

CBRNE Emergency Preparedness for Major Sports Events: Medical Prospective.

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Type of Chemical Incidents

- Transportation (road) accidents
- Fire and explosions
- Industrial incident (destruction of assets and massive release of toxic substances)
- Hazard materials release
- Targeted facilities during conventional conflicts or as a target of prohibited activities
- Flooding or Earthquake triggering chemical disaster/incident

Chemical Incidents

- Chemical incidents : Can be Either
 - Accidental
 - or
 - Deliberate

Accidental Chemical Incidents

- Typically, number of casualties is large, being distributed over relatively wide geographical terrain.
- Occur as a side effect of other incidents including transport, storage and handling of chemicals, such as traffic and natural incidents.

E.g. Bhopal, India 1984 incident with Methylisocyanate cloud = phosgene + isocyanate more than 5000 dead and 200,000 injured

Deliberate Chemical Incidents

- Deliberate incidents include:
 - Use in wars.
 - Acts of terrorism.
 - Chemical agents do not have the same destructive effects.
 - The effects of chemical weapons are much less than conventional weapons.

Chemical Weapons Agents Commonly Used in Industry:

- **Cyanides (metal plating)**
- **Isocyanate (the cause of the Bhopal, India disaster)**
- **Phosgene**
- **Chlorine**
- **Arsenic (pressure-treated wood)**
- **Organophosphates**



War

- Direct attack or collateral injury

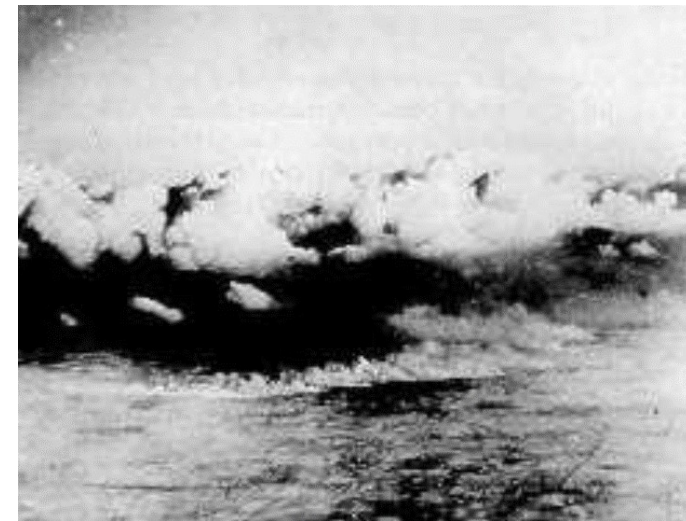
Chlorine

Sulfur mustard

Nerve agents



French gas attack on German lines,
Belgium, 1916



Weapons of Mass Destruction (WMD)

- These are agents discovered and developed during the twentieth century for military use, being collectively known as Weapons of Mass Destruction (WMDs) which had a considerable role in major wars (WWI and WWII).
- Include chemical, biological and radiological weapons.
- Are capable of causing large number of casualties, social panic and property loss, making them a continuous security nightmare for governments and nations worldwide.

Chemical Weapons: Types

Lethal agents:

Nerve agents

Vesicant agents

"Blood" agents

Choking agents

- Lead Increase Mortality

Non-lethal agents:

Vomit agents

Tear gases

Pepper spray

- Panic and Chaos

Classification of Hazardous Chemical Substances

Class	Examples
Physical Incapacitating Agents	CS DA
Psychiatric Incapacitating Agents	LSD BZ
Assault Agents	Opiates Tranquilizers
Combat Agents (CWAs)	Nerve agents Vesicants Pulmonary Agents Cyanides
Toxins	Botulinum Ricin Streptococcal toxins
Poisons of Heavy Metals	Arsenic Mercury Thallium Uranium

Factors Governing the Consequences

Hazardous chemicals do possess four major criteria in common:

