Médecins Sans Frontières

EXPOSURE TO CHEMICAL AGENTS MANUAL

Threat and Response – Interim Guidance

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Foreword

MSF personnel operate in contexts presenting, in some cases, the threat of chemical agent's release. At times, this threat translated into incidents impacting the missions.

During the first half of 2018, MSF Operational Centers have been working together in order to understand and evaluate the level of preparedness, both in the field and in headquarters, vis-à-vis such threat – notably in Syria and Iraq.

One of the recommendations of this common exercise was to review and update the current contingency plan on chemical weapons in Syria, though utilizing a de-contextualized approach. In other words, to produce a practical document that different missions could utilize in various contexts presenting such threat – thus not limited to Syria and Iraq. MSF-OCP decided to undertake this work in collaboration with MSF-OCB and the intersectional MSF EMACC-WG (Emergency Medicine, Anaesthesia and Critical Care Working Group). This manual is the result of this effort.

This manual is an interim guidance document

How to use this manual

Aim, objectives, and assumptions

This manual aims to increase the awareness of- and to provide technical guidance to MSF personnel, both in the field and in headquarters, on chemical agent's threat, preparedness, and response.

The objectives of this manual are three-fold:

- First, to describe the threat chemical agents can pose and the related risk of exposure (i.e. emergency preparedness scenarios).
- Second, to detail the steps MSF personnel shall follow in order to protect themselves, the patients, and MSF premises (e.g.: health facility, office, house) vis-à-vis the risk of exposure to a chemical agent.
- Third, to provide clinical guidance on the treatment of victims of chemical exposure.

This document is valid only if the following assumptions are accepted and met:

- MSF doesn't intervene in chemically contaminated areas.
- MSF doesn't position itself as the first responder for chemical related incidents. To the contrary, it does not intend to rescue populations in a chemically contaminated area, nor to locate programs along the path of referral of contaminated patients.
- MSF operational managers in charge of context and security analysis shall consider some factors in order to evaluate the chemical threat and the related risk (e.g.: location of the project in relation to the presence of factories or deposits utilizing or storing chemical agents, frontline movements and utilization of chemical weapons of warring parties in conflict settings).
- MSF personnel (both international and national) who are going to work in an environment possibly subject to a chemical release must be briefed on the threat, the related risk, and the protection measures that are in place in a given context.

This manual is not a risk analysis nor a security or contingency plan, which are context-dependent and domain of the operational managers both in the field and headquarters. As such, while ensuring the security of the staff members as well as the quality of care provided, operational managers shall adapt the information and the procedures detailed in this manual based on their mission's context, resources, and availability of material.

Organization of the manual

This manual addresses the topic through a Foreword, an Introduction, and four sections divided themselves into chapters. In order to find the required information in this manual, the user has at his/her disposal:

- A complete, detailed table of content at the beginning of the document.
- A colour based system to easily identify each section and its corresponding content.

The sections reflect the three main pillars of Response to a chemical related incident: Protection, Decontamination and Treatment:

Section A (Definition, categories, and threat): providing definition and categories of chemical agents.
Section B (Response – Protection): detailing protection against primary and secondary exposure.
Section C (Response – Decontamination): detailing decontamination of patients, belongings, spaces and vehicles, including waste management and decontamination area setup.
Section D (Response – Treatment of exposed patients): detailing therapeutic aspects for exposed patients with supportive care and antidotes where available.

In line with its practical approach, this manual also offers:

- "**Key Principles**" tables at the beginning of each parts or chapters, which provide an informative snapshot of each topic presented.
- **"WHAT TO DO IF…"** tables, at the end of each part or chapter, which provide a summary of the practical actions the personnel shall take during specific situations/scenarios.
- The E-prep stock required, at the end of each chapter.

The different steps this manual details are intertwined according to a specific order. For a full understanding of the logic utilized to address the topic, the authors recommend the user to read the whole document at least once, before focusing on any given specific subject.

Dissemination of the manual

This manual must be utilized in conjunction with a specific briefing and training strategy that allows the understanding and the sharing of information. It will thus improve the awareness on the subject while avoiding the loss of institutional memory due to personnel turnover in the field and in headquarters.

The dissemination of this manual will be accompanied by a strategy envisioning the identification of Focal Points, both in headquarters and in the field, who will be trained internally and externally on the chemical agent's issue and will then be in charge of regularly train the field personnel.

Manual development

This manual is designed for use by field and headquarters personnel operating in contexts where they identify the threat of chemical agents' release(s) and the related risk of exposure. It tries to respond in the simplest and most practical way possible to the questions and the problems the personnel face in relation to this topic.

This document utilizes the accumulated experience of Médecins Sans Frontières, through a collaborative effort of field-experienced referents from the medical, logistics, security, and operations departments. It also draws from the expertise and the technical documents of external organizations and institutions (e.g.: WHO, SAMU, BSPP).

Despite all efforts, it is possible that certain errors may have been overlooked in this manual. The authors would therefore be grateful for any comments or criticisms to ensure this document continues to evolve and remains adapted to the reality of the field.

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This manual is also available as an online format on the EMACC Sharepoint: Click here

Table of Contents

Abbreviations

BSPP	Brigade de Sapeurs-Pompiers de Paris
BP	Blood Pressure
BZ	3-Quinuclidinyl benzilate
CBRN	Chemical, Biological, Radiological and Nuclear
CNS	Central Nervous System
CW	Chemical Weapon
CWA	Chemical-Warfare Agent
CPAP	Continuous Positive Airway Pressure
EPREP	Emergency Preparedness and Response Plan
ER	Emergency Room
ECG	Electrocardiogram
ICU	Intensive Care Unit
IM	Intramuscular
IV	Intravenous
NBC	Nuclear Biological and Chemical
NRBC	Nuclear, Radiological, Biological, and Chemical
PPE	Personal Protective Equipment
RDSL	Reactive Skin Decontamination Lotion
SAMU	Service d'Aide Médicale Urgente
VX	Venomous Agent X
WHO	World Health Organisation

Section A: DEFINITION, CATEGORIES, and THREAT

1. Introduction

Definition and specifications

Chemical agents are part of the broader group of Nuclear, Radiological, Biological, and Chemical (NRBC or CBRN) agents. The threat that chemical agents pose is thus part of the wider NRBC threat.

Chemical agents can be released as a vapour (gas), an aerosol (fine mist or spray), a liquid, or in powder forms. They can be dispersed in the air we breathe, the water we drink, or on surfaces we physically contact.

Many chemical agents – such as Sarin (nerve agent) – are odourless, colorless, and tasteless, making them very difficult to detect until individuals or animals show symptoms of exposure.

The long-term health effects of certain chemical agents, such as carcinogenicity or specific organ failure, must be kept in mind for medical follow up of disaster victims.

Categories

Chemical weaponized agents (CWAs) are classified into six main categories. **See table 01**.

Table 01 – Classification of Chemical Weaponized Agents (CWAs).

Category	Description
Nerve agents (neurotoxic) **e.g. : Tabun, Soman, Sarin, VX** ***Potentially lethal at low concentration***	These agents interfere with the normal nerve function and are lethal at low concentrations. They can be absorbed both as a liquid through the skin - which can be lethal within 20 to 30 minutes - or as vapour through the lungs - where death may occur quicker.
Choking agents **e.g.: Phosgene, Chlorine** **Potentially lethal**	The inhaled gas irritates the lungs causing fluid to accumulate. These agents can be lethal.
Blistering agents **e.g.: Lewisite, Yperite (Mustard Gas)** ***Rarely lethal if appropriate medical care is available***	Volatile liquids. Skin contact with liquid agent causes more harm through blistering; inhalation of gas will damage lungs. Long-term toxicity to internal organs.
Asphyxiant / Blood agents **e.g.: Cyanide** ***Potentially lethal***	Hydrogen cyanide is a highly volatile liquid. It inhibits the ability of cells to use oxygen and can be lethal.
Choking/Incapacitating agents **e.g.: Agent 15, BZ, Opioids** ***Rarely lethal***	Incapacitate by affecting the central nervous system, producing hallucinations and irrational behavior.
Riot control/Incapacitating agents **e.g.: Tear-gas, pepper-gas** ***Non-lethal if outdoor release*** ***Potentially lethal if indoor release***	These agents irritate the eyes, causing lacrimation and altered vision - immediate onset and short duration. Effects decrease within 15 min. and disappear within 3h30min.

2. Threat and Exposure

Key Principles

In non-conflict settings, a chemical threat can occur from an accidental chemical spill (e.g. industrial factories, deposits, pipelines, or accidents during transportation). Although accidental chemical spills are not discussed in detail in this manual, decontamination principles remain equally pertinent to accidental chemical spills.

In conflict settings, a chemical threat can occur from the release of chemical warfare agents. A chemical release or an individual contaminated by a chemical agent may not be immediately detectable.

Field personnel should therefore be aware of the indicators of alert suggesting a potential chemical threat in their operational environment.

Field personnel may be exposed to chemical contamination through primary or secondary exposure.

Primary (or direct) exposure

Definition

Exposure to a chemical agent, following the release of a chemical or a CWA related incident[1].

Indicators of alert

- Activated emergency warning systems.
- Emergency personnel activity and announcements.
- People wearing personal protective equipment (breathing protection and chemical protection suits).
- Discarded personal protective equipment.
- Explosion(s) with little or no structural damage.
- Droplets of oily film on surfaces.
- Unusual liquids, sprays or vapours.
- Low-lying clouds or fog unrelated to weather; clouds of dust; suspended – possibly coloured – particles.
- Unusual or unauthorized spraying in the area.
- Unexplained odours (e.g. garlic, bitter almonds, peach pits, newly mown hay or grass, horseradish).
- Unusual number of dead or dying animals in the area.

[1] Within the context of MSF missions, field personnel could be at risk of primary exposure while working or traveling (e.g. outreach activities, assessments) in areas where the risk of a chemical release is high.

Secondary (or indirect) exposure

Definition

Exposure to a chemical agent via contact with a primary exposed individual, before they are fully decontaminated[2].

Indicators of alert

- Patients arriving at a health facility reporting they have been contaminated.
- Patients arriving at a health facility from an area where an emergency warning was activated.
- Victims displaying symptoms of nausea, difficulty breathing, convulsions, disorientation, or patterns of illness inconsistent with natural disease (e.g. blisters or lesions on the skin could suggest a blistering agent or corrosive substance exposure).
- Multiple casualties exhibiting similar symptoms and no apparent signs of trauma.
- Positive identification by detection equipment where available.

[2] Within the context of MSF missions, field personnel could be at risk of secondary exposure via contact with exposed patients presenting at a health facility.

Section B: RESPONSE - Protection

Key Principles

In the event of a chemical related incident, MSF field personnel must protect themselves and implement all possible measures to protect the patients hospitalized in an MSF health facility. The main measures of protection are:

> To put on appropriate Personal Protective Equipment (PPE) [3].
> To activate evacuation or confinement procedures.
> To set-up a decontamination area (see section C).

The protection measures depend on the situation involving the risk of chemical contamination and aim to mitigate the risk of primary or secondary exposure.

In a primary exposure, field personnel are exposed to toxic chemicals mainly through direct contact with an agent spilled or released in their operational environment.
The protection measures against primary exposure are:

> The use of Escape Kit PPE and decontamination measures.
> The evacuation from a contaminated area or the temporary confinement in place while awaiting for the external environment to be safe and presenting an acceptable risk of exposure to chemicals.

Within the scenario of secondary exposure, field personnel are primarily exposed to toxic chemicals through direct contact with the agent on patients' skin / clothing or by inhalation or mucosal contact of a chemical present on a patient's skin/clothing.
Protection measures against secondary exposure include:

- Use of the full PPE, but not the escape kit PPE (i.e. not the escape hood).
- Use of a decontamination area to safely decontaminate the patient(s) and remove the risk of contaminating other patients / personnel.
- Once decontaminated, a patient is no longer a threat of secondary exposure to the health personnel. He/she can be treated like any other patient, without the use of any specific chemical exposure PPE by the staff. Standard healthcare universal precautions (e.g. gloves, mask, and gown) should be used when appropriate.

