MEDICAL UNIVERSITY – PLEVEN
FACULTY OF PUBLIC HEALTH
CENTER FOR DISTANCE LEARNING

AN INTRODUCTION TO DISASTER MEDICINE

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- **Disaster medicine** is primarily based on **emergency** and **military medicine**. It is young branch of the medicine, which touches on various disciplines within and outside the medical field.

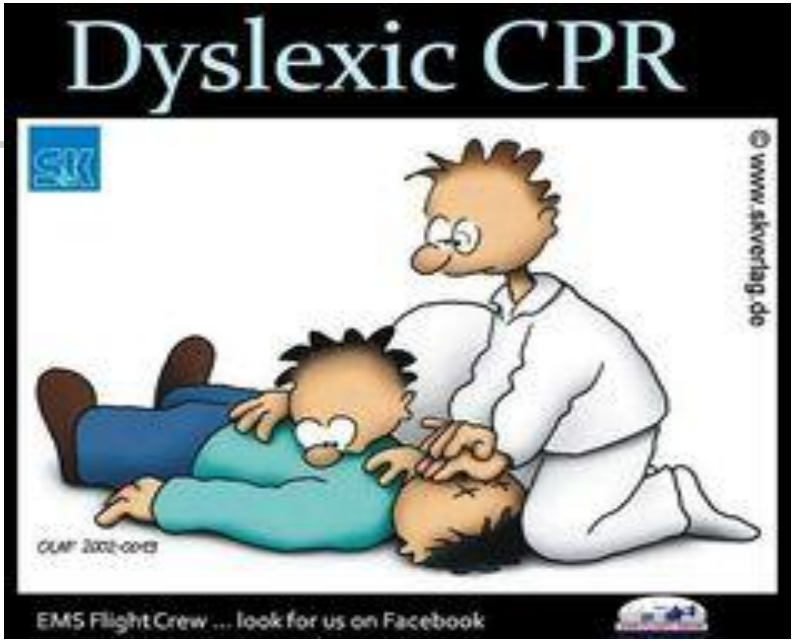
Disaster medicine is taught:

- On **academic level** for medical students
- On **post-academic level** for doctors and specialists
- On **para-academic level** for nurses, ambulance crews and firemen. The first chairs in disaster medicine were established in the beginning of the 80^{ths} in **Linkoping, Sweden and Amsterdam, the Netherlands**. Today disaster medicine is taught at many universities in Europe and America.

- **Disaster medicine is complex of medical and medico-organizational actions into an integrated management system for disaster situation.**

- This term cover the whole range of medical cares from the scene of the disaster to the hospital bed.

The **specific problems** of disaster medicine can be divided into **two groups**:



Medical problems:

- Advanced life support
- Basic life support
- Triage
- Emergency surgery
- Emergency anesthesiology
- Specific disasters (nuclear, chemical, biological)
- Nutritional aspects of the disasters
- Psychological aspects of the disasters
- Hygienic aspects of the disasters
- Rehabilitation

The **specific problems** of disaster medicine can be divided into **two groups**:

Medico-organizational problems:

- Disaster relief organization
- Mobil medical teams
- Transportation of casualties
- Hospital procedures
- Evacuation of populations
- Disaster epidemiology
- Disaster victim identification
- Managerial aspects
- Legislative aspects

Classification of disasters (according to the nature of the destructive agent)

1.Natural disasters:	*2.Man-made (technologic or cultural) disasters:*
❑ earthquakes ❑ floods ❑ cyclones, hurricanes, tornadoes ❑ volcanic eruptions ❑ landslides	❑ Physical (water, coal, gas, petrol) ❑ Chemical ❑ Nuclear ❑ Bacteriologic

Classification of disasters (according to the nature of the destructive agent)

3.Socio-economic disasters:

- **Epidemics**
- **Famines**
- **Terrorism**
- **Wars**

4.Transport disasters:

- **Railways**
- **Automobiles**
- **Air crash**
- **Maritimes**
- **Fluvials**

5.Mixed disasters

CHEMICAL DISASTERS

Chemical disasters result from the storage, processing and transportation of large amounts of highly flammable, explosive, and toxic chemicals.

- The released toxic substances or their byproducts into the environment result in ***intoxication*****.** Most catastrophic chemical release or spills occur in the transportation phase of the industrial process.

- The fires very often cause ***blast burn*** or ***inhalation injuries***.
- On other hand the explosions result in ***mechanical traumatic*** lesions
- The chemical contamination of the water table, the soil and the food chain can cause **delayed effects** for years with impairment to the **neurological** or **immune system**.

1. Scope of the problem

The problems related to industrial safety in developing countries include:

- the inability to ensure the proper use of new technology
- the **lack of effective urban zones that separate residential communities from industrial sites**
- **the lack of prehospital emergency medical services**

2. Basic concepts

The **term *chemical disaster*** may be understood as a great calamity in which **many people (at least 50) perish** and in which a chemical cause the **death** or **injury** of so many people that the **normal health and emergency services** are, or **threaten** to become, **overburdened**.

