorching or damage to clothing
   c. An unusual smell, e.g. garlic (indicates mustard gas), bitter almonds (indicates cyanide), fresh hay or grass (indicates phosgene). Do NOT try to smell the patient.
   d. Persons accompanying the patient present with mild/single symptoms of exposure (suggesting concomitant or secondary contamination has occurred)

3. **Are there confirmed signs and symptoms of exposure?** - If a chemical event has been confirmed, a patient presenting with signs and symptoms of exposure **by default is to be considered as contaminated.** Some signs and symptoms may appear after a delay of hours to days.

If there is any suspicion that the patient is contaminated with chemicals, decontamination is an urgent and first step. The likelihood of medical complications increases with duration of the exposure – contaminated clothing should be removed as soon as possible.
Prepare for emergency decontamination

Ensure that exposed patients are decontaminated outside your health facility, prior to entry for treatment and even if they are not displaying symptoms. Ensure that a decontamination area is marked, cordonned off, with single points for entry/exit, and all people leaving the area are decontaminated. Security personnel should be assigned to the area for crowd control and to ensure appropriate flow of individuals into / out of the decontamination area.

Decontamination should be carried out by professional, trained staff. Personnel involved in decontamination must wear appropriate personal protective equipment to protect their airways, skin and eyes, including gloves, masks, gowns and goggles.

Medical personnel must decide in advance what level of resuscitation will be attempted before or in the decontamination area.

Basic equipment for emergency decontamination

- Scissors
- Buckets (5-10 litres size)
- Sponges/soft brushes/washcloths
- Liquid soap/washing up liquid/shampoo without conditioner
- Warm water; 0.9% saline; including solution for washing eyes
- Disposable towels/drying cloths
- Large plastic bags (for clothing and double bagging)
- Small clear plastic bags
- ID/Triage labels/tags/pens
- Sturdy containers for used decontamination equipment
- Replacement clothing or sheets/blankets

Remove contaminated clothing as a matter of urgency. This significantly reduces contamination

- Explain what you are going to do before you start and as you go along.
- Remove/cut off clothing gently and speedily. Do NOT pull clothing off over the head. If clothing is adherent to patient, do not rip, pull or tear: soak gently and thoroughly with water until clothing can be separated from underlying tissue.
- Gently handle scissors to cut off clothes avoiding sensitive or wounded body areas. Lift clothes carefully so as not to harm.
- Remove shoes as they may hold contaminated soil.
- Remove all accessories: jewellery, watches, rings, hearing aids, contact lenses.
- Fold clothing inside out to contain contamination. Glasses may be decontaminated and returned to the patient once clean.
- Place clothing and accessories in large plastic bag and label as hazardous.
- Lift the person from the cut off clothes to a clean stretcher and blanket.
- Decontaminate affected areas (see below).
Decontaminate using the RINSE – WIPE – RINSE technique

Contain all solid waste and water run-off from the decontamination process, where possible. This is important to preventing secondary contamination.

**Step 1:** Blot off any liquid on the skin with clean absorbent material e.g. a wound dressing or incontinence pad. Brush or scrape off solids, e.g. powder.

**Step 2:** Gently rinse/wash affected areas with soapy water (0.9% saline for open wounds and eyes): this dilutes the contaminant and removes particles and water based chemicals. Start with face/airways first and work down to toes. Pay special attention to skin folds, skin creases, nails, ears, and hair. Flush eyes copiously with 0.9% saline as needed. If possible, use copious amounts of water as small amounts of water could facilitate the spread and absorption of some chemicals.

**Step 3:** Wipe affected areas gently but thoroughly with sponge or soft brush or washcloth: this removes organic chemicals and petrochemicals (not water soluble).

**Step 4:** If available, use specialized decontamination solution (e.g. RSDL). Alternatively use liquid soap/washing up liquid/shampoo without conditioner.