1. Protection against PRIMARY exposure

Escape Kit Personal Protective Equipment (PPE) for Primary Exposure

- The Personal Protective Equipment (PPE) is essential to protect the field personnel from primary exposure to a chemical agent spilled or released in their operational environment.
- The use of adequate and appropriate PPE should protect field personnel from hazards affecting the respiratory system, skin, eyes, face, head and hearing.
- The safe use of PPE requires specific training and practice.

Personnel concerned

- Field personnel who are subject to a chemical release affecting their operational environment.

[3] Personal Protective Equipment (PPE) is any equipment (including clothing) that protects an individual's body - including the face and respiratory system - from a chemical exposure. It varies depending on the risk of exposure identified and the type of activity intended to be carried out by the person wearing PPE. A light PPE can include an escape hood, gloves, and normal long clothing. A more complete version includes NBC overall suit, mask and filter canister, gloves and boots. When referring to PPE, this manual specifies the material required depending on the type of risk it addresses.

Material required

See table 02.

- The Escape Kit PPE against primary exposure includes[4]:
  - Escape hood or NBC gas mask + filter canister (see specifications in PPE for secondary exposure chapter)
  - Decontamination materials[5].
- The material for protection against primary exposure does not include the NBC overall suit + gloves and boots. The rationale that drives this decision is the following:
  - MSF does not intervene in chemically contaminated areas, which reduces the risk of primary exposure and contamination.
  - In the event of primary contamination, the steps a staff member must take are **(1)** to leave the contaminated area or to confine in-place and **(2)** to self-decontaminate as soon as possible – in which case, wearing an NBC mask or escape hood is considered an adequate contingency measure.

Specifications of the Material

- The Escape Kit PPE protects:
  - The respiratory system against adverse health effects caused by breathing contaminated air.
  - The eyes and face from the hazards of flying debris, hot sparks, and chemical splashes.
- The escape hood protects against any chemical agent for a time-span between 20 and 30 minutes. **See figure 01.**
- An appropriate NBC mask and filter canister protects against a chemical agent for 1 hour. **See figure 02.**

[4] Escape kit PPE for primary exposure may not be suitable for preventing secondary exposure.

[5] Decontamination should occur concurrently with donning (i.e. put on or pull on) the escape kit PPE if feasible.

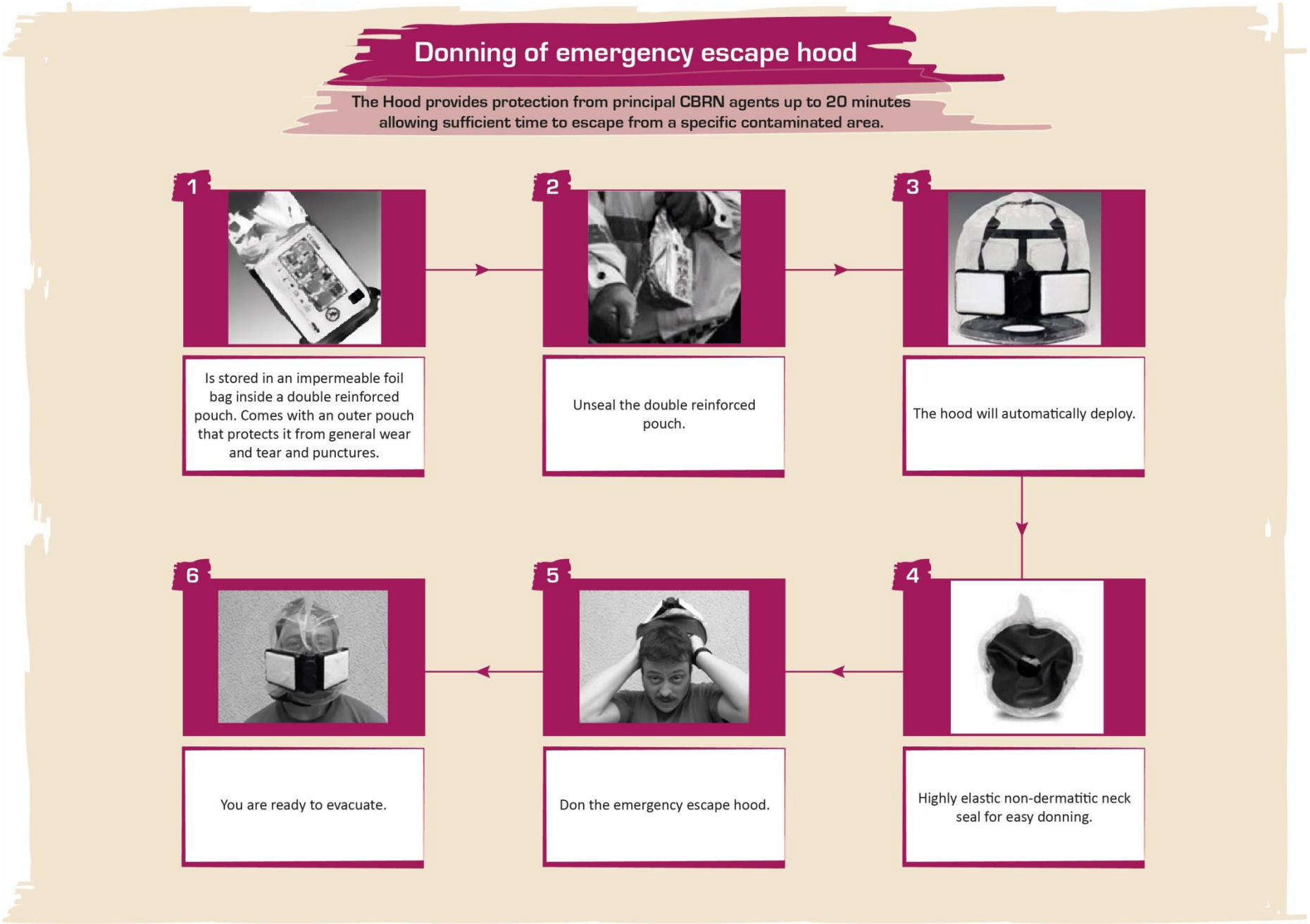


Figure 01 – Guide for Donning of Emergency Escape Hood.

Donning CBRN Gas Mask

The Gas mask NBC, type ABEK2P3 provides protection from principal CBRN agents for at least 2hours up to 8 hours(according to type of gas) allowing sufficient time to remain if necessary in contaminated area and escape in safely conditions.

1

Remove canister/cartridge from its packaging. Inspect the canister/cartridge to be surethat it is not damaged remove sealer caps of the canister.

2

Inspect the mask to be sure that it is not damaged This mask should not be worn with glasses or with large beard.

3

Thread the filter canister/cartridge into the facepiece port and hand-tighten.

4

Slightly expand the harness straps, place chin into the face- piece, and pull the harness over the back of the head. Support the weight of the mask by holding the outlet valve assembly in the palm of one hand. With the free hand, adjust the facepiece securely to the face, making sure the chin and nose are seated securely.

5

Evenly tighten the neck straps by pulling them straight back.

6

While holding the facepiece securely in position, tighten one temple strap at a time by pulling straight back (not out) with small jerks until mask feels snug on that side. Tighten the other temple strap in same manner until both sides feel the same.

7

If necessary, tighten the top straps for best visibility and fit.

8

Block off cartridge inlet using the palm of the hand.Inhale gently and hold breath for 2 seconds. If the seal is good, the facepiece will collapse and remain collapsed against face. Remove hand and breathe normally. If the facepiece did not remain collapsed during the test, readjust straps and perform Negative Pressure Seal Test again.

Figure 02 – Guide for Donning of NBC Gas Mask.

Evacuation

- To evacuate means to move people from a threatened area to a safer place.
- An evacuation requires enough time for people to be warned, to get ready, and to leave an area. If there is enough time and conditions allow for it, evacuation is the best protective action.
- Evacuation also applies when confinement is not possible or considered unsafe (e.g. while in a vehicle during outreach activities or following the release of a chemical inside a building).

Personnel concerned

- Field personnel who are subject to a chemical release affecting their operational environment and who are out of reach of an immediately effective confinement area.

Procedure of evacuation

- Prior to evacuating a contaminated area, it is critical to know the wind direction in your region and on the route(s) of evacuation.
- Close the windows and turn off the air conditioning, if inside a vehicle.
- Leave the building, if inside a closed contaminated space.
- Move away from the source, upwind or crosswind from the agent (minimum 11 km).

Confinement

- To confine means that individuals should seek shelter inside a dedicated room and/or building and remain inside until the danger passes.
- Confinement applies when evacuating would cause greater risk than sheltering in place, or when an evacuation cannot be performed.
- Confinement should ensure that:
  - Contaminated air does not enter the confinement site.
  - Contaminated individuals do not enter the confinement site unless previously decontaminated.
- Confinement requires a confined space that can be either a dedicated room or an entire building (e.g.: health facility, office).
- If no building is nearby, then a vehicle can act as temporary confinement space for a short period, if the windows are closed and the ventilating systems are shut off.

Personnel concerned

- Field personnel, patients and care takers who are subject to a chemical release and cannot evacuate.
- Field personnel should confine into a dedicated confinement room; patients and care-takers should confine inside the health facility turned into a confinement space.

Technical requirements of a confinement space (room or building)

- It should not be directly accessible from outer areas, in order to avoid a direct contact between contaminated external spaces and the confinement space:

- There should be an intermediate warm zone between the confinement space and the outdoor area.
- The intermediate zone must be equipped with self-decontamination equipment and instructions in its use.

- It should include access to a bathroom and communication equipment (e.g. telephone, radio, etc.).
- It should be equipped with enough PPE (see "Protection against secondary exposure" chapter) for the field personnel who may be in charge of receiving, triaging, and treating contaminated victims. **See table 02.**

Technical requirements of a confinement room only:

- Ideally, a confinement room should be located upstairs (against the dispersion of chemical agents) and presenting as few windows as possible.
- If a safe room is already identified, it should be utilized as a confinement room, even if it is not located upstairs. This practice will avoid the confusion caused by the duplication of safe vs. confinement rooms.
- A confinement room should allow a space of 1.20 m^2 / person.

Procedure of confinement:

- Individuals seeking confinement must utilize the intermediate zone to self-decontaminate before entering the confinement space (see "Decontamination" chapter).
- Seal the space to create a temporary barrier between clean and contaminated areas:
  - Close all windows, doors, air vents.
  - Turn off fan, air conditioning, and forced-air heating systems.
  - Seal windows and other openings with plastic sheeting and duct tape (if possible this should be done ahead of time in a pre-identified confinement room).
  - Place wet towels, rags, or other airtight materials along openings under doors or around windows to prevent any agent from seeping in.

EVACUATION or CONFINEMENT?

The choice of mitigating actions for a given situation depends on a number of factors. In some cases, evacuation may be the best option; in others, confinement in-place may be preferable.

The evaluation of the factors listed below may support the personnel to determine the effectiveness of an evacuation vs. a confinement in-place:

- Location (and security situation of the present location).
- Number of people to evacuate or to confine.
- Time available to evacuate or to confine.
- Ability to control evacuation or confinement.
- Building types and availability.
- Weather conditions.
- Effect on vapour and cloud movement.
- Potential for change and possible consequences on evacuation or confinement.

The importance of these factors can vary depending on the level of emergency of a given situation.

WHAT TO DO IF…

The choice of mitigating actions for a given situation depends on a number of factors. In some cases, evacuation may be the best option; in others, confinement in-place may be the best course.

- A chemical release occurs **outdoor:**
- Avoid any obvious plume or vapour cloud.
- Wear an escape hood or a NBC mask, if available.
- If NBC mask or escape hood is not available, cover mouth and nose, as well as any exposed skin (e.g. roll down sleeves, button up coat/jacket).
- If it is safe and possible to do so, move away from the source and relocate to a safer, non-contaminated location.
- If it is neither safe nor possible to evacuate, go into a building in order to confine Location (and security situation of the present location).

- A chemical release occurs **indoor**:
- Find clean air quickly by exiting the building, avoid passing through the contaminated area.
- Exit through a window to directly access clean air, if necessary.
- If exiting the building is not possible, then move towards the roof if it is safe.