- **Toxicity:** the ability to harm organs and tissues, and it increases with increasing dose
- **Latent period:** the time that elapses from exposure to appearance of signs and symptoms, and the lower the dose, the longer it lasts
- **Persistence:** the time during which the chemical agent continues to cause harm. It depends on its nature and concentration.
- **Transmissibility:** contaminating “clean” individuals and properties, either through contact or evaporation (gassing-off)

Factors Governing the Consequences

- Toxicity and Latent period **determine the nature and degree of treatment needed.**
- Persistence and Transmissibility **determines the protective and preventive measures needed to avoid contamination and ensure proper decontamination of casualties and location of the incident.**



Types of CBRNE Events

- **By advance notice:**
 - Advance notice sufficient for organized response
 - Advance notice sufficient for gate control
 - No advance notice
- **By type of agent:**
 - Known vs Unknown
 - Persistent vs Non-persistent
 - Dangerous (requiring protection) vs Non-dangerous

CBRNE Incidents during Mega Events:

Can be :

- Single attack against a given target :
Usually Anticipated.
- Multiple attacks against various places/targets:
Usually Random in a city hosting a mega event.
Non-anticipated.
- In both settings:
One or more CR agents can be released with or without explosives.

Challenges in Response Planning to CBRNE incidents in Mega Events:

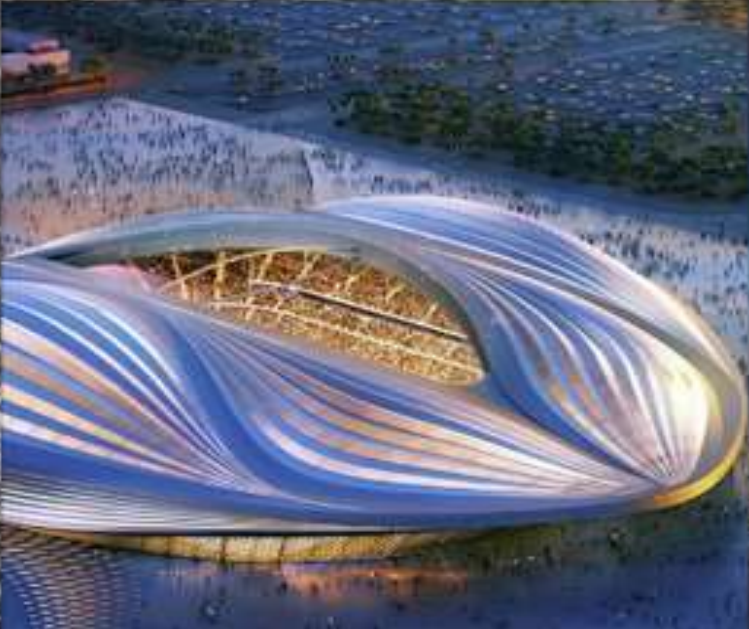
In many occasions Planning depends on assumptions / speculations because safety and security plans are top secrets in mega-events with restricted access.

General Planning might include the following:

- Traffic Control / Ban (Restrictions of car area; Traffic deviations; free emergency lanes to nearest hospitals; etc.)
- Deployment of different Emergency Services (both conventional and CBRNE/HAZMAT) around the stadium.
- Deployment of Decontamination facilities around the stadium.
- Ensure proper full PPE for all Emergency Services staff .
- Deployment of Ambulance Services response to the scene .
- Deployment of MCI units with support equipment.

General Planning might include the following:

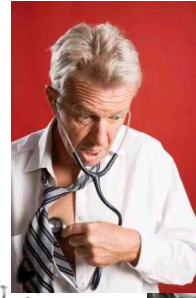
- Deployment of the Civil Defense with different types of engines and specialized equipment.
- Pre-set assembly points for rescue vehicles and additional mass transportation vehicles.
- Incident Command vehicles
- Notification of hospitals and other health facilities.
- Armed Forces set in alarm status (before-during-after the events)