**Step 5:** Gently rinse affected areas

**Step 6:** Gently dry cleaned areas with disposable towels. Consider dressing open wounds.

**Step 7:** Make sure all staff self-decontaminate before leaving the decontamination area. This may require a change of clothing, so additional clothes should be available for staff.

In later care of the patient, consider as contaminated any removed shrapnel or other debris when treating trauma injuries.
Triage and identify class of exposure

Triage undertaken may adapt to the resources available to the health facility and the scale/severity of an event. The flow-chart below is applicable to a mass casualty event, and to resource limited settings. Flow chart vital signs are based on adult parameters and will need adaptation for paediatric casualties.

The table of toxic signs indicates categories of chemicals based on likely characteristics of exposure. **Full signs and symptoms must be consulted for further clinical diagnosis.** Respiratory signs and symptoms may be present following exposure to any of the agents.

### Signs of toxicity to look for during physical examination
- Miosis (pinpoint pupils)
- Copious secretions
- Fasciculations
- Seizures
- Confusion/Loss of consciousness
- Dry mouth & skin
- Hyperthermia
- Dilated pupils
- Delayed redness / blistering of skin
- Delayed respiratory distress
- Eye irritation
- Delayed pulmonary oedema
- Nausea and vomiting
- Eye irritation
- Increased secretions

### Flow chart vital signs
- **Walking**
  - yes
  - no
- **Breathing**
  - yes
  - no (after airway manoeuvres) → DEAD
- **Respiratory rate**
  - 10-30 /min
  - <10 or >30/min → Priority 1 Immediate
  - >2 secs or <40 or >120/min
- **Capillary refill time or pulse**
  - <2 secs or >40 or <120/min → Priority 2 Urgent
  - <2 secs or >40 or <120/min → Priority 1 Immediate
# Signs and symptoms of chemical exposures

<table>
<thead>
<tr>
<th>Class of chemical exposure</th>
<th>Signs and symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHEMICAL WARFARE AGENTS</strong></td>
<td>Miosis (pinpoint pupils), sometimes unequal&lt;br&gt;Blurred/dim vision&lt;br&gt;Tight chest and breathing difficulty&lt;br&gt;Muscle twitching/fasciculation&lt;br&gt;Copious secretions (excessive salivation, runny nose, lachrymation, bronchorrhoea including cough and wheezing)&lt;br&gt;Sweating&lt;br&gt;Headache&lt;br&gt;Nausea, vomiting,&lt;br&gt;Incontinence and diarrhoea&lt;br&gt;Seizures&lt;br&gt;Impaired judgement, nervousness, irritability&lt;br&gt;Loss of consciousness and, potentially, CNS depression including secondary respiratory failure</td>
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<tr>
<td>Nerve agents (e.g. Tabun, Sarin or VX)</td>
<td>Lachrymation, eye irritation, conjunctivitis, corneal damage, transient blindness&lt;br&gt;&lt;strong&gt;Delayed signs and symptoms (several hours):&lt;/strong&gt; redness and blisters of the skin with pain. Later on, detachment of the upper skin layers with impaired wound healing&lt;br&gt;Upper airway irritation&lt;br&gt;Respiratory distress – usually a late complication&lt;br&gt;Immune deficiency</td>
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<tr>
<td>Blister agents (e.g. mustard gases, lewisite)</td>
<td>Gasping for air, asphyxiation&lt;br&gt;Seizures&lt;br&gt;Confusion&lt;br&gt;Nausea&lt;br&gt;Cherry pink skin</td>
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<tr>
<td>Cyanide</td>
<td>Mydriasis (dilated pupils)&lt;br&gt;Altered consciousness, delusions, hallucinations&lt;br&gt;Dry mouth and skin&lt;br&gt;Tachycardia&lt;br&gt;Hyperthermia&lt;br&gt;Ataxia (incoordination)</td>
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<tr>
<td>Class of chemical exposure</td>
<td>Signs and symptoms</td>
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<tr>
<td>---------------------------</td>
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<tr>
<td><strong>RIOT CONTROL AGENTS</strong></td>
<td>Stinging and burning sensation to eyes and mucous membranes</td>
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<tr>
<td></td>
<td>Lachrymation/salivation</td>
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<tr>
<td></td>
<td>Runny nose</td>
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<td></td>
<td>Tight chest</td>
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<tr>
<td></td>
<td>Headache</td>
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<tr>
<td></td>
<td>Nausea</td>
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<tr>
<td>Tear gas / riot control agents</td>
<td><strong>OTHER TOXIC CHEMICALS</strong></td>
</tr>
<tr>
<td>Chlorine</td>
<td>Eye redness and lachrymation</td>
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<td></td>
<td>Upper airway irritation</td>
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<td></td>
<td>Cough (may be productive)</td>
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<td>Suffocation or choking sensation</td>
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<td></td>
<td>Tight chest</td>
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<td></td>
<td>Shortness of breath/wheezing</td>
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<td></td>
<td>Hoarse voice</td>
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<td></td>
<td>Nausea and vomiting</td>
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<td></td>
<td><strong>Delayed signs and symptoms (a few hours):</strong> Pulmonary oedema</td>
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<td>Phosgene</td>
<td>Eye redness and lachrymation</td>
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<td></td>
<td>Nausea and vomiting</td>
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<td>Tight chest</td>
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<td>Shortness of breath/wheezing</td>
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<td>Hypotension</td>
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<td></td>
<td><strong>Delayed signs and symptoms (up to 72 hours):</strong> Pulmonary oedema</td>
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<tr>
<td>Thallium</td>
<td>Abdominal pain</td>
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<td></td>
<td>Nausea, vomiting, diarrhoea, constipation</td>
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<td></td>
<td>Seizures</td>
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<td>Delirium, depression</td>
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<td>Scalp and body hair loss</td>
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<td>Painful peripheral neuropathy and distal motor weakness</td>
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<td></td>
<td>Ataxia (incoordination)</td>
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<td>Neurocognitive deficits</td>
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</tbody>
</table>
Treatment protocols for highly toxic chemical exposures