2. Basic concepts

- A ***catastrophic situation*** **may be considered a threat to** perhaps **10 persons**. **This is the number of individuals with which the crew of** an **Emergency Medical Services** (**EMS**) **ambulance can effectively cope**.
- **An event in which only one or a few persons are the victims may be considered as** an ***accident***.
- A ***catastrophe*** **can be considered to encompass any situation in which the need for aid surpasses** the **normal capacity** to **deliver medical** and **technical assistance**.
- A ***hazard*** exists where there is as situation that in **particular circumstances** could lead to **harm**.

3. Classification of the chemical disasters:

Disaster may be classified as follows:

- **1. According to the number of victims produced by an incident.**
- **2. The extent of the contaminated area.**
- **3. The population density in a contaminated area for volatile chemicals.**
- **4. The amount of chemical involved.**
- **5. The toxicity of the chemicals.**
- **6. The magnitude of the measures that must be taken to counteract the accident and to limit its consequences.**
- **7. Consequences on the environment.**

4. Factors affecting the severity and occurrence of industrial disasters

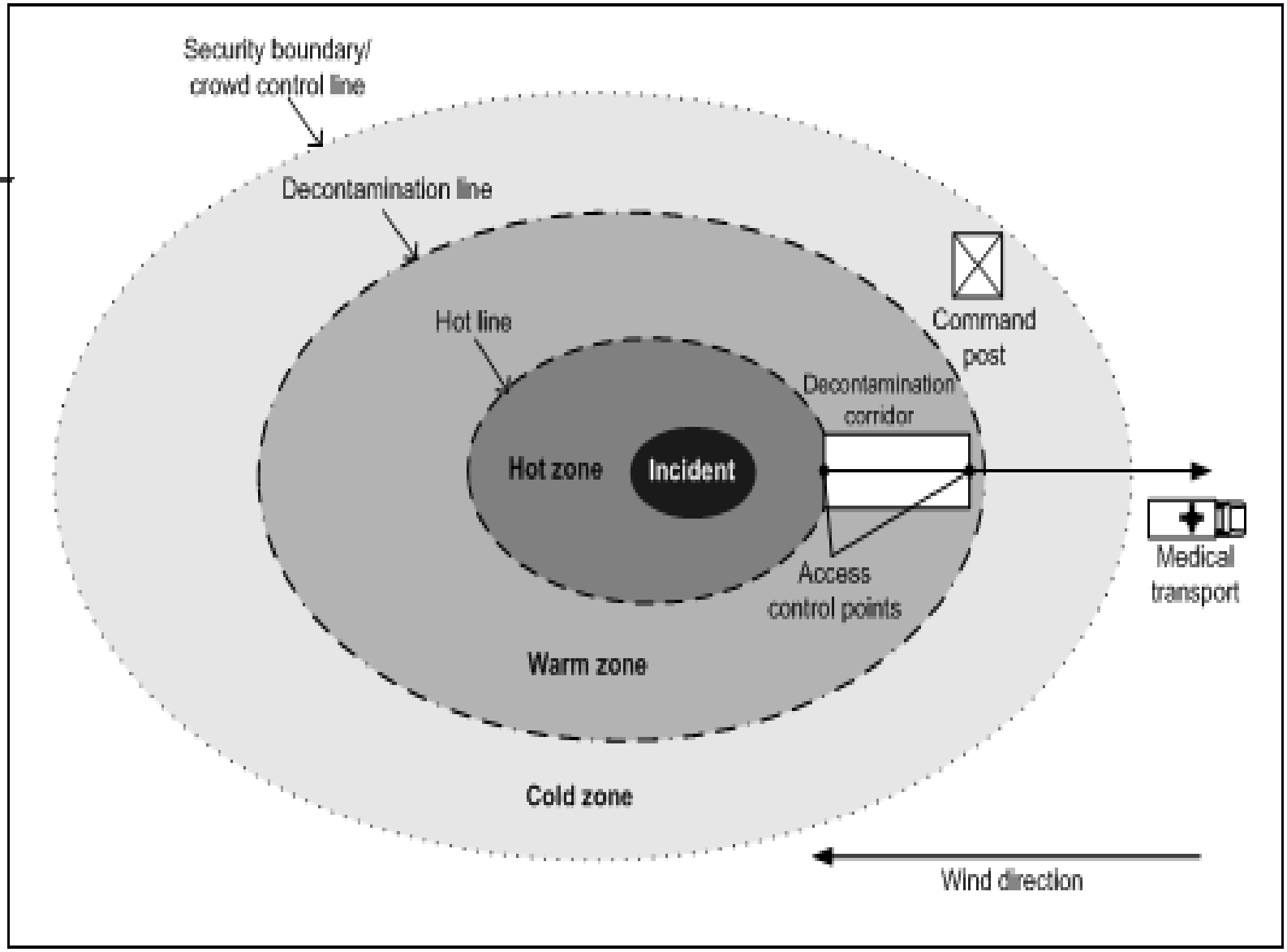
The community's risk for industrial disaster is increased from some natural and human factors:

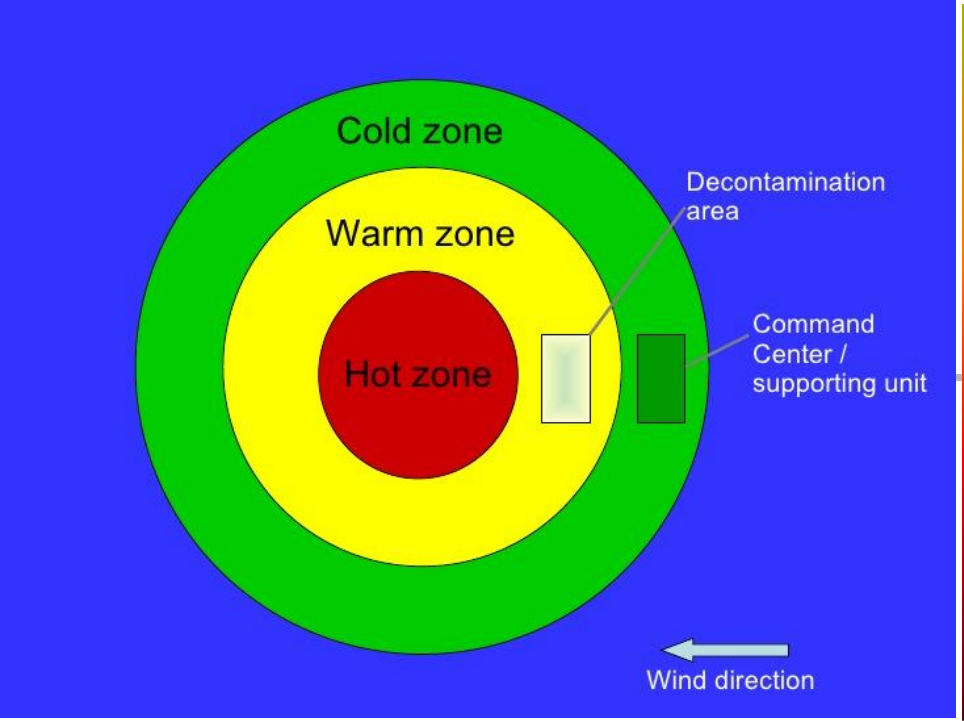
- • **The location** of industrial sites **in regions** subjected to **natural disasters**. **Flood**, **earthquakes** and **hurricanes** can destroy a community's civil infrastructure and its industrial base, critical industrial safety systems, etc.
- • **Human factors** as human **errors** from **fatigue** or **inadequate training**;
- • **Lack** of **strong occupational and industrial health expertise** or **functioning emergency medical systems**