Crowd behavior



Crowd behavior

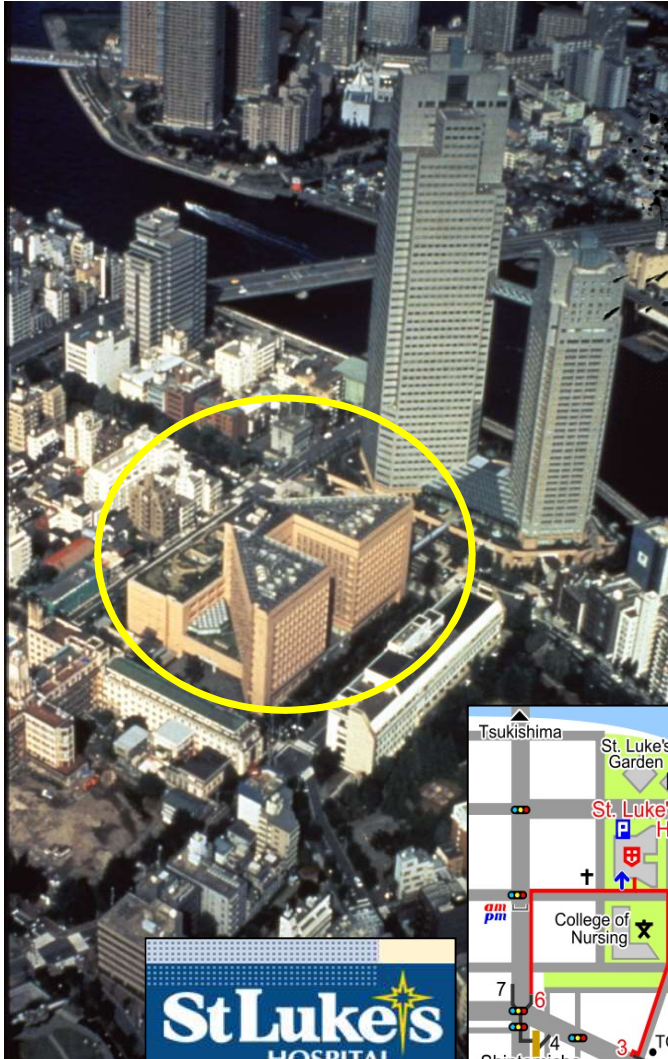


1:5


80%



Crowd behavior



How did the Sarin **victims** arrived at St. Luke's Hospital?

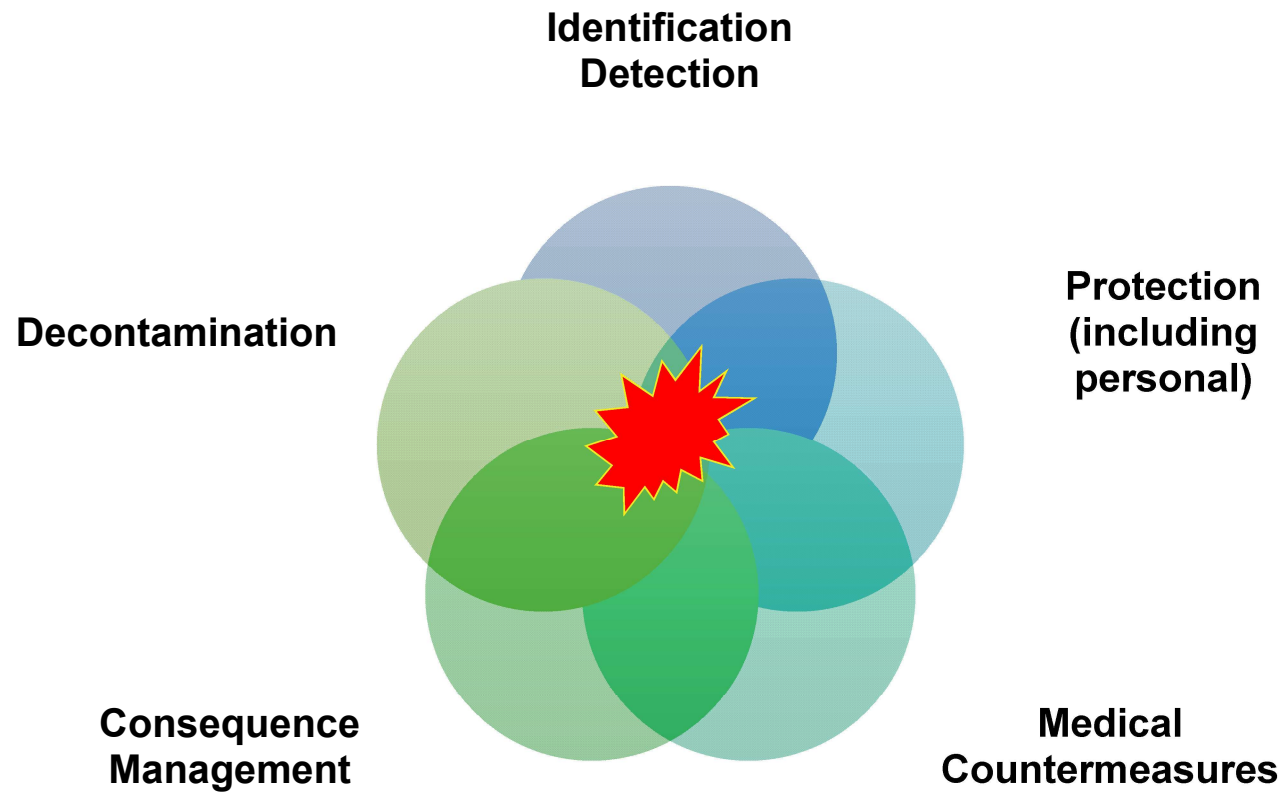
Transportation	Number	Percentage
640		
 Ambulances	64	10%
Minivans of Fire Defense Agency	35	5.5%
Non-medical vehicles	541	84.5%