- You suspect being, primarily exposed to a chemical agent:
- Avoid contact with others to prevent secondary contamination.
- Put on the escape hood or the NBC mask.
- Move away from the point of chemical release or exposure as quickly as possible.
- Do not remove the hood or mask until being sure that there is no further inhalation risk from the agent (if in doubt, keep the mask on).
- Self-decontaminate through dry and/or wet decontamination (see decontamination section).
- Confine or further evacuate.

In practice, within the context of MSF missions, the risk of primary exposure could concern:

- An outreach team assessing an unexplored area.
- A regular team working in a location where a non-preventable chemical incident occurs (e.g.: chemical spill from factory or deposit nearby.
- Riots resulting in the use of riot control agents occurring near MSF program location.
- Accidental exposure from project's chlorine stock.
- Accidental exposure during vector control activities from spraying of potent insecticides.

2. Protection against SECONDARY exposure

Personal Protective Equipment (PPE) for Primary Exposure

- (PPE is essential to protect field personnel at risk of secondary exposure to a chemical agent.
- The use of adequate PPE should protect field personnel from hazards affecting the respiratory system, skin, eyes, face, ears, head, hands, feet, and body.
- The safe use of PPE requires specific skills developed through training and experience.

Personnel concerned

- Field personnel in charge of receiving, triaging, and decontaminating contaminated patients in a health facility.
- Once decontaminated, patients are no longer a threat of secondary exposure to the staff. They can be treated like any other patient, without the use of any specific chemical PPE by the staff.

Material required

See table 02.
PPE **against secondary exposure** includes:

- **NBC gas mask** + **filter canister**
  - > Mask: full face mask, sizes S, M and L, must conform to EN 136: 1998.
  - > Connector of mask to cartridge: as per standard EN 148-1: 1999.
  - > Mask visor: optical class 1 (EN 166).
  - > Filter canister:
    - As per standard EN 148-1: 1999.
    - Marked ABEK2 Hg P3.
    - Colour markings: brown, grey, yellow, green, white and red.
- **NBC Overall suit** + 2 pairs of **gloves** (butyl and/or nitrile. External gloves have to be CBRN-rated) + boots. **See figure 03.**

Specifications of the material

- NBC gas mask + filter canister protect:
  - > The respiratory system against adverse health effects caused by breathing contaminated air.
  - > The eyes/face from the hazards of flying fragments, hot sparks, chemical splashes, and corrosive/irritant gases.
- NBC overall suit + gloves (butyl and/or nitrile) + rubber boots protect:
  - > The skin from contamination.
- Two pairs of gloves should be worn (inner nitrile and outer butyl or chemical resistant nitrile.
- The PPE confers a loss of mobility, dexterity, vision and ability to communicate freely. It also places an increased physiological burden on the user.
- PPE protects against secondary contamination to any chemical agent for approx. 1 hour.
- Thus, personnel in PPE should be timely and strictly rotated.
- PPE should be removed (i.e. doffed) carefully to avoid touching contaminated areas. It should be removed in a designated location, according to specific procedures and disposed of as hazardous waste. **See figure 04.**

Table 02 – EPREP Material for Protection*		
Personal Protective Equipment (1 person) against PRIMARY EXPOSURE		
Description	**MSF code**	**Quantity**
ESCAPE HOOD EH15 Avon (single use)	PSAFZFR0053	1
BAG RUCKSACK, nylon, light OR VEST from PeACE kit	PPACBAGSRNL	1
Items to utilize for self-decontamination, when necessary		
RSDL Reactive Skin Decontamination Lotion, package	SDRERSDL4L-	1
FULLER EARTH POWDER, 250g	PSAFNBRCPFE2	3
EYE-WASH SODIUM CHLORIDE, 0.9%, 500 ML, FLEX. BAG, PVC FREE	EMEQEYEW7--	5
TISSUE PAPERS , packet (to remove RSDL or fuller earth)	--	1
REFUSE BAG, 100L, 70µM, BLACK	PHYGBAGR1HB7	1
SCISSORS, 17CM, BLUNT ENDS	ASTASCISS7B	1
GLOVE, EXAMINATION, nitrile, s.u., non sterile, L	SMSUGLEN1L-	10
SPARE CLOTHING	--	1
Personal Protective Equipment (1 person) against SECONDARY EXPOSURE		
Description	**MSF code**	**Quantity**
OVERALL NBC (Tychem F-70780), 3b, hooded, s.u., Size M/L/XL/XXL	PSAFNBRCOF3M/L/X/E	1
GLOVES BUTYL NBC, pair, size 7/9	PSAFNBRCGBN7/9	1
BOOTS, rubber, pair, size 41/43/45	PHYGBOOTR41/43/45	1
GAS MASK NBC (ABEK2P3) one size, ARFC	PSAFNBRCMGAO	1
(mask, chlor vapour) FILTER (ABEK2P3)	PSAFMASKCF2	1
Confinement Room (1 room)		
Description	**MSF code**	**Quantity**
PPE AGAINST SECONDARY EXPOSURE (see above), PLUS:	--	--
PLASTIC SHEETS AND DUCT-TAPE TO SEAL DOORS AND WINDOWS	--	--
COMMUNICATION EQUIPMENT—LANDLINE TELEPHONE, MOBILE PHONE, INTERNET ACCESS	--	--
FIRST AID KIT	KMEDKFAI5--	--
FIRE EXTINGUISHER	PSAFFIREAF9	--
FLASHLIGHTS	PELELIGFML2	--
BATTERY-OPERATED RADIO AND EXTRA BATTERIES	--	--
CAN AND BOTTLE OPENER	--	--
KNIFE AND SCISSORS	--	--
FAN	--	
EXTRA BLANKETS	--	--
PASSPORTS AND OTHER IMPORTANT PAPERS	--	--

* Item quantities will depend on the specific set-up and size of the mission(s), unless otherwise specified.
MSF code only applies to certain items.

Figure 03 – Guide for Donning of NBC Overall.
Note: Different donning process may be required depending on the type of overall.

Figure 04 – Guide for Doffing of NBC Overall.
Note: Different doffing process may be required depending on the type of overall.

Section C: RESPONSE - Decontamination

Key Principles

Decontamination is the first and most important treatment of a chemically contaminated patient and is defined as the removal of chemical agents or the reduction of their concentration to non-hazardous levels from the body of the exposed person.

The main aspects of this response phase are:

> The suspicion of a chemical contamination (based on the available indicators of alert or positive ID by detection equipment if available).
> The safe decontamination of the victims.

Knowing the category of the agent and its related symptoms is **not relevant** during the decontamination phase of the treatment since, at this stage, suspecting a chemical contamination is independent from the agent's specific effects on patients.

The most important rules of decontamination are:

- First, personnel must protect themselves by wearing the full chemical PPE.
- Second, decontaminate the patient(s), personal belongings, ambulances/vehicles, and the spaces utilized.

The decontamination must occur in the decontamination area or, in any case, in a dedicated and isolated zone, outside the healthcare facility.

Patients exposed to chemical agents should be decontaminated even if they are not displaying symptoms of exposure.

Decontamination may occur in parallel with triage and the provision of lifesaving treatment.

There exist two approaches towards decontamination [6] :

- Dry decontamination, using absorbent materials (chemical inactivation procedure).
- Wet decontamination, using water and soap (physical removal procedure).

If patients are conscious, mobile and possess enough strength, the preferred way of decontaminating is through guided self-decontamination.

If patients are unconscious or too weak, personnel should decontaminate them.
In all cases, decontamination should always be implemented or supervised by trained personnel.

1. Decontamination of exposed patients [7]

Removal of contaminated clothing & personal items

- The removal of contaminated clothing is a highly effective step in decontamination, which removes between 80-90% of the agent from a victim.
- It limits the auto-intoxication of victims related to the risk of resorption from the clothes.
- It applies to both dry and wet decontamination procedures.
- This procedure will be done by personnel wearing a complete PPE (NBC overall, boots, gloves, NBC mask & filter canister).

[6] Viscous or oily agents may be difficult to remove through one method alone.

[7] Note that all decontamination described here only removes the agents; it does not deactivate or neutralize them. Oxidizers or purpose made chemicals are needed for neutralization.

- The removal of contaminated clothing and personal items is performed in the red zone of the decontamination area.

Individuals concerned

- All patients and personnel exposed to a chemical agent, primarily or secondarily.
- All personnel involved in the decontamination process.

Material required

- Big and small waste plastic waste bags.
- Nitrile gloves.
- Self-adhesive tape.
- Scissors.

Procedure for removal of clothing & personal items

- Place a first large waste bag on the ground as a drop sheet (ensure you can reach the kit whilst standing on the drop sheet).
- Remove shoes standing on the drop sheet.
- Remove or cut-off clothing. **See figure 05 and 06.**
  - > Do not pull clothing off over the head.
  - > If clothing is adherent, 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.

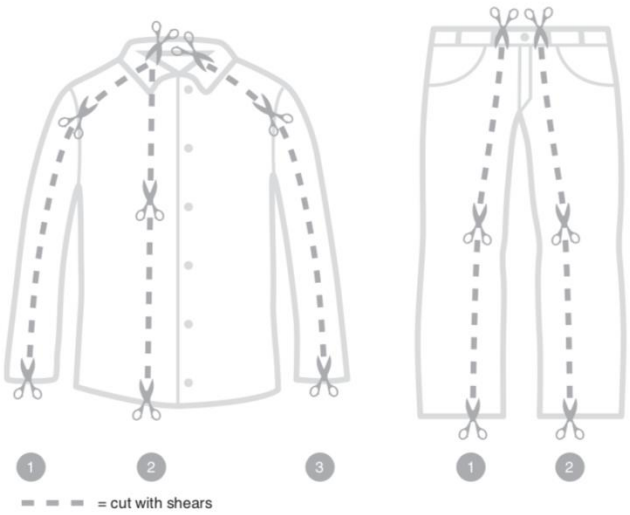


Figure 05 – Guide for Cutting-off Clothing

- Place clothing in a second large waste bag.
- Remove personal belongings (watch, jewellery, etc.) and place them in a small plastic bag.
- Close the big and small waste bags and seal it with self-adhesive, labelled tape.
- Place the sealed big bag inside a third large waste bag for double containment.
- Place the sealed small bag inside a second small waste bag for double containment.

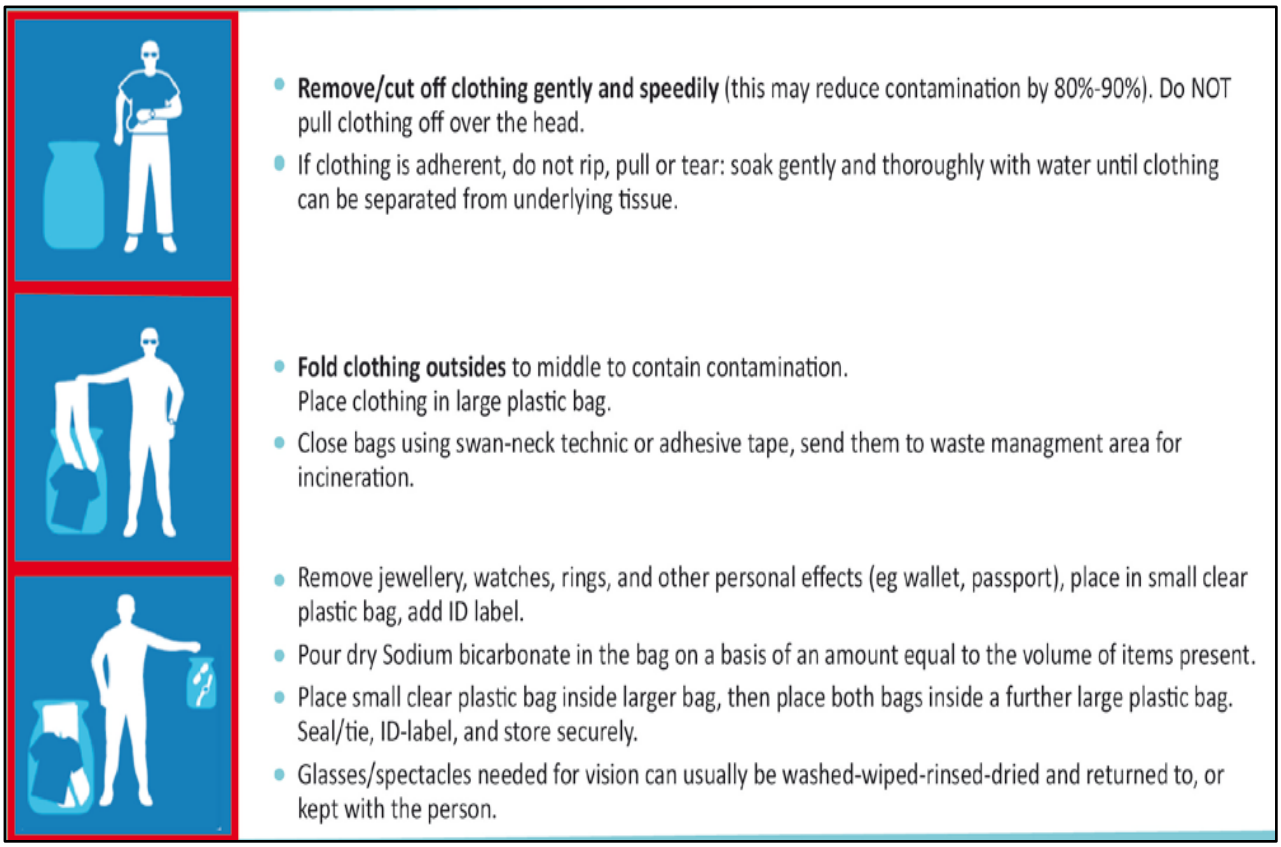


Figure 06 – Guide for Removal of Clothing and Personal Belongings.