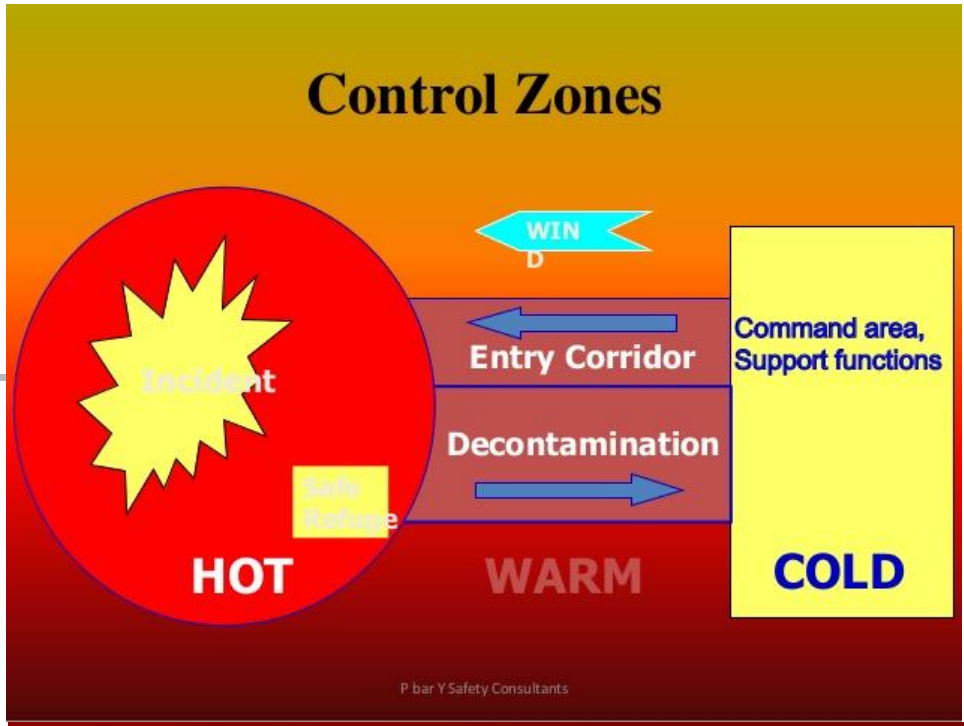
5. Chemical disaster procedures

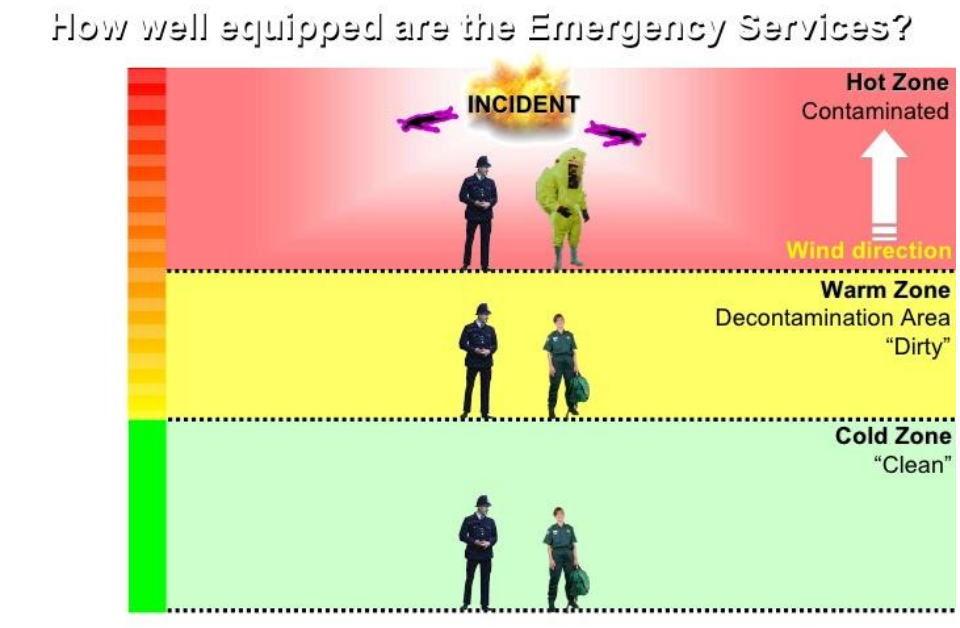
Chemical disasters pose some unique problems:

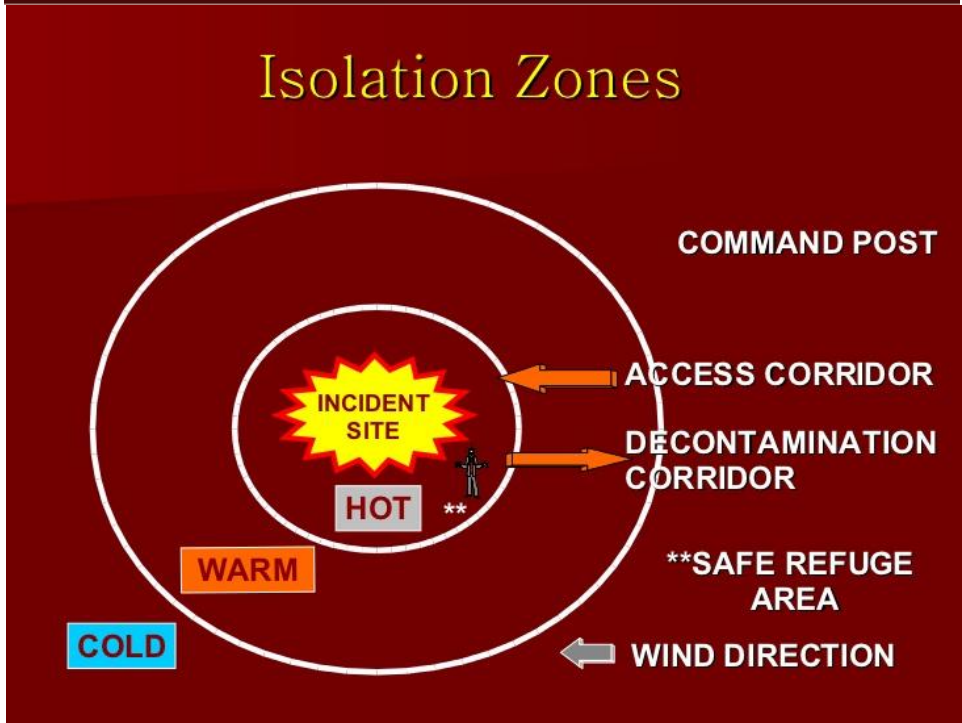
- Substance identification is important prior to a massive rescue effort.
- On-site decontamination procedures are essential for both victims and emergency medical services personnel.
- On-scene separation of **hot**, **warm**, and **cold** zones will facilitate safe initial responses to the injured.
- Protective clothing may be essential for those involved in rescue and triage procedures.


Security boundary/
crowd control line
Decontamination line
Hot line
Command
post
Decontamination
corridor
Hot zone
Incident
Access
control points
Medical
transport
Warm zone
Cold zone
Wind direction