~6.000 victims

169 hospitals & clinics

Complexity of Response to Chemical Incident



RESPONSE PRIORITIES

- **Rescue of people and save their lives**
- **Protect sources of water and food supply**
- **Protect installations and properties**
- Protect environment
- Prevent escalation of the incident
- Rapidly restore normality
- Facilitate enquiries

Planning Principles: Specific to Chemical incidents

GATHERING INFORMATION:

Databases should be established for hazardous sites.
contents of transportation (e.g. containers or ships).
chemical information.
health care resources.
emergency contact information.

PREPARATION OF A CHEMICAL INCIDENT RESPONSE PLAN:

Existence of a response plan is a key factor in the timely response to a chemical emergency.

COMMUNITY IMPACT ASSESSMENT:

Scenario setting
Exposure pathways
Population vulnerability assessment
Health impact assessment
Evaluation

Planning Principles: In Response

INCIDENT COMMAND.

COMMUNICATION:

Inter-agency communication

Risk and crisis communication – information and public warnings

BUILDING HUMAN CAPACITIES (TRAINING & EXERCISES)

Environmental chemistry.

Common symptoms associated with chemical exposures.

Toxicology.

Risk & exposure assessment.

Emergency actions & procedures to reduce risk to responders & the public.

Proper use & limitations of PPE.

Sampling.

Key components of a control system for a major chemical hazard.

Risk communication techniques.

Local chemical sites etc.



Toyko Sarin Attack

Actions in priority

- In a chemical incident, the actions in order of priority are:

Containment

Decontamination

Resuscitation

Primary treatment and

Definitive care

The Structural Approach to Chemical Incident in the Pre and Post Hospitals and Health Facilities





Combined Emergency Service Response Priorities



Systematic Approach at the Scene

- Command and Control
- Safety
- Communication
- Assessment
- Triage
- Decontamination
- Treatment
- Transport