Dry decontamination

Dry decontamination is an emergency procedure that:

- reduces the level of contamination present on the victims
- limits the transfer of contamination

The dry decontamination procedure **does not** provide full, in-depth decontamination; therefore a wet decontamination procedure must follow.

The procedure should be performed by personnel wearing a complete PPE (coverall, boots, gloves, NRBC mask and filter canister).

Dry decontamination should be performed as soon as possible, either at triage or in the red zone of the decontamination area, following removal of clothing.

Individuals concerned

- Exposed patients waiting for wet decontamination.
- Personnel exposed to a chemical agent, directly or indirectly, while out of immediate reach of wet decontamination.
- All personnel involved in the decontamination process and out of immediate reach of wet decontamination.

Material required

See table 03.

- Reactive Skin Decontamination Lotion (RSDL). This lotion is available in sponges and inactivates any chemical agent.
- Fuller's earth material - such as, usually, clay.
- If RSDL and fuller's earth are not available, the use of sodium bicarbonate, flour, wiping gloves with activated charcoal, absorbent diapers, or any sand-like powder can be used in an emergency.
- Plastic waste bag.
- Nitrile gloves.
- Self-adhesive tape.

Procedure for dry decontamination

See figure 07.

- Place the RSDL sponge or any other absorbent material available on a clean surface.
- Place a first large waste bag on the ground as a drop sheet (ensure you can reach the kit whilst standing on the drop sheet).
- Remove shoes standing on the drop sheet.
- With RDSL sponge, decontaminate any exposed skin: face, head, neck and throat, hands, forearms.
- Put on two pairs of nitrile gloves.
- Remove clothing and personal belongings.
- Remove the outer pair of gloves and place them in the second large waste bag.
- Close and place the sealed bag inside a third large waste bag for double containment but leave this bag open for now.
- Decontaminate the inner gloves using the RSDL sponge and put on a new pair of gloves over the inner gloves.
- Decontaminate the remaining areas of skin that may have been exposed to the agent. Pay particular attention to areas where perspiration accumulates, e.g. groin, armpits, hollow of the knee, etc.
- Remove the outer pair of gloves and place them in the third large waste bag.
- Put on a new pair of gloves over the inner gloves.
- Cover any open wounds with the surgical dressings and step off the drop sheet on uncontaminated ground.
- Put on coverall and overshoes.
- Place the drop sheet inside the third large waste bag together with any other used items (e.g. RSDL packaging, used RSDL sponges).
- Remove the outer pair of gloves and place them also in the third large waste bag.
- Close the bag and seal it with the self-adhesive, labelled tape.
- Remove the inner pair of gloves and place them in a third small plastic bag.
- Use a dry wipe cloth and wash lotion to remove excess RSDL. Place the wipes in the third small plastic bag, close the bag and seal it with the self-adhesive, labelled tape.
- Securely store the three bags containing contaminated clothing, waste material and personal belongings for further decontamination or disposal.

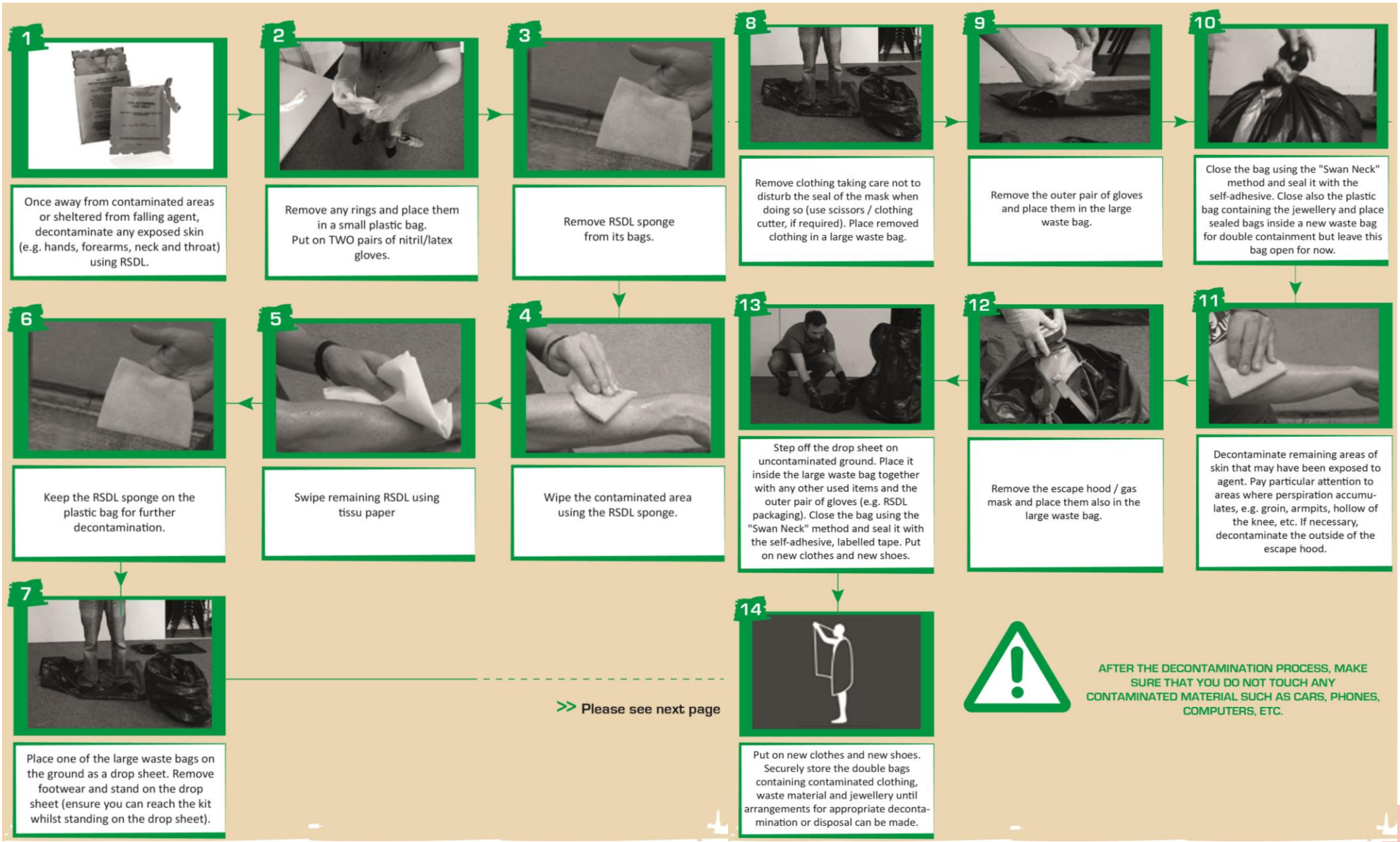


Figure 07 – Guide for Dry Decontamination.

Specific procedure of face/head decontamination

If you suspect that an agent is present inside the escape hood due to contamination of the face or head prior to donning it, carry out the procedure as follows:

- Thoroughly decontaminate the hands and the neck seal of the hood using the RSDL.
- Use one hand to locate the neck seal of the hood.
- Take a deep breath, hold it and close your eyes.
- Gentle pull the neck seal away from the neck, whilst using the other hand to decontaminate the affected area with RSDL.
- Withdraw the hand and RSDL sponge; allow the neck seal to reform.
- Blow out hard before opening eyes to clear any vapour from within the hood.

Wet decontamination (rinse-wipe-rinse technique)

- Wet decontamination is a detailed procedure that must be carried-out in a decontamination area with accessible shower.
- Even if not preceded by dry decontamination, wet decontamination alone can provide a full, thorough decontamination.
- If soap is not available, the wet decontamination should still be carried-out using water only.
- This procedure will be done by personnel wearing a complete PPE (coverall, boots, gloves, NBC mask & filter canister) or supervised if the contaminated person is mobile.
- The wet decontamination is performed in the yellow zone of the decontamination area.

Individuals concerned

- All patients and personnel exposed to a chemical agent, directly or indirectly.
- All personnel involved on the decontamination process.

Material required

See table 03.

- Water and soap.
- Clean absorbent material (sponge, soft brush, or washcloth.
- 0.9% saline.
- Disposable towels.
- Dressing material.

Procedure for wet decontamination

See figure 08.

- Remove shoes, clothing, and personal belongings.
- Gently rub-off any liquid and/or solids (e.g. powder) on the skin with clean absorbent material e.g. a wound dressing or incontinence pad.
- Gently rinse/wash affected areas with soapy water (0.9% saline for open wounds and eyes).
  - > This solution 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.
- Wipe affected areas gently but thoroughly with a sponge, a soft brush, or a washcloth.
  This removes organic chemicals and petrochemicals that are not water soluble.

- Gently rinse affected areas.
- Gently dry cleaned areas with disposable towels.
- Consider dressing open wounds.

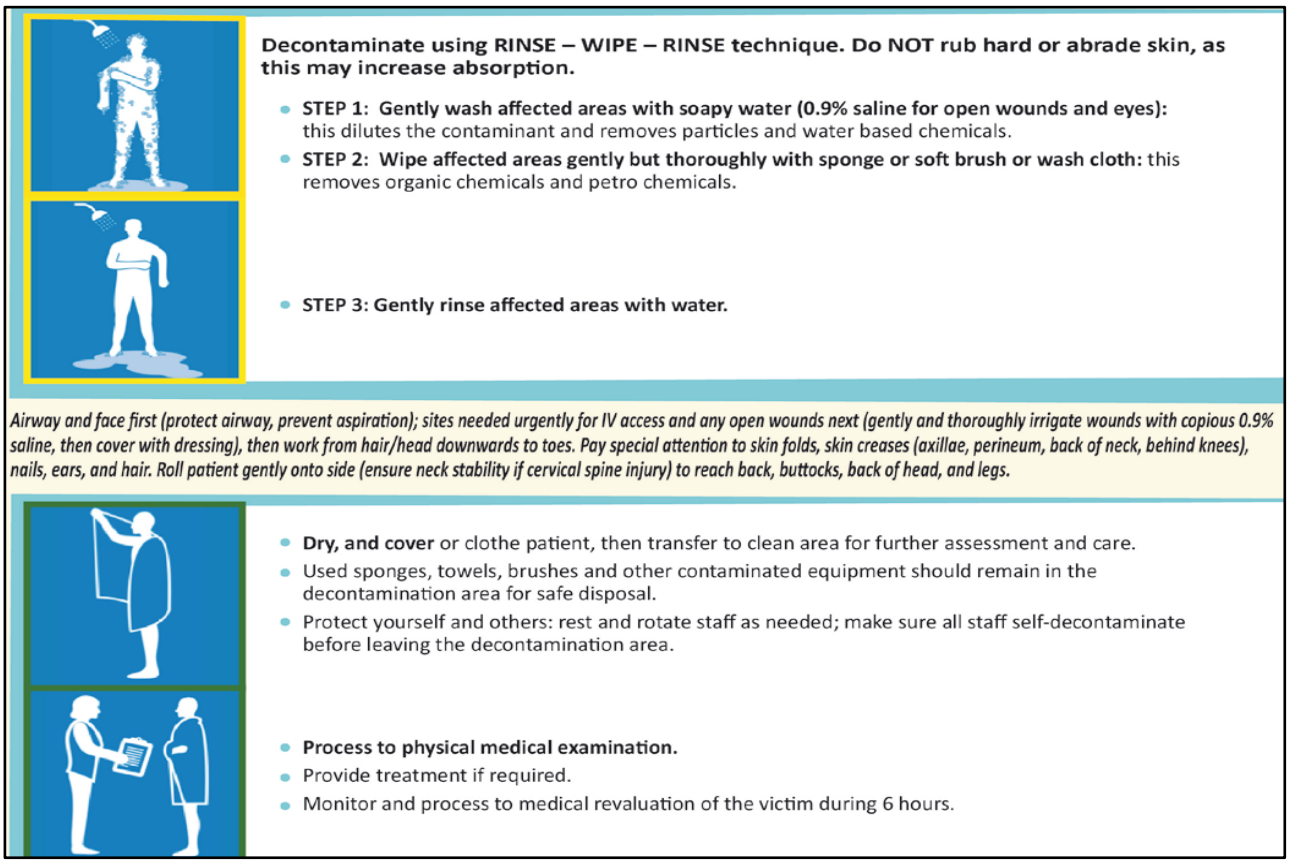


Figure 08 – Guide for Wet Decontamination.