This table provides brief information on treatment and cannot address all eventualities.
- The antidote regimens listed below are for guidance, there are a number of regimens in current use by medical authorities in different countries.
- For all exposed patients apply ‘ABC’ assessment and treat after decontamination, triage. Be aware of potential for blast and penetrating injury associated with a violent incident.
- After the initial response, expert consultation should be sought in order to address potential complications.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Antidotes¹</th>
<th>Initial treatment</th>
<th>On-going and supportive therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve agents (e.g. sarin/GB, VX, tabun)</td>
<td>Autoinjector formulations are available for these antidotes, however, standard autoinjectors cannot be used on young children because the needles are too long for their muscle bulk. ADULT Atropine: 2mg IM or IV every 5-10 minutes (see on-going and supportive therapy). For</td>
<td>- Atropine before other measures. Administer to all moderate and severe cases. Use higher initial dose in severe poisoning. Repeat atropine at 5-10 minute intervals until improvements in secretions and bradycardia. - Oxime (pralidoxime or</td>
<td>Assisted ventilation after antidotes for severe exposure. Careful monitoring is required in atropine use to ensure that an adequate dose is given but not an overdose. During atropine therapy, where possible, place patient on an ECG monitor. Administration of</td>
</tr>
</tbody>
</table>

¹ Sources used for antidote regimens are given at the end of this document
severe symptoms, up to 6mg can be given on initial dose.

AND if available, administer as soon as possible following exposure but after atropine administration:

Pralidoxime chloride or mesylate: 30 mg/kg (up to 2g) slow IV. Repeat every 4-6 hrs, or give infusion of 8-10 mg/kg/hr

OR

Obidoxime 250 mg IM or slow IV followed by infusion of 750 mg in 24 hours). Maximal daily dose 1000 mg.