**Different services
have different roles in
a combined response**

CSCATDTT

Responsibilities at the Scene : Specific to Medical Services

Assessment

- Medical scene assessment
- Hazard assessment

Triage

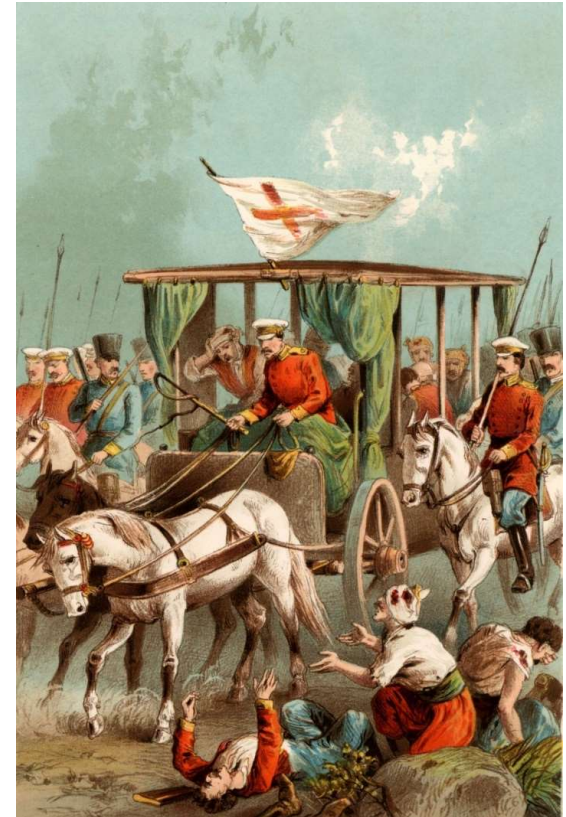
- Dynamic triage sieve
- Dynamic triage sort

Treatment

- Life-saving first aid
- Advanced life support
- Casualty clearing station

Transport

- Packaging
- Provision
- Ambulance circuit
- Documentation



Key Principles of Command and Control

- Previous determination of the system of appointment of the commander and other key positions.
- All emergency services share a common system of command during the incident.
- All emergency Services should adopt a unified command system previously agreed upon during Major Incidents to avoid adverse consequences.
- Usually the most experienced member in the emergency services.
- Establish coordination between the various emergency services.

Control of the scene : Containment

Control of the scene is achieved by:

- Establishing different response areas.
- Identifying and controlling points of entry and exit.
- controlling the movement of individuals into & out of the area of chemical contamination.
- Reducing the possibility of spread of contamination.



Initial Response

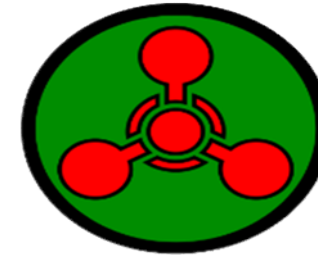
- Identifying the **safe distance**.
- Identification of the **source of danger**.
- **Limited access** and prevention of driving through the spilled material.
- Immediately **report the potential contaminants** to their base control.
- Rescue of victims done only by specially trained persons, with appropriate **(PPE)**.



Toxic Hazard



Radiation Hazard



CWA Hazard



Biological Hazard

Assessment of the Scene

- Type and nature of the incident.
- The scientific and trade name of the chemical material .
- Potential risk from exposure to contamination.
- The number of casualties.
- The symptoms & signs, nature of injuries.
- Suspected routes of exposure, if possible.
- The risk of secondary contamination.
- The required level of protection by personal protective equipment.
- The need for decontamination and its level necessary.
- The safe distance from the chemical material.

Activating the Chemical Incident Plan and Notification

- Emergency services
- The receiving Emergency Department /Hospitals.
- Public Health Department.
- National Poisons Information Service.
- Environment Agency.
- Local water authority (mains and waste water may have separate providers)

Personal Protective Equipment:

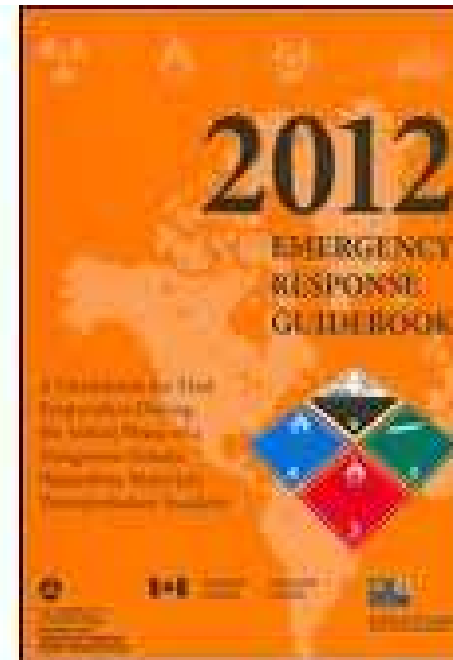


خدمة الإسعاف
Ambulance Service



Identification of Chemical Agents

- An attempt should be made to identify the agents involved with help of concern Local agents e.g. MOE , Civil Defense Etc.



Critical Message Structure

METHANE

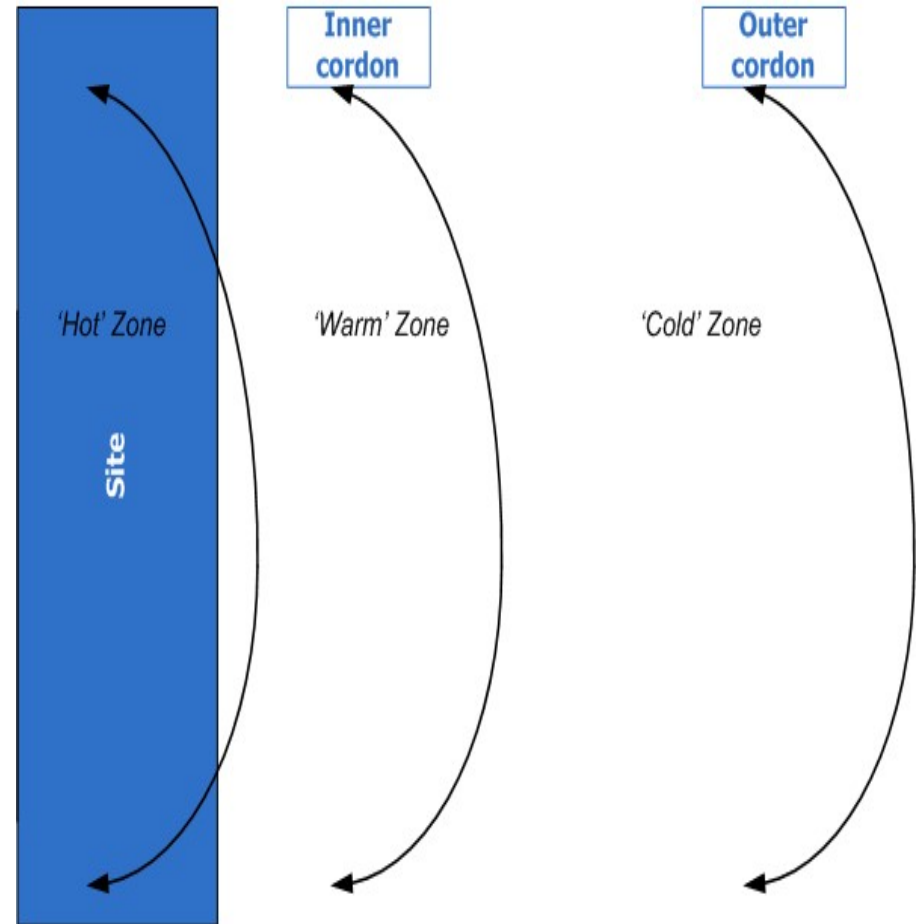
- M** Major incident STANDBY or DECLARED
- E** Exact location (grid reference)
- T** Type of incident
- H** Hazards, present and potential
- A** Access, and egress
- N** Number and severity of casualties
- E** Emergency services, present & required