2. Decontamination of personal belongings

- Decontamination of personal belongings occurs in both the yellow and the green zones of the decontamination area[8].
- Decontamination personnel must wear a complete PPE (coverall, boots, gloves, NBC mask & filter canister) while in the yellow zone.
- Decontamination personnel need not wear extensive PPE while in the green zone. Long rubber gloves are adequate.

Decontamination in soap/water solution

Material required

See table 03.

- Water and soap.
- 1 Plastic bag.
- Basins / buckets.
- Long rubber gloves, pair.

[8] Note that all decontamination described here only removes the agents; it does not deactivate or neutralize them. Oxidizers or purpose made chemicals are needed for neutralization.

Procedure for decontamination in soap/water solution

- In the washing (yellow) zone, remove all personal belongings (watches, jewellery, cash, etc.) and place them in a plastic bag.
- Seal and rinse the bag with water and soap in the washing area, and pass it to an operator in the green zone.
- Soak the items in soapy water solution for 2 hours.
- Rinse with abundant water and dry.
- Afterward, they can be returned to the patient or the family.
- Plastic bags used for containing the personal belongings should also be soaked and then put into refuse bag for disposal.

Note: Cellphones and wallets cannot be safely decontaminated and must be disposed of.

Decontamination using absorbent medium

Material required

See table 03.

- Absorbent medium (baking soda, Fuller's earth, bentonite, flour).
- RSDL sponge or RSDL Solution with Wiping Towel/sponge.
- Water and soap solution.
- 3 sealable transparent bags.
- 2 basins of 10-20L.
- Table(s) for Disinfection of at least 3m².

Procedure for decontamination using absorbent medium

- In the washing (yellow) zone, remove all personal belongings (watches, jewellery, cash, phones, watches, electronics, etc.) and place them in a plastic bag containing an absorbent medium.
- Seal and rinse the bag with water and soap in the washing area, and pass it to an operator in the green zone.
- Label the bag with patient details.
- First dip into a soapy water basin and then into a clean second plastic bag.
- Dip into a second soapy water basin and wipe the exterior surface of the bag with a RSDL sponge or RDSL impregnated towel/sponge.
- Let dry in a ventilated space and place in a third transparent bag with patient details reapplied.
- Leave for minimum 24 hours and wipe items with RSDL before returning.

Note: Make sure there is sufficient space to allow for a linear flow of materials in/adjacent to the drying and dressing area keeping in mind working room, the two soapy water basins, and sufficient room for the valuable bags

3. Decontamination area

The decontamination area is where contaminated patients are decontaminated, before being transferred for further treatment.

- The decontamination area must be serviced by utilities, close to a water drainage installation, and ready to be used at a short notice.
- It must be marked and cordoned off, with single points for entry/exit.
- All people leaving the area must be decontaminated.
- It must ensure crowd control and appropriate flow of individuals.

Layout of a decontamination area

General requirements

See figure 09.

- The decontamination area must include :
  - > **Three separate zones**: -red- (undressing), -yellow- (washing and disinfection), and -green- (drying and dressing).
  - > **Three separate corridors**: male / female / disabled or injured patients on stretchers.
  - > **Minimum dimensions** of 6 m wide x 9 m long.
- The entrance should be close to the ambulance reception area and far from the entrance to the ER.
- The exit should be close to the entrance to the ER and far from the ambulance reception area.
- The area should be well ventilated and well lit.
- Waste flow needs to be considered to minimize flow crossover and therefore cross contamination.

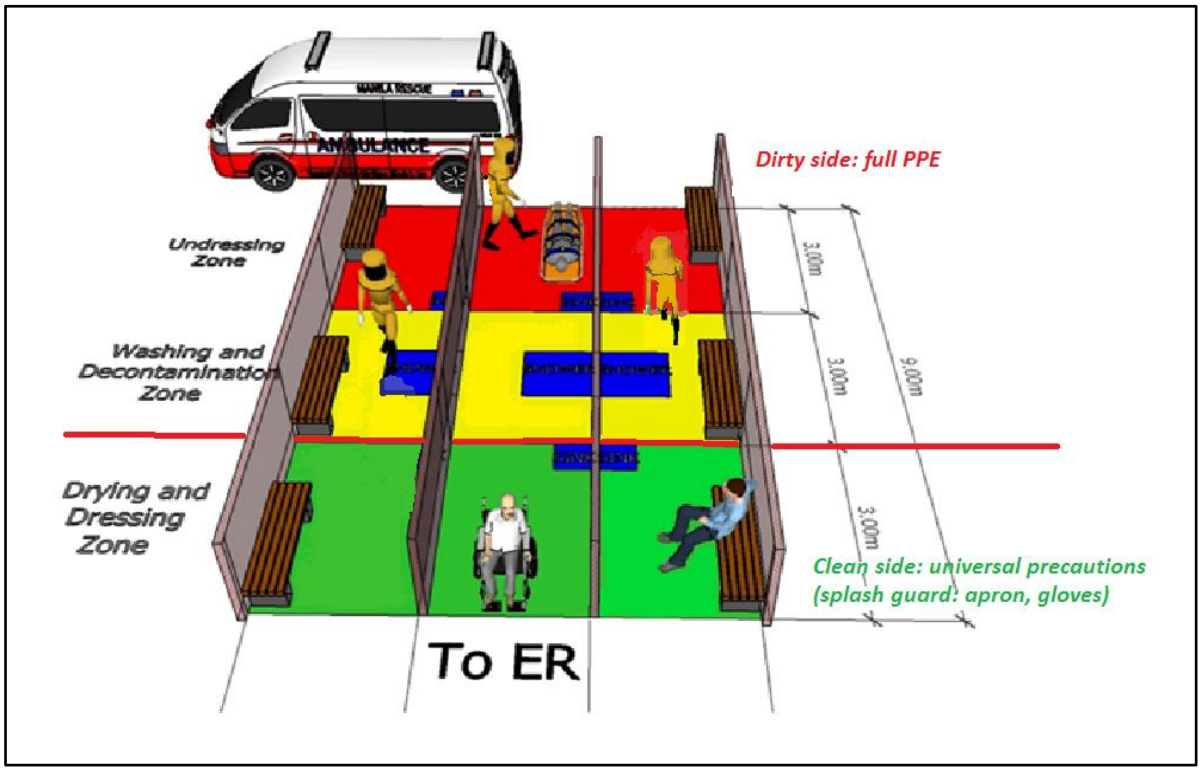


Figure 09 – Layout of Decontamination Area.

Undressing Zone: red area.

Contaminated zone where people undress

- Victims received in this area are **exposed to the highest level of contamination**. Personnel face the highest risk of secondary exposure in this area.
- Only personnel wearing full chemical PPE are allowed in this area.
- Contaminated patients must:
  - > **Undress** and **remove their personal belongings** (avoid pulling shirts over the head).
  - > **Proceed to the washing zone**, assisted by health personnel wearing PPE.
- If patients are unconscious or unable to stand, health personnel must remove the patients' clothes (cutting with scissors on the front and along the sleeves) and take them to the washing zone on a stretcher.

- The majority of solid waste is produced here. Adequate space required for waste build up, especially in mass casualty situations (Valuables should be stored separately for later decontamination).
- This area is the most chaotic zone of the decontamination area, since patients usually arrive confused. Crowd management is key for triage, and follow up.
- Staff not wearing PPE should stay at least 10 m away from the area (preferably up-wind).

Washing and Disinfection zone: yellow area.

Contaminated zone where people shower

- Transition area where patients can use a shower to decontaminate themselves. Non-mobile patients should be decontaminated by staff in chemical PPE.
- The majority of waste water is produced here. Adequate space is required for staff assistance during the decontamination process.
- It is important not to rush this step to ensure:
  - The complete process of decontamination.
  - The safety of personnel and non-contaminated patients.

Drying & Dressing zone: green area.

Decontaminated zone where people dry and re-dress

- Area for patients to dry off and get dressed into clean clothes before being transferred for further treatment.
- The personnel working in this area must wear universal precautions/splash guard PPE (gloves, apron).
- Any personnel wearing complete PPE from the contaminated zones should wash and decontaminate themselves before entering this zone.
- Minimal solid waste or waste water produced here.

Different types of decontamination areas

Bare minimum decontamination site

- Minimum one lane Male/Female (each lane's width shall measure min. 3m).
- Clearly marked lanes (with boundary tape, rope, orange fencing, etc.) indicating the division between lanes and between zones (red, yellow, green).
- If the surface is angled, the clean area should be upslope from the contaminated area to allow the water to flow away to a safe drainage system.
- Water source.

Mobile/Rapidly deployable decontamination site

- Rapidly deployable prefab for use in stable facilities.
- Minimum two separate lanes Male/Female (each lane's width shall measure min. 3m).
- In case of mass casualties, a third lane should be set-up for non-walking patient (slow lane).
- Lanes and zones (red, yellow, green) must be separated by screens made of painted metal frame and covered with thick opaque plastic canvas (similar to the material used for tarps covering trucks, cholera beds or pool lining). **See figure 10.**
- Plastic sheeting can be used if more resistant materials cannot be found.

- Medical privacy screen can be an alternative in case of emergency, but should be made from absorbent materials and cannot be easily decontaminated after use.
- Connected to a nearby water source through a hose. A valve should be present on the hose and located close to the water source and NOT INSIDE the contaminated area.
- Channel the water from the contaminated area into a safe drainage system.

Figure 10 – Setup of a Mobile Decontamination Site.

Fixed decontamination site

See figure 11.

- Minimum of two separate lanes Male/Female (each lane's width should measure a minimum of 3 m).
- In case of mass casualties, a third lane should be set-up for non-walking patient (slow lane).
- Requires a fixed painted metal frame structure covered with thick opaque plastic canvas[9].
- Requires 10 screens (as in the mobile set-up) as a back-up to open a third lane in case of mass casualties.
- Minimum of 2 showers per lane, ideally 4.
- Requires dedicated water source with plumbing with specific pressure and water temperature for shower heads and one hose in each lane plus an extra hose outside if needed for a 3rd lane with mobile set-up.

[9] Dim: 2.5-3m long by 2-2.5m high

Figure 11 – Setup of a Fixed Decontamination Site.