**CHILD**

Atropine: 0.05 -0.1 mg/kg IM or 0.02 mg/kg IV not to exceed 2mg per dose. Every 5-10 minutes until resolution of atropine) to regenerate acetylcholinesterase

- Diazepam for prolonged seizures:
  
  Adult – 5-10 mg IV (higher doses up to 40 mg, may be necessary);
  
  Child - 0.05 to 0.3 mg/kg IV(maximum 10 mg).

Other benzodiazepines (e.g. lorazepam, midazolam) can be used.

Onset of symptoms from dermal contact with chemicals in liquid form may be delayed. Observe contaminated asymptomatic patients.

Repeated antidote
<table>
<thead>
<tr>
<th>Blister agents e.g. mustard gas, lewisite</th>
<th>There are no antidotes for mustard agents.</th>
<th>In the case of ingestion do not induce vomiting. <strong>EYES:</strong> Irrigate with a 0.9% sterile saline solution and then use sterile petroleum jelly or ophthalmic ointments, such as 5% boric acid to prevent eyelids sticking together. Prevent infection with a topical antibiotic. Apply local anaesthetic drops (though these administration may be necessary.</th>
<th>Observe the patient for signs of: developing skin lesions, development of pulmonary symptoms, fluid and electrolyte imbalance and depression of haemopoietic activity. Patient should be kept in a darkened room, given sunglasses to help with photophobia.</th>
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</thead>
<tbody>
<tr>
<td>symptoms. AND Pralidoxime chloride or mesylate¹ 15-30 mg/kg slow IV. Repeat once at 30-60 minutes, then at one hour intervals for 1-2 doses, as necessary. OR Obidoxime: 4 - 8 mg/kg by slow IV; in case of need followed by infusion with 10 mg/kg/24 hours</td>
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</tbody>
</table>
may damage the cornea). Do not patch the eye.

**SKIN**: wash affected skin with copious amounts of soap and water. Itching can be reduced by local applications of cooling preparations, e.g. calamine lotion, topical corticosteroids, or water. Prevent secondary infection, apply topical antibacterial ointments, and cover with sterile dressing. Analgesics should be given as required.

**RESPIRATORY TRACT**: Cough may be relieved by codeine. In severe cases, aggressive airway management and bronchial lavage with mechanical ventilation / positive end expiratory pressure (PEEP) and oxygen administration may be required. Cricothyrotomy rather than endotracheal intubation is controlled best by systemic narcotic analgesics. Aggressive fluid resuscitation (volume repletion) done with burn victims is not generally required. In general, blisters can be left intact. The blister fluid does not contain mustard. Blisters that break should be well irrigated and carefully monitored for secondary infection. Apply a topical antibiotic such as silver sulfadiazine cream. Dressings should be changed and the wound inspected every 3 - 4 days. Inhalation of moist air and mucolytic therapy may
may be appropriate when there is significant upper airway involvement. Bronchodilators, or steroids, may be useful if bronchospasm is significant.

If severe exposure to mustard is suspected, consider use of intravenous sodium thiosulphate to decrease systemic effects. This must be done within first hour, and preferably 20 minutes after exposure.

relieve respiratory tract irritation.

Treatment for chemical pneumonitis may be required.