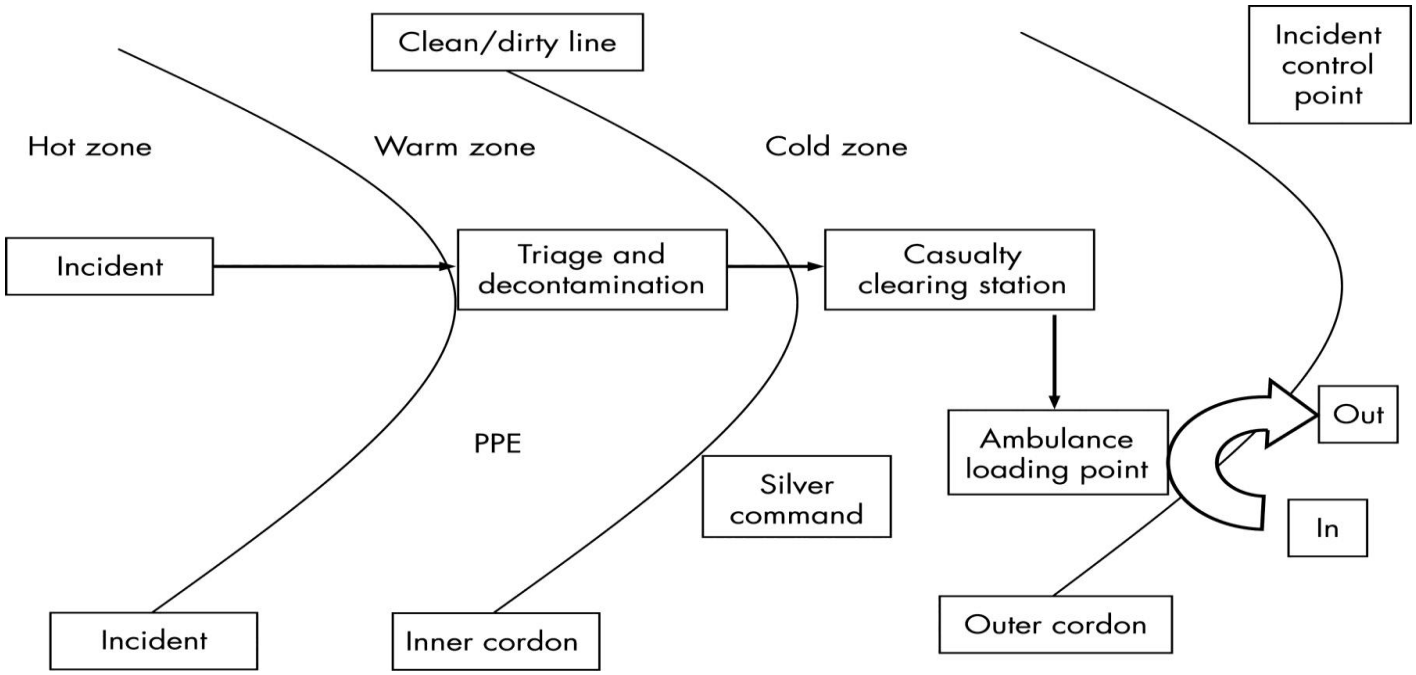

Cold zone
Warm zone
Hot zone
Decontamination area
Command Center / supporting unit
Wind direction


Control Zones
WIN D
Entry Corridor
Command area, Support functions
Incident
Decontamination
HOT
WARM
COLD
P bar Y Safety Consultants


How well equipped are the Emergency Services?
INCIDENT
Hot Zone
Contaminated
Wind direction
Warm Zone
Decontamination Area
"Dirty"
Cold Zone
"Clean"


Isolation Zones
COMMAND POST
ACCESS CORRIDOR
INCIDENT SITE
DECONTAMINATION CORRIDOR
HOT
**
WARM
**SAFE REFUGE AREA
COLD
WIND DIRECTION

Medical HAZMAT site plan.



Treatment of a chemical, biological, radiological and nuclear (CBRN) incident in the "Hot Zone".