Table 03 – EPREP Material for 1 Decontamination Area*		
Description	**MSF Code**	**Quantity**
Undressing and decontamination zones		
MATERIAL FOR SET-UP OF DECONTAMINATION SITE (depending on the type of site)	--	--
SCISSORS, 17CM, BLUNT ENDS	ASTASCISS7B	--
REFUSE BAG, 100L, 70µM, BLACK	PHYGBAGR1HB7	--
TRANSPARENT BAG (ZIP-LOCK), 2L OR BIGGER	--	--
DUST BIN, 100L, DARK GREEN + LID	--	--
MARKER PERMANENT, LARGE CHISEL POINT, BLACK	ASTAPENM3BB	
ADHESIVE LABELS FOR TRANSPARENT BAGS	--	--
BUCKET, PLASTIC, 15L, STACKABLE	CWATBUCK5SP	--
TABLE, ±80X50X75CM, FOLDABLE	AFURTABLF0805	--
Drying and dressing zone		
TOWEL	--	--
RUBBISH BIN, 100L, DARK GREEN + LID	PHYGRUBB1CWG	--
SPARE CLOTHING (PAJAMAS OR LONG TUNIC)	--	--
RUBBER SANDALS, VARIOUS SIZES	--	--
TABLE, ±80X50X75CM, FOLDABLE	AFURTABLF0805	--
STRETCHER, FOLDABLE ALONG LENGTH / WIDTH, ALU,4 FEET, 215X58CM	EHOESTRT2--	--

* Item quantities will depend on the specific set-up and size of the mission(s), unless otherwise specified. MSF code only applies to certain items.

4. Decontamination of ambulances and vehicles

- This decontamination must be done by personnel wearing a complete PPE (coverall, boots, gloves, NBC mask & filter canister).
- The procedure must be carried out by at least two people at a time.

Material required

See table 04.

- Clean water.
- Soap/water solution.
- 20L buckets.
- Complete PPE.

Procedure for decontamination of ambulances vehicles

- Ensure there is at least a 15m radius around the ambulance/vehicle.
- Prepare soap/water solution.
- Prepare 2 x 20L buckets of clean water.
- Put on chemical PPE.
- Open all doors of the ambulance/vehicle with the windows rolled up.
- Clean the whole vehicle with soapy water solution to make sure there is no significant mud remaining (use sponges or rags, if necessary).
  - Pay special attention to the inside parts of the vehicle the patient may have been in contact with.
  - If it is suspected that the vehicle might have been directly exposed to a chemical (e.g. being in the vicinity of a location where a chemical release occurred), its exterior must also be washed with soap/water solution.
- Fully rinse the ambulance/vehicle with abundant clean water to remove the residual soap.
- Doff PPE following standard procedure.

5. Decontamination of spaces

- This decontamination must be done by personnel wearing a complete PPE (coverall, boots, gloves, NRBC mask & filter canister)[10].
- The procedure must be carried out by at least two people at a time.

Material required

See table 04.

- Clean water.
- Soap/water solution.
- Sponges.
- Big plastic bags.
- Complete PPE.

Procedure for decontamination of spaces

- Wash the walls, the floor, and the shower with sponges and soap/water solution.

[10] Note that all decontamination described here only removes the agents; it does not deactivate or neutralize them. Oxidizers or purpose made chemicals are needed for neutralization.

- Wash all buckets, bins, and tables using sponge and soap/water solution; rinse and dry; put back in the decontamination area kit.
- Place the suits, gloves, tape, filter canister, and any washcloth in a large refuse bag.
- Boots: soak in soap/water solution for 2 hours; rinse and dry; put back in the PPE kit.
- Masks: wash with sponge & soap/water solution; rinse and dry; put back in the PPE kit.
- Cleaning personnel must then remove the PPE, pick it up with gloves and place in refuse bags.
- Refuse bags must be collected and taken to a safe area for disposal.

6. Waste management

- MSF personnel should ensure that the waste produced through the process of decontamination is properly disposed of in order to prevent any further contamination of individuals, animals, and the environment.
- When MSF personnel have no option for disposal (e.g. treatment of contaminated water), they should apply specific procedures and adjustments to ensure no further contamination of individuals, animals, or the environment.
- Personnel should store and confine contaminated waste until procedures for disposal are in place.

Contaminated water (liquid waste)

- It is assumed that the large amount of water used in the decontamination process, in contrast with the smaller amount of a chemical agent, will result in low risk of contamination of water systems in any given operational environment.
- Personnel need not utilize any specific method of disposal/treatment of contaminated water. However, specific recommendations need to be followed:
  - > Depending on the type of waste water treatment (infiltration, local sewage system), ensure the waste water used for washing and decontamination does not itself become a source of contamination to the community.
  - > **Protection of water resource**:
  - Ensure that water sources for the health facility and/or the local community are not exposed to post contamination (wells, boreholes, river…). If required, keep a security stock of safe water (sealed bottles…).
  - > **Protection of the environment:**
  - Ensure that contaminated waste water is not directed to a river, fields, or any environmental space used by individuals or cattle.
  - > Identify where the water runoff will be and ensure it is contained in a safe area.
  - > Waste water needs to flow from lower contamination to higher contamination areas before being collected and directed away from the health facility, personnel, and neighbouring communities. This will minimize future cross-contamination.

Contaminated items (solid waste)

- Personnel disposing of solid waste must wear full PPE.
- Place all waste in large plastic bags (no more than 65% full) in the yellow zone of the decontamination area and seal them. **See figure 12.**
- Wash the exterior of the bags and place them in a second waste bag.
- Transport the material to a well-ventilated waste zone.

- Incinerate[11] the material in a secured incinerator and if not possible, encapsulation.
- Once the combustion is achieved, the area should be avoided by at least 20m until there is no smoke.
- If the material has not been sufficiently incinerated, the process must be repeated.
- Once all material has been incinerated, it can be handled as any other medical waste.

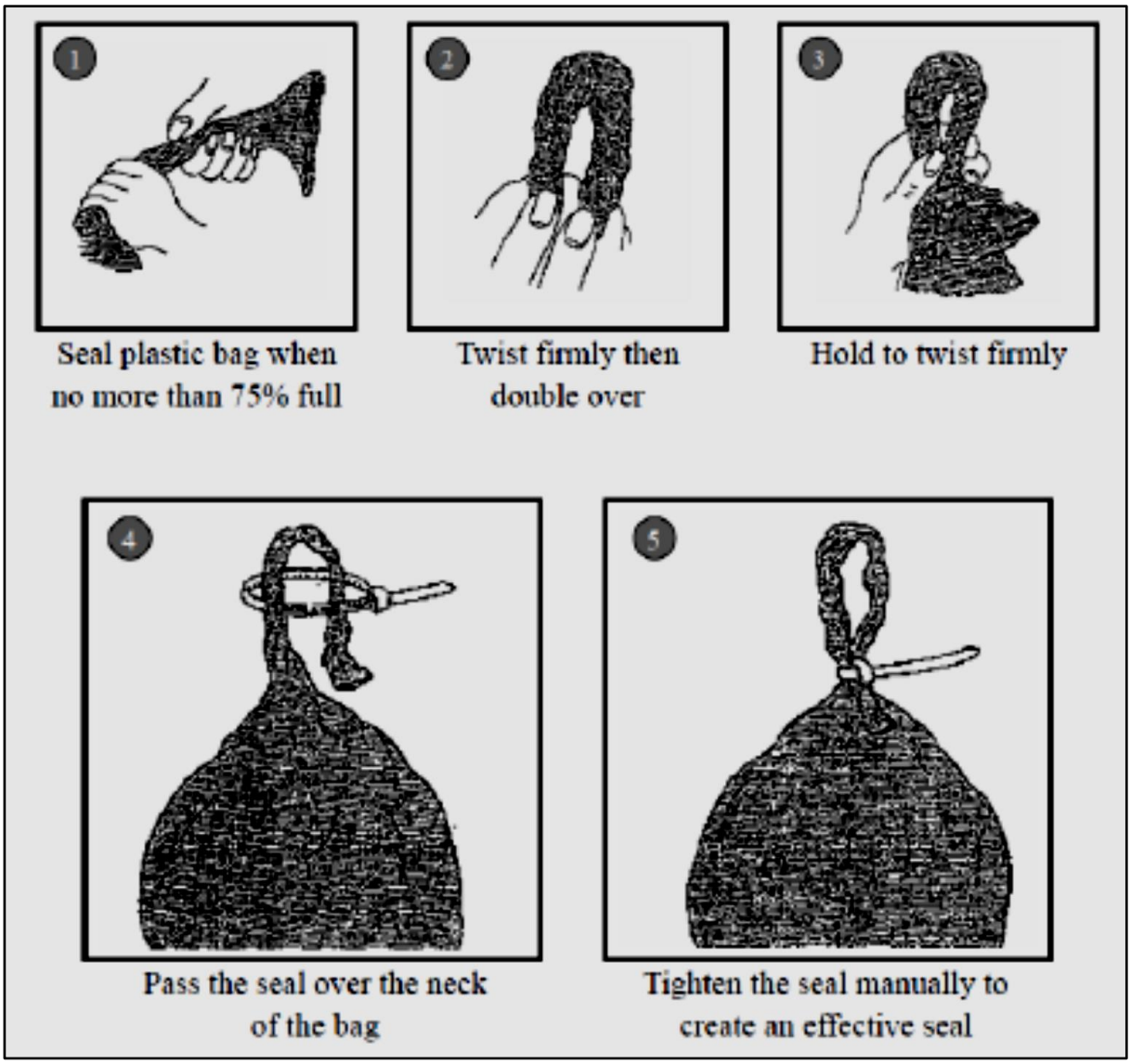


Figure 12 – Guide for Swan-Neck Sealing Method for Clinical Waste Bags.

Decontamination team

- Personnel making up the decontamination team listed below are an estimate of the minimum number of staff members required to perform the process of decontamination of chemically-exposed victims.
- They must be adapted according to the composition and size of the mission, as well as to the specifics of any given context.

Reception area (before Triage)

- **2 x Crowd-control officers**
  - > Keep all people not suspected of being contaminated from the decontamination zone.
  - > Crowd control Officer must wear complete PPE.

[11] Note that white phosphorus should not be incinerated.

Triage area

- **1 x Medical staff member**
  - > Asks questions to suspected exposed patients.
  - > Prioritize and direct patients for decontamination.
  - > **Staff at triage must wear complete PPE**.

Decontamination area RED zone.

- **3 to 4 x Medical staff members**
  - > (Help) undressing & decontaminating (dry decontamination) patients.
  - > Trained on donning and doffing PPE and on decontamination.
  - > Minimum 1 staff per walking patient (M/F) and 2 staff per stretcher patient.
  - > Rotation recommended every 20-30 minutes.
  - > **Staff in the RED zone must always wear complete chemical PPE**.

Decontamination area YELLOW zone.

- **3 to 4 x Medical staff members**
  - > (Help) decontaminating (wet decontamination) patients.
  - > Trained on donning and doffing PPE and on decontamination.
  - > Minimum 1 staff per walking patient (M/F) and 2 staff per stretcher patient.
  - > Rotation recommended every 20-30 minutes.
  - > **Staff in the YELLOW zone must always wear complete PPE**.

Decontamination area GREEN zone.

- **1 to 2 x Medical staff members**
  - > (Help) dressing patients.
  - > Trained on donning and doffing PPE and on decontamination.
  - > Minimum 1 staff per walking patient (M/F) and 2 staff per stretcher patient.
  - > **Staff in the GREEN zone can wear long rubber gloves. No need to wear full chemical PPE,** but basic PPE should still be worn.

Exit of the decontamination area

- **2 x stretcher bearers**
  - > Help transferring injured or disabled patients to other departments of the hospital.
  - > Minimum 1 staff per walking patient (M/F) and 2 staff per stretcher patient.
  - > **Staff at the exit zone don't need to wear chemical PPE**.

Cleaning and Waste management

- **1 to 2 x cleaning / waste manager staff members**
  - > Decontaminate the decontamination zone, patient's valuables, and vehicles.
  - > Manage and dispose of all waste.
  - > Trained on donning and doffing PPE and on decontamination.
  - > **Wear complete PPE or partial PPE depending on the task**.

WHAT TO DO IF…

Patients suspected of having been exposed to a chemical agent arrive at a health facility.

- Decontamination team wears the PPE.
- Receive, triage, and decontaminate the patient(s) in the decontamination area, **even if not presenting symptoms of exposure.**
- Treat the patient(s).
- Decontaminate personal belongings and ambulances/vehicles possibly contaminated.

Table 04 – EPREP Stock for Decontamination*.