| Lung irritants e.g. chlorine, phosgene | There are no antidotes for lung irritants. | Move patient into fresh air. Put patient at rest in a semi-upright position and keep warm. Give symptomatic therapy as required e.g. oxygen and bronchodilators may be required. Treat cough with codeine 30-60mg/daily. Intubate and ventilate as necessary. | Monitor for 48 hours for delayed symptoms with chest X-ray and monitoring of arterial blood gases. If acute lung injury develops, increase PEEP and other interventions for Acute Respiratory Distress Syndrome or non-cardiogenic pulmonary oedema. |
| **Cyanide** | **For first aid:** oxygen by mask and amyl nitrite: crushed 0.3ml ampoule inhaled for 15 sec, may repeat after 3-5 min. Amyl nitrite ampoule may be broken into an Ambu bag or similar resuscitator if patient not breathing.  
**Possible antidote regimens are:**  
Sodium thiosulfate  
PLUS  
Hydroxocobalamin (safer for patients with hypotension but must use high-dose formulation which is not so widely available), OR  
Sodium nitrite (to induce methaemoglobinemia; not recommended in smoke inhalation), OR  
4-DMAP (to induce | **100% oxygen therapy, ventilate and intubate, if indicated.** | **Monitor the patient for metabolic acidosis. Use of 50 – 100 ml of 8.4% solution sodium bicarbonate may be considered. Correct electrolyte imbalance.**  
Patients who reach hospital alive after having inhaled cyanide probably do not need antidotal treatment since cyanide acts quickly.  
Sodium nitrite and 4-DMAP may cause haemolysis in patients with G6PD-deficiency. |
methaemoglobinemia; not recommended in smoke inhalation)

**ADULT:**
Both sodium nitrite and sodium thiosulphate are administered to a patient with cyanide poisoning.

Sodium nitrite 300mg (e.g. 10ml of 3% solution) **by slow IV over 5-10 min.** Sodium nitrite can be repeated at 50% of the original dose after 30mins if no improvement.

AND

Sodium thiosulfate: 400mg/kg to max of 12.5g (e.g. 1.6ml/kg to max 50ml of 25% solution) over 10 minutes. Additional doses may be given if necessary.

As an alternative to therapy
with sodium nitrite and sodium thiosulfate, hydroxycobalamin can be used:

Hydroxycobalamin: 5g over 15 min;

4-DMAP: 3-4 mg/kg IV. Repeat after 4 hours if symptoms persist.

**CHILD**
Sodium nitrite: 4-10 mg/kg to max of 300mg. (3% solution: 0.13-0.33ml/kg). Sodium nitrite can be repeated at 50% of the original dose after 30 mins if no improvement.

AND

Sodium thiosulfate: 400mg/kg to max of 12.5g (e.g. 1.6ml/kg to max 50ml of 25% solution) over 10 minutes. Additional doses may be given if necessary.
As an alternative to therapy with sodium nitrite and sodium thiosulfate, hydroxycobalamin can be used:

Hydroxocobalamin: 70mg/kg IV over 15 min.

| Incapacitant/psychomimetic atropine-like compounds e.g. BZ | Physostigmine has been used as an antidote to BZ, however, it may have serious side-effects. Do NOT use atropine since this will add to the toxic effects. | Treatment is symptomatic and focuses on preventing the patient harming themselves by their actions. Attempt to resolve the situation without physical or chemical restraint. Midazolam 1-2mg IV every 2-3 minutes until patient can be safely managed, or if IV access cannot be gained 5-10mg IM. | Try to keep the patient in a quiet environment. Remove potentially dangerous objects or objects that can be swallowed. If physical restraint is required use soft restraints at hands and feet, face-up. Monitor vital signs and distal limb signs to ensure circulation is not restricted by the restraints. Monitor for signs of heat stroke and treat accordingly. |
| Riot control agents - Lachrymators | There are no antidotes for these agents. | Remove patient to fresh air. Put patient at rest in a semi-upright position and keep warm. Wash face and skin with soap and water. Irrigate eyes with clean water or saline. Do not rub the eyes. Give oxygen and symptomatic therapy as required. | In most cases symptoms will be self-limiting. For respiratory distress intubate and ventilate as required. Treat skin lesions as burns. |
Sources

Clinical Sources:

Decontamination
- Adapted from CBRN incidents: clinical management and health protection, UK Health Protection Agency 2008

Incident triage:
- Adapted from JSP 999 clinical guidelines for operations. Available at: https://www.gov.uk/government/publications/jsp-999-clinical-guidelines-for-operations

Treatment regimens:
Nerve agents:

Lewisite:
- Professor Horst Thiermann, Bundeswehr Medical Service, personal communication.

Cyanide:
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