CBRN emergency trauma management

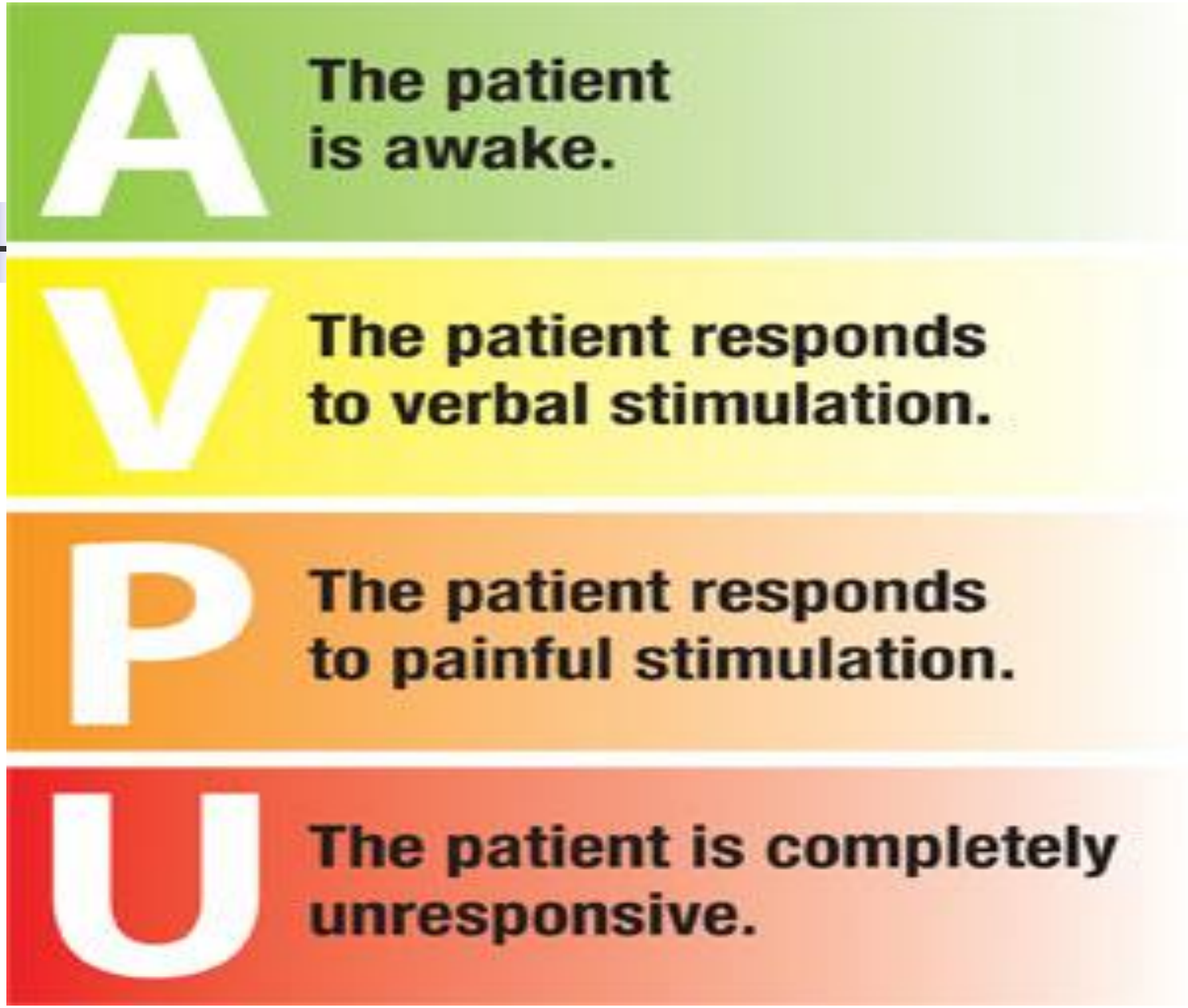
M – control of massive haemorrhage

A – airway and antidote

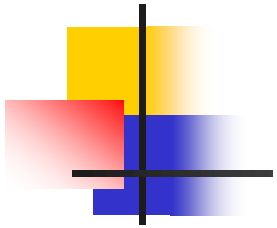
R – respiratory protection and oxygen

C – circulatory system management

H – head (CNS assessment AVPU and pupils)


A
The patient is awake.
V
The patient responds to verbal stimulation.
P
The patient responds to painful stimulation.
U
The patient is completely unresponsive.

Proposed “Hot Zone” treatment plan.



Hot zone	Warm zone		Cold zone clean/dirty line
Medical recce Triage MARCH IV/IO antidote	Triage Essential trauma interventions with antidote (oxygen atropine diazepam amyl nitrite)	Decontamination Continued medical care with antidote	Continued medical care and transfer to definitive care

5. Chemical disaster procedures

- **Ambulances and other vehicles removing the injured require decontamination procedures.**
- **Hospitals require a triage area, a separate decontamination area, and separate entrance.**
- **Transport vehicles may require placards to indicate the type of chemical contamination involved.**
- **Mass evacuation of the population should be considered.**

Prevention and control measures

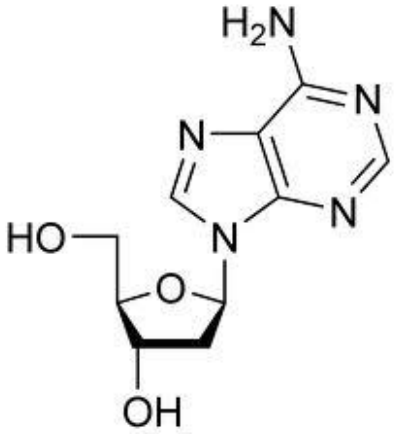
1. Hazard identification

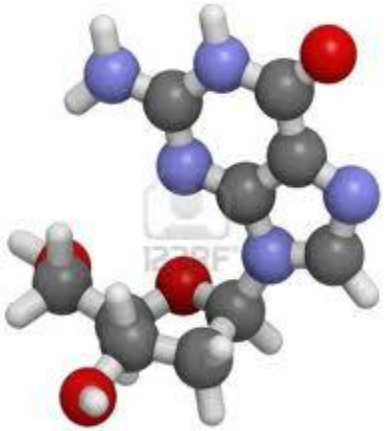
This process, called **hazard identification**, requires **identifying all chemical products** that are **stored, manufactured or transported** by local industry and that might affect the community in the event of an industrial disaster.

It is necessary to detail:

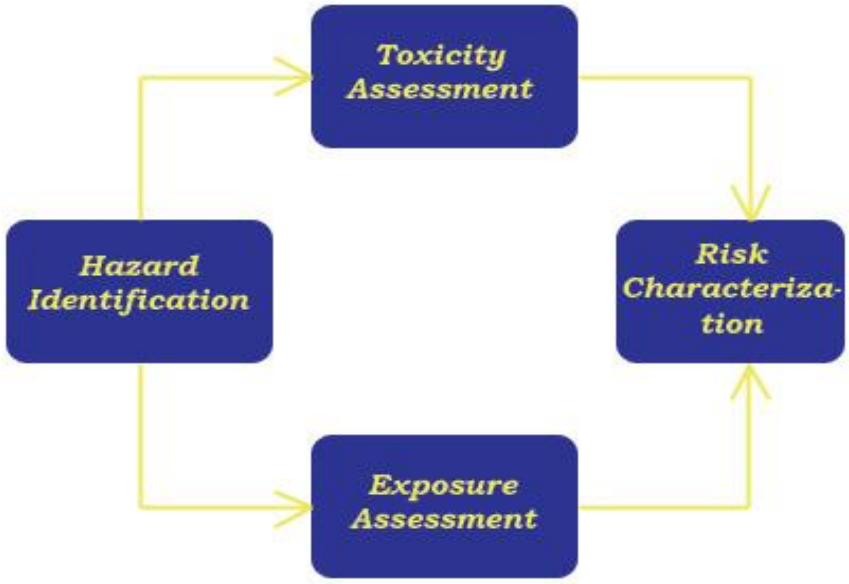
- the **physical characteristics** of the chemical agent;
- the **expected health effect** associated with human exposure;
- the **information** on **chemical reactions** and **hazard-neutralization strategies**.

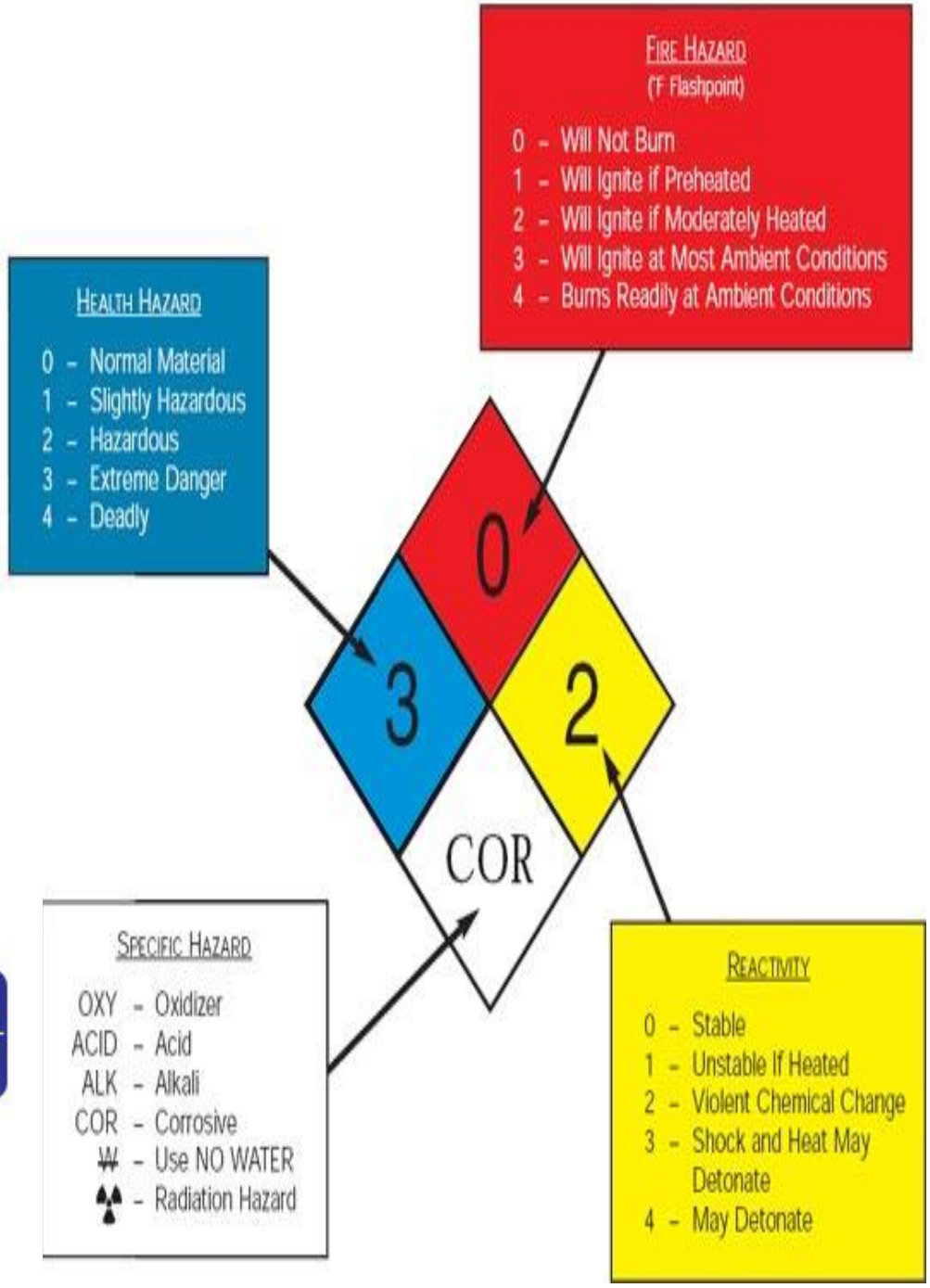
- A chemical substance is a material with a definite chemical composition.
- New chemicals are being discovered daily & at last count there are about 30 million chemical compounds






SAFETY RESPONSIBILITY
DEPENDS ON EVERYONE


Toxicity Assessment
Hazard Identification
Risk Characterization
Exposure Assessment