Zones of the Scene

Hot zone is the contaminated area of initial release or spread

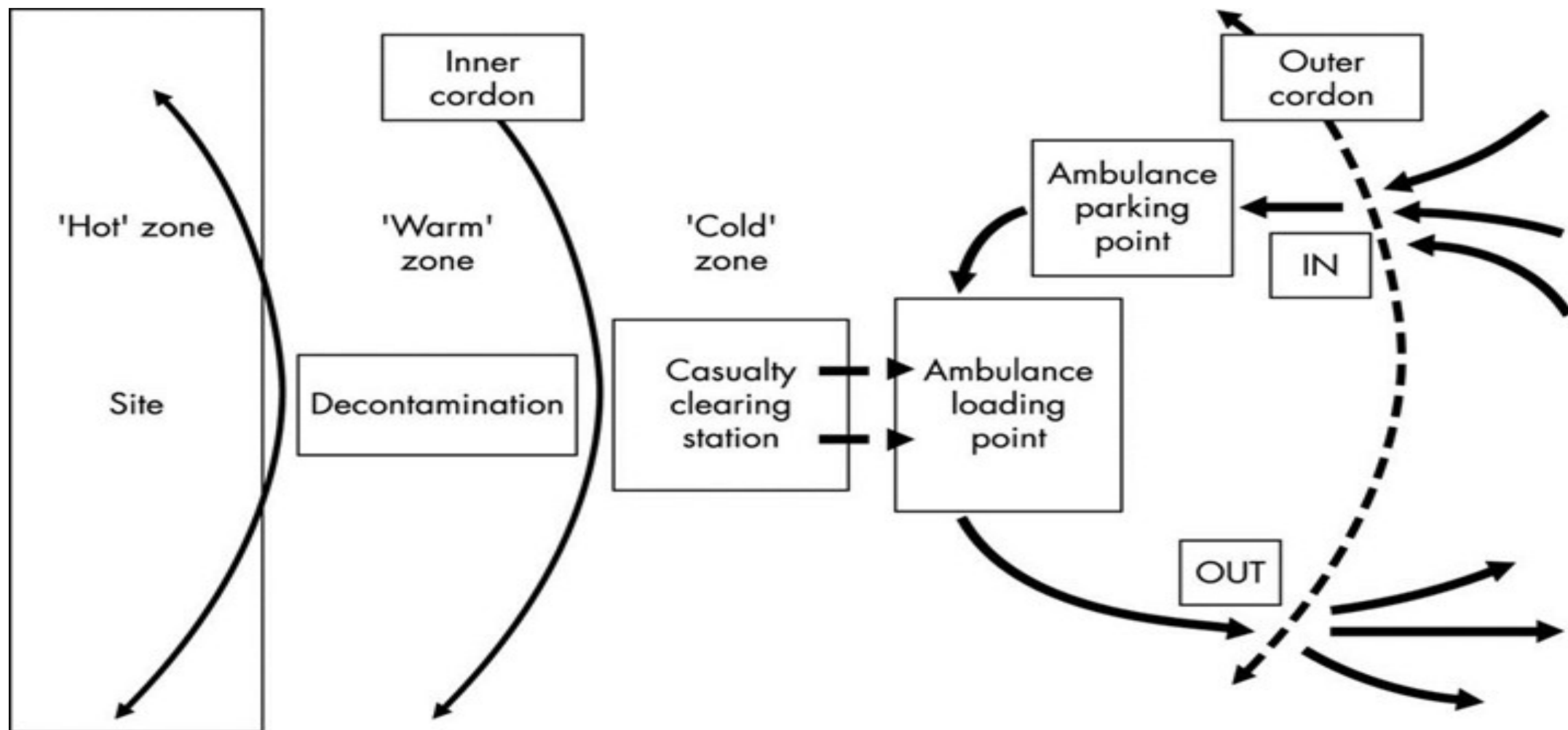
Warm zone is the area which becomes contaminated by the movement of people