Description	MSF Code	Quantity
Standard list for dry decontamination (1 patient)		
LOGISTICS MATERIAL FOR 1 DECONTAMINATION AREA, PLUS:	--	--
RSDL REACTIVE SKIN DECONTAMINATION LOTION, PACKAGE	SDRERSDL4L-	1
EYE-WASH SODIUM CHLORIDE, 0.9%, 500 ML, FLEX. BAG, PVC FREE	EMEQEYEW7--	1
DRY WASHCLOTH (OR SPONGE)	--	10
SOAP, LIQUID, 500ML BOTTLE	--	1
SHAMPOO, WITHOUT CONDITIONER, 1L		1
HAND DISINFECTANT, BOX OF 15 WIPES,	--	1
WASH LOTION, BOTTLE		1
DRESSING; SURGICAL, ADHESIVE, STERILE, PACK		1
Standard list items / equipment for decontamination of items & waste management		
SEALABLE TRANSPARENT BAGS	--	--
PERMANENT MARKER	ASTAPENM3BB	--
ABSORBENT MEDIUM (BAKING SODA, FULLERS EARTH, BENTONITE, FLOUR)	--	--
SOAP	--	--
2 X 10-20L WASHING BASINS	--	--
RSDL SPONGES OR RSDL SOLUTION WITH WIPING TOWEL / SPONGE	SDRERSDL4L-	
TABLE(S) FOR DISINFECTION OF AT LEAST $3M^2$	--	--
GARBAGE BAGS – HEAVY DUTY	--	--
Standard list items/equipment for decontamination of spaces & vehicles		
WASHCLOTH (or SPONGE)	--	--
BUCKET, plastic, 15l, stackable	CWATBUCK5SP	--
BUCKET, plastic, 20l, stackable	--	--
SOAP, liquid, 500ml bottle	--	--

* The personnel performing decontamination must wear PPE against secondary exposure.
The list above does not include PPE (listed in the "E-PREP stock for Protection).
Item quantities will depend on the specific set-up and size of the mission(s), unless otherwise specified.
MSF code only applies to certain items.

Section D: RESPONSE - Treatment of Exposed Patients

Key Principles

The clinical treatment that accompanies and follows decontamination is – initially – symptomatic and – then – specific with antidotes, when these exist and are available.

Identifying the offending agent based on the patient's symptoms becomes relevant for an adequate treatment.

For all exposed patients an ABCDE medical assessment should be undertaken.

Ask yourself, "What is killing the patient now".

Supportive care is vital in the management of exposed patients, in conjunction with the use of antidote regimens.

Patients may continue to deteriorate after admission to the hospital, particularly if complete decontamination was not achieved. It is therefore advised that all patients should be monitored.

After the initial response, expert consultation should be sought in order to address potential complications.

1. Introduction

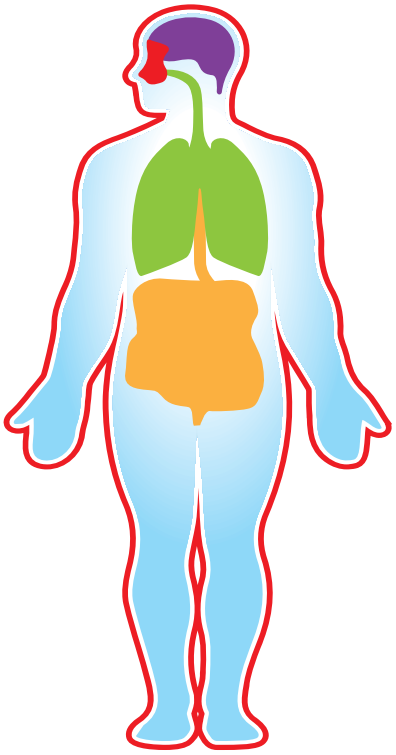
Exposure to chemical agents could happen concurrently with traumatic injuries. The **MARCH** acronym can be used as an approach to the management of patients with an exposure to chemical agents plus traumatic injuries. Health care workers should don appropriate PPE prior to patient care. **See figure 13.**

M	**M**assive haemorrhage (direct pressure, pack/wrap wound, tourniquet)
A	**A**irway (recovery position if no c-spine injury, oral airway, advanced airway); Administer **A**ntidotes
R	**R**espirations (normal, shallow, laboured, absent? caused by chemical agent or trauma? **R**apid Decontamination (use copious water)
C	**C**ountermeasures (nebulizer meds, IV/IO drips, suction airway, advanced airways); **C**irculation (pulse check, skin check, shock status, IV/IO, splint broken bones)
H	**H**ypothermia (prevent hypothermia); **H**ead wound (is altered mental status from chemical agent, blast exposure, direct trauma?)

Figure 13 – The MARCH Approach[12]

The clinical signs shown below provide a guide to the type of chemical possibly involved. The full list of signs and symptoms should be consulted for further clinical diagnosis (see below). Note that individual patients may present differently, therefore, the overall picture presented by a range of patients should be considered. Respiratory signs and symptoms may be present following exposure to any of the agents. **See figure 14.**

[12] Based on $M^2A^2R^2C^2H^2E^2$ which is taught in Tactical Casualty Combat Care



CENTRAL NERVOUS SYSTEM	
Seizures	CYANIDE / NERVE AGENTS
Hyperthermia	BZ / AGENT 15
EYE, NOSE AND SKIN	
Constricted pupils	NERVE AGENT / OPIOIDS
Dilated pupils	NERVE AGENT / CYANIDE
Dry mouth & skin	BZ/AGENT 15
Eye Irritation	BLISTER AGENTS / RIOT CONTROL AGENTS (RCAs) / LUNG IRRITANTS
Blistering of skin	BLISTER AGENTS
Cyanosis	CYANIDE
RESPIRATORY TRACT	
Asphyxiation	CYANIDE
Copious secretions	NERVE AGENTS
Delayed respiratory distress	BLISTER AGENTS
Delayed pulmonary oedema	LUNG IRRITANTS
DIGESTIVE TRACT	
Nausea	LUNG IRRITANTS / RCAs / INCAPACITATING AGENTS / CYANIDE
Diarrhoea	NERVE AGENTS
MUSCOLOSKELETAL	
Fasciculations	NERVE AGENTS

Figure 14 – Guide for Toxidrome Recognition in CW attacks.

2. Nerve agents

Common symptoms of exposure

Nerve agents act like organophosphate poisoning by blocking cholinesterase (leading to excessive acetylcholine) and thus creating a cholinergic syndrome. Acetylcholine will act on muscarinic and nicotinic receptors and symptoms from either toxidrome can occur concurrently.

Muscarinic toxidrome: DUMBELS

- **D** iaphoresis
- **U** rination
- **M** iosis
- **B** ronchorhea / Bradycardia / Bronchospasm
- **E** memsis
- **L** acrimation
- **S** alivation

Nicotinic toxidrome: the days of the week in English: MTWtHFSS

- **M** ydriasis
- **T** achycardia
- **W** eakness
- **H** ypertension
- **F** asciculations
- **S** eizures
- **S** omnolence

Treatment (after decontamination)

- Start with ABCDE medical assessment and management, and initiate antidote treatment in parallel - Assisted ventilation may be required for severe exposure.
- 3 types of antidotes exist for Nerve agents, and all three are available at MSF. An auto-injector containing all 3 antidotes also exists: Ineurope® -. **See tables 05, 06, 07 and 08**.

> **Atropine:**

Table 05 – Atropine Administration

Administration	Notes & supportive therapy
• **Adults** *Loading dose* – 2mg IM or IV every 5-10 minutes. – For severe symptoms, up to 6mg can be given on initial dose. *Maintenance dose* – 1.5 to 6 mg/h – Continuous atropine infusion is not always necessary; repeat injections, dictated by clinical presentation, may be sufficient. – Max 30 mg of cumulative doses on D1 for a 70kg adult • **Children** *Loading dose* – 0.05 -0.1 mg/ kg IM or 0.02 mg/kg IV (not to exceed 2mg per dose) every 5-10 minutes. *Maintenance doses* – 0.05 mg/kg/h – Continuous atropine infusion is not always necessary; repeat injections, dictated by clinical presentation, may be sufficient – Max 1.2mg/kg cumulated doses on D1 for children **Duration of treatment with atropine** – Repeated antidote administration may be necessary until "atropinisation" achieved by: • Clear chest on auscultation • Improved oxygenation • Lack of excessive oral secretions • Heart rate > 80 beats per minute. • Dry skin (axillae). – The duration of use should generally not exceed a few hours, though close patient monitoring is essential to identify any return of muscarinic signs (importance of OP toxicokinetics).	– Will act on the muscarinic receptors – to combat hyper secretion and bronchospasm – Administer to all moderate and severe cases. – Correct hypoxia if possible prior to atropine to prevent life-threatening arrhythmia. – Careful monitoring is required in atropine use to ensure that an adequate dose is given and to prevent overdose. – During atropine therapy, where possible, place patient under ECG monitoring. – Main adverse effects (due to their frequency or severity): Thickening of secretions, accommodation disorders, tachycardia, constipation, urine retention, excitability, mental confusion. – Do not use pupil size as a guide to adequate atropine administration. – Onset of symptoms from dermal contact with chemicals in liquid form may be delayed. Observe contaminated asymptomatic patients. – Autoinjector formulations are available for these antidotes. (ex : Ineurope® - combination of 3 antidotes : Atropine 2mg, Avizafone 20 mg, and Pralidoxine 350 mg) – Standard auto-injectors are intended for adults: the needles are too long for the muscle bulk of very young children and the dose of antidotes is too high. The use of a standard auto-injector could be considered in the case of a severely poisoned child needing urgent treatment, however, the described limitations should be taken into account. – **Use of antidote in specific populations** *Pregnancy*: due to the life-threatening situation, the use of atropine is possible during pregnancy, regardless of the term. – **Contraindications** (should consider risk-benefit in exceptional emergency situations) Risk of acute closed-angle glaucoma, risk of urinary retention caused by urethro-prostatic disorders.

> **Oximes:**

Table 06 – Pralidoxime Administration

Administration	Notes & supportive therapy
Minor forms (optional treatment) • **Adults** (Pralidoxime base) – 200-400 mg slow IV or IM. • **Children** (Pralidoxime base) – 20 to 40 mg/kg IV over 15 min. **Moderate forms** • **Adults** (Pralidoxime base) *Initial dose:* – 1 g (5 vials) slow IV or IM (up to 2 g).	– To regenerate acetylcholinesterase at all levels (CNS, Muscarinic and Nicotinic receptors) – More efficient when administered early, and in combination with atropine – Other oximes such as HI-6 can be utilized but are not widely available

Maintenance dose: – Infusion of 5-8 mg/kg/h, or repeat injection of 200-400mg at a frequency determined by clinical progression e.g.: approximately every 4h. • **Children** (pralidoxime base) *Initial dose:* – 20 to 40 mg/kg IV over 15 min. *Maintenance dose:* – 10 mg/kg/h. Adjust according to clinical progression **Severe forms** • **Adults** (pralidoxime base) *Initial dose:* – 2g (10 vials) slow IV or IM. *Maintenance dose:* – Infusion of 5-8 mg/kg/h, or repeat injection of 200-400mg at a frequency determined by clinical progression (e.g approximately every 4h). • **Children** – Same as moderate forms	– Auto-injector formulations are available for these antidotes. (ex: Ineurope® - combination of 3 antidotes : Atropine 2mg, Avizafone 20 mg, and Pralidoxine 350 mg) – Standard auto-injectors are intended for adults: the needles are too long for the muscle bulk of very young children and the dose of antidotes is too high. The use of a standard auto-injector could be considered in the case of a severely poisoned child needing urgent treatment, however, the described limitations should be taken into account. – **Use of antidote in specific populations** *Pregnancy*: due to the life-threatening situation, the use of Pralidoxime is possible during pregnancy, regardless of the term. **Antidote efficacy assessment parameters** Improvement of respiratory parameters Lower doses of atropine required to achieve the previously mentioned signs.