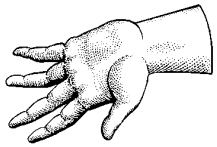

FIRE HAZARD
(°F Flashpoint)
0 - Will Not Burn
1 - Will Ignite if Preheated
2 - Will Ignite if Moderately Heated
3 - Will Ignite at Most Ambient Conditions
4 - Burns Readily at Ambient Conditions
HEALTH HAZARD
0 - Normal Material
1 - Slightly Hazardous
2 - Hazardous
3 - Extreme Danger
4 - Deadly
0
3
2
COR
SPECIFIC HAZARD
OXY - Oxidizer
ACID - Acid
ALK - Alkali
COR - Corrosive
W - Use NO WATER
- Radiation Hazard
REACTIVITY
0 - Stable
1 - Unstable If Heated
2 - Violent Chemical Change
3 - Shock and Heat May Detonate
4 - May Detonate

Chemical Agent Detection

- Some can be seen

- Some can be smelled

- Some can be tasted
- Most can be felt (e.g. burning sensation, choking)



- *All can be detected by appropriate instruments*

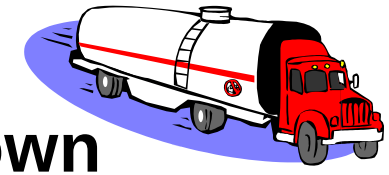
Types of Chemical Agents

Some chemical agents are persistent, many are not persistent

Persistent chemicals

- **remain on surfaces without evaporating or breaking down for more than 24 hours**
- **can remain for days to weeks**

Non-persistent chemicals



- **quickly evaporate and break down**
- **carried in bulk on commercial carriers**

Types of Chemical Agents

Chemical agents are commonly classified by the type of harm they cause.

1. Nerve Agents – **disrupt nervous system, causes paralysis, fatal quickly**
2. Blister Agents – **destroy skin and tissues, cause blindness, may be fatal**
3. Choking Agents – **lung fills with fluid, cause choking, quick or delayed fatality**
4. Blood Agents – **interferes with oxygen at the cellular level, fatal quickly**
5. Riot-Control Agents – **skin and breathing irritations, rarely fatal**




Exposure Pathways

Typical exposure path varies with chemical type

++ Typical path + Possible path -- Unlikely path

Chemical Agent	Pathway		
	Inhalation	Ingestion	Skin or Eye Contact
Nerve	++	+	+ +
Blister	+	--	+ +
Choking	+ +	--	+
Blood	+ +	--	--
Riot-Control	+ +	--	+ +

Chemical Agent Effects and Treatment

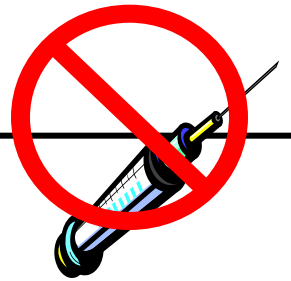
Chemical agents may be solid, liquid, or gas.

HEALTH EFFECTS

- Disorientation
- Dizziness
- Nausea
- Blindness
- Serious Injury
- Immobilization
- Death

MITIGATION

1. Minimize exposure:
   - Avoid chemical cloud
   - Cover face to filter breathing
2. Get medical attention:
   - Skin decontamination
   - Antidote



Some have no antidote!

2. Vulnerability analysis and risk assessment

Vulnerable populations may be:

- **people with disabilities;**
- **children** attending school;
- **patients and medical personnel** working in nearby hospitals.

3. Emergency preparedness includes:

- **arranging medical care and proper referral destination** for patients exposed to hazardous materials
- establishing **warning systems to alert** nearby communities of a chemical release
- **determining minimal threshold concentrations** of toxic chemicals that would require the community **to evacuate** in the event at a chemical release

  · An **accurate** and **timely information** is also necessary regarding to:

- **physical properties** of **chemical agents** and their **clinical effects**
- **information** on proper **chemical neutralization** and **plume-dispersion estimation models**
- **appropriate antidotes for victims and their proper administration**

3. Emergency preparedness

- **To protect industrial workers** and **emergency responders** it is necessary to require:
  - **personal protective equipment**
  - **respirator to protect the airway**
  - **protective measures for the skin and the eyes**
- **For entering** an environment where the extent of the **chemical hazards is not fully known** is generally recommended:
  - **chemical-resistant clothing, boot and hood**
  - **double-layered chemical- resistant gloves**
  - **positive-pressure self-contained breathing apparatus**


SCOTT
22
SCOTT

RESCUE SERVICES OF THE COMMUNITY

The relief during disaster is organized at **local, regional and national levels**.

The services of **local and regional level** are:

- **the fire brigades**
- **the Police**
- **the health services**
- **the major industries**

At **national level** operate:

- **Red Cross**
- **The National Police Force**
- **The Civil Defense**

The **Ministry of Health**, the **Armed Forces** also play important role. The purpose of the **Civil Defense** organization is to conduct activities in **prewar and wartime**, but it may also be called upon in **major disasters** during peacetime.

At higher level there are international **relief organizations** such as:

- **The International Civil Defense Organization**
- **The United Nations Disaster Relief Organization**
- **The International Committee of the Red Cross and Red Crescent**
- **The World Health Organization**