Cold zone is the uncontaminated area between the outer and inner cordons





Scene layout in chemical incidents





Safe Refuge Area

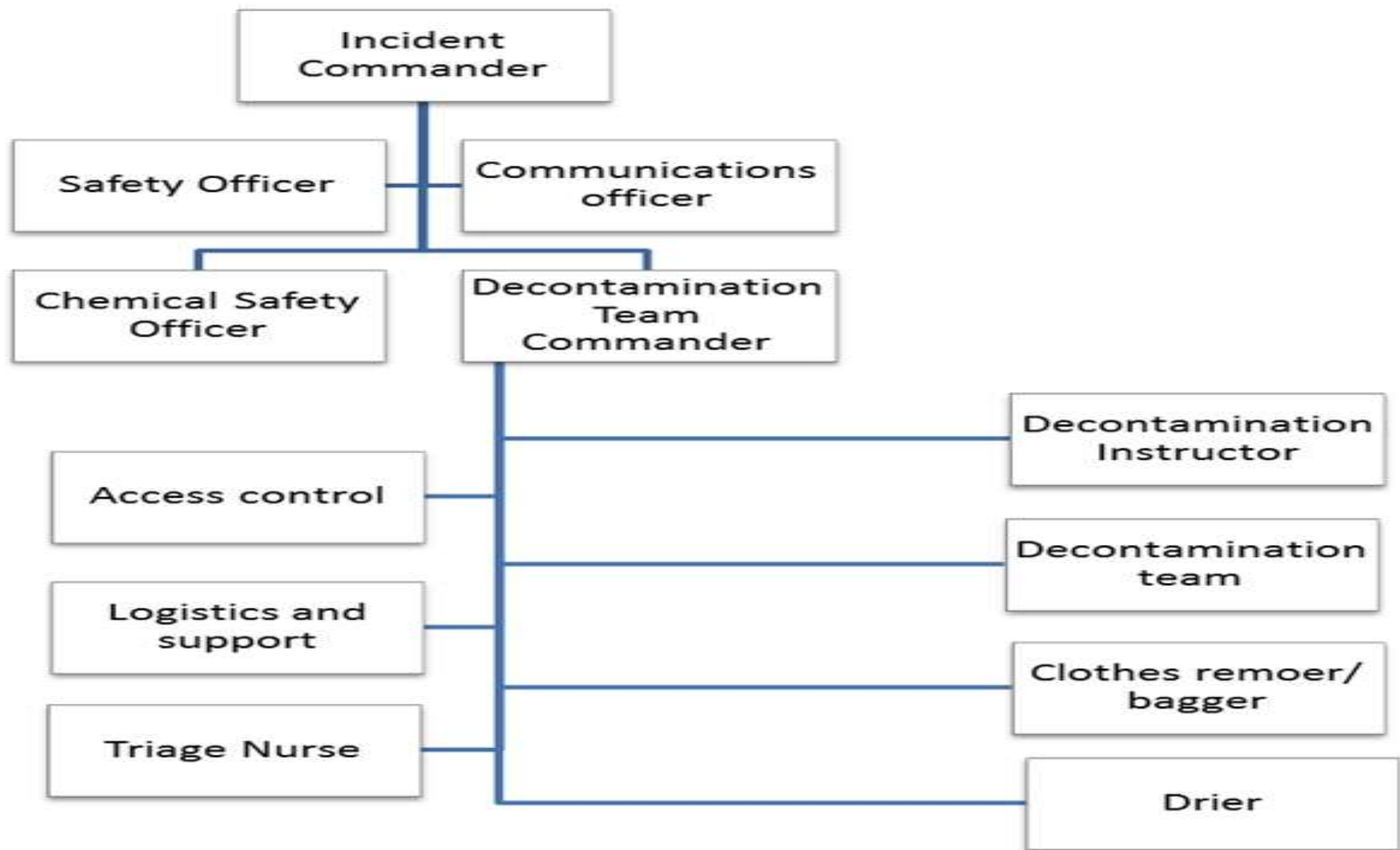
- Patients must be gathered at **safe point in the hot zone** waiting to undergo decontamination.
- To control the contamination in a safe place inside the hot zone rather than spreading it by the movement of personnel or people between different regions.
- These points are away from the risks and the leakage of chemicals in spite of its presence in the hot zone.
- It is preferred to identify this region by police cones if possible.





Crowd Control Line

It is preferred to establish a control line to prevent access of bystanders and public. This can be achieved by putting a green bar around the cold zone which prevents the entry of any individual who does