> **Benzodiazepines:**

Table 07 – Benzodiazepines Administration	
Administration	**Notes & supportive therapy**
• **Adults** – Diazepam 5-10 mg IV/IM (higher doses up to 40 mg, or repeated doses may be necessary). • **Children** – Diazepam 0.05 to 0.3 mg/kg IV/ IM, repeated doses may be necessary (maximum 10 mg). In all cases, if seizures last more than 5 minutes, then treat as any status epilepticus, while administering the other antidotes (Atropine and Pralidoxine)	– For treatment of seizures or empirically in severe cases. – Other benzodiazepines (e.g. lorazepam, midazolam) can be used minutes after exposure. – Avizafone is a pre drug for Diazepam which is included in Auto-injector formulations (ex : Ineurope® - combination of 3 antidotes : Atropine 2mg, Avizafone 20 mg, and Pralidoxine 350 mg) – Standard auto-injectors are intended for adults: the needles are too long for the muscle bulk of very young children and the dose of antidotes is too high. The use of a standard auto-injector could be considered in the case of a severely poisoned child needing urgent treatment, however, the described limitations should be taken into account.

> **Auto-injector formulation: Ineurope®**

Table 08 – Ineurope® Auto-injector Administration	
Administration	**Notes & supportive therapy**
Adult – Intramuscular injection (after solution reconstitution) into the thigh, possibly through clothing, on appearance of the first symptoms of intoxication. – If intoxication symptoms persist, the injection can be repeated once only, 15 minutes after the first injection.	**Content:** Ineurope® auto-injector device is a combination within the same three-compartment syringe of: • Atropine sulphate (2 mg), • Avizafone hydrochloride (20 mg), • Pralidoxime methylsulphate (350 mg, corresponding to 217 mg pralidoxime base). **Main indication:** Emergency treatment of organophosphate intoxications in the field, with suspected use of neurotoxic agents such as sarin, VX, soman or tabun.

3. Choking agents (phosgene, chlorine)

Common symptoms of exposure

- Eye redness and lacrimation.
- Upper airway irritation.
- Cough.

- Suffocation or choking sensation, tight chest.
- Shortness of breath, wheezing.
- Hoarse voice.
- Nausea and vomiting.
- Delayed signs: pulmonary oedema by lung injury.
- If isolated intoxication: Absence of pinpoint pupils, absence of burns.

Treatment

- The treatment is **symptomatic.** Proceed to ABCDE medical assessment and management.
- For the specific symptoms linked to the choking agent:
  - > Put patient at rest in a semi-upright position and keep warm.
  - > Extensive amount of oxygen can be required.
  - > Give symptomatic therapy as required:
    - **Treat laryngitis**
      Nebulization of 1mg adrenaline + 4ml of Normal Saline.
    - **Treat Bronchospasm**
      Refer to acute asthma decompensation protocol:
      - Salbutamol nebulization (5mg in adult and 2mg in children <2years of age) + Ipratropium (0.5mg in adults and 0.25mg in children 5 years of age).
      - Hydrocortisone IV (100mg in adults, 5mg/kg in children)
    - **Treat acute lung injury when necessary**
      - Consider Non-Invasive Ventilation if available.
      - O-Two CPAP can be an alternative.
      - Invasive ventilation may be required.

4. Blistering agents (mustard gas, lewisite)

Common symptoms of exposure

- Tearing, eye irritation, conjunctivitis, corneal damage.
- Redness and blisters of the skin with pain.
- Respiratory distress.

Note: Note that all symptoms can be delayed from 1 to 12 hours or more, depending on the severity of the intoxication.

Treatment (after decontamination)

Note: Yperite is not easily soluble in water; therefore the decontamination should start with a dry decontamination, and proceed with wet decontamination. Not following these steps might result in spreading the agent on non-contaminated skin, rather than removing it.

- The treatment is **symptomatic.** Proceed to ABCDE medical assessment and management.
- For the specific symptoms linked to the blistering agent, which can be delayed from 1-12 hours or more:

> **Eyes (if irritated and painful)**
  - Irrigate with distilled water or copious 0.9% sterile saline solution (after 3 drops of Oxybuprocaine for the pain, and eventual Morphine titration) – Irrigation should be continuous for 30 minutes. Use an open IV line 20 to 30 cm above the opened eye.
  - Use sterile Vaseline if available or to prevent eyelids sticking together.
  - Prevent infection with a Tetracycline eye ointment.
  - Do not patch the eye.

> **Skin**
  - There are two steps to decontamination. If possible start with dry decontamination (Fuller's earth, Bicarbonate, flour or sand if nothing else is available) then wash affected skin with copious amounts of soap and water. (The low solubility of Yperite makes wet decontamination poorly effective and eventually harmful by just spreading the Yperite on the body surface, if not preceded by dry decontamination).
  - Itching can be reduced by local applications of cooling preparations, e.g. calamine lotion, or water. Apply silver sulfadiazine cream and cover with sterile dressing. Treat as a burn patient. Refer to burn guideline.
  - Analgesics should be given as required. Consider morphine, the burns can be very painful.

> **Respiratory tract**
  - Oxygen therapy.
  - **Treat Bronchospasm**

    Refer to acute asthma decompensation protocol:

    Salbutamol nebulization (5 mg in adults and 2 mg in children below 2 years of age) + Ipratropium (0,5 mg in adults and 0,25 mg in children below 5 years of age).

    Hydrocortisone IV (100 mg in adults, 5 mg/kg in children).
  - **Treat acute lung injury when necessary**

    Consider Non-Invasive Ventilation if available.

    O-Two CPAP can be an alternative.

    Invasive ventilation may be required.
  - Cricothyrotomy rather than endotracheal intubation may be appropriate when there are significant upper airway lesions.
  - In the case of ingestion do not induce vomiting.

5. Blood asphyxiant agents (cyanide)

Note: Consider cyanide intoxication also in a context of inhalation during exposure to a fire.

Common symptoms of exposure

- Cyanide blocks the use of oxygen at the cellular level; the respiratory centres in the CNS are particularly sensitive to its action.
- Cyanide has an almond smell that is rarely detected in practice.
- **Severe intoxication** will result in the death of the patient within 10 minutes, after seizures, coma, apnoea, and cardiovascular collapse.

- **In other cases:**
  - Head ache, confusion, coma, seizures.
  - Respiratory distress with first tachypnoea (due to severe metabolic acidosis from elevated lactate) then bradypnoea.
  - Hypotension, cardiovascular collapse.
  - Patients can present a normal or low BP discordant with their agitation.
  - Possible skin colour changes: cherry-red (cyanide or cyanogen chloride).
  - Possible cyanosis (blue-grey discoloration of lips and skin).
  - Nausea.

Treatment

- Proceed to ABCDE medical assessment and management and initiate antidote treatment in parallel, if available. (Note that MSF is not equipped with Cyanide antidotes and cases of suspected cyanide toxicity should be referred to a higher level of care if feasible).
- Symptomatic treatment:
  - Administer high flow oxygen - Artificial ventilation may be required in case of apnoea. Note that no case of severe cyanide intoxication has shown improvement without the use of antidotes.
  - Treat eventual seizures:
    - Adult: Diazepam 5-10 mg IV/IM.
    - Child: Diazepam 0.05 to 0.3 mg/kg IV/IM.
  - Treat cardiovascular collapse:
    - Fluid resuscitation – Use of inotropes when ICU available.

6. Incapacitating agents

The common effect of this group of agents is to incapacitate exposed victims, via their psychotropic effects. Besides this common feature, the agents will induce further different symptoms. An antidote is available against opioids only.

Anticholinergic – BZ, Agent 15 (gas)

Common symptoms of exposure

- Dry mouth and skin.
- Hyperthermia.
- Red skin (flush).
- Blurred vision, mydriasis (dilated pupils).
- Altered consciousness, ataxia (incoordination), delusions, hallucinations.
- Tachycardia.

Mnemonic: “Mad as a hatter” (altered mental status), “blind as a bat” (mydraisis), “red as a beet” (flushed skin), “hot as a hare”(anhydrosis), and “dry as a bone” (dehydration).

Treatment

- Proceed to ABCDE medical assessment and management.
- Provide symptomatic treatment, with the aim of preventing patients harming themselves by their actions.

- Attempt to resolve the situation without physical or chemical restraint.
- Only if necessary, sedate with a benzodiazepine:
  - Adult: Midazolam 1-2 mg IV every 2-3 minutes until patient can be safely managed, or if IV access cannot be gained 5-10mg IM.

Opioids

Common symptoms of exposure

- Drowsiness, dizziness, ataxia, coma.
- Miosis (pin point pupils).
- Respiratory depression and apnoea in severe intoxication.

Treatment

- Proceed to ABCDE medical assessment and management.
- Initiate antidote therapy in parallel, if respiratory depression.
- If respiratory depression:
  - Administer high flow oxygen.
  - Consider bag mask ventilation if apnoea, while administrating the antidote.
- Antidote: Naloxone (for opioids). **See table 09.**

Table 09 – Naloxone Administration

Adult

- 0.4 to 2 mg IV injection, repeated if necessary after 2 to 3 minutes until adequate spontaneous ventilation is restored. Follow with a continuous infusion of 1 to 5 µg/kg/h, or by 5 to 10 µg/kg by IM injection every 90 minutes. Half-life of Naloxone shorter than many opioids, therefore antidote will likely wear off before opioid.

Child

- 5 to 10 µg/kg by IV injection, repeated if necessary after 2 to 3 minutes, until adequate spontaneous ventilation is restored, followed by a continuous infusion of 1 to 5 µg/kg/h, or by 5 to 10 µg/kg by IM injection every 90 minutes.

7. Riot control agents

Common symptoms of exposure

- Stinging and burning of the eyes and mucous membranes.
- Lacrimation/salivation.
- Runny nose.
- Tight chest.
- Headache.
- Nausea.

Treatment

- Proceed to ABCDE medical assessment and management after decontamination with abundant amount of water.
- These agents will almost never be life threatening, unless the patient has an underlying condition such as asthma, in which case consider treating the asthma attack (refer to asthma protocol).
- Proper and repeated decontamination is the treatment of choice.

Table 10 – EPREP Stock for Treatment of Exposed Patients*					
Antidotes / treatment for nerve agents					
Antidote / item / medication	**Amount per vial**	**No. of vials / items / medication for 48hrs ttt of 16 adults**	**No. of vials / items / medication for 48hrs ttt of 8 children**	**TOTAL No. of vials / items / medication**	**MSF Code**
Pralidoxime	200mg PLX base	480	240	720	DINJPRAL2A1S
Atropine	1mg in 1mg vials	480	144	624	DINJATRO1A-
Diazepam	10mg in 2mg vials	64	16	80	DINJDIAZ1A-
Pralidoxime, Atropine, Avizafone	217mg PLX base 2mg Atropine 20mg Avizafone	32	N/A for children	32	N/A
Antidotes / treatment for choking agents					
Antidote / item / medication	**Amount per vial**	**Nb of vials / items / medication for 48hrs ttt of 16 adults**	**Nb of vials / items / medication for 48hrs ttt of 8 children**	**TOTAL Nb of vials / items / medication**	**MSF Code**
Salbutamol	5mg	64	16	80	DORASALB1N-
Ipratropium	0,5mg	64	16	80	DORAIPRA+++
Adrenaline	1mg	24	8	32	DINJEPIN1A+
Hydrocortisone	100mg	24	8	32	DINJHYDR1V-
O-Two CPAP	N/A	16	8	24	SCTDCPAP20+
Antidotes / treatment for blistering agents					
Antidote / item / medication	**Amount per vial**	**Nb of vials / items / medication for 48hrs ttt of 16 adults**	**Nb of vials / items / medication for 48hrs ttt of 8 children**	**TOTAL Nb of vials / items / medication**	**MSF Code**
Oxybuprocaine opht	0.4 % inn 5ml	16	8	24	DEXOOXYB1--
Morphine	10mg	32	8	40	DINJMORP1A-
Calamine lotion	15%, 500mL	4	2	6	DEXTCALA1L5
Antidotes / treatment for opioids					
Antidote / item / medication	**Amount per vial**	**Nb of vials / items / medication for 48hrs ttt of 16 adults**	**Nb of vials / items / medication for 48hrs ttt of 8 children**	**TOTAL Nb of vials / items / medication**	**MSF Code**
Naloxone	0,4mg	48	12	60	DINJNALO4A-

* Item quantities will depend on the specific set-up and size of the mission(s), unless otherwise specified.
MSF code only applies to certain items.

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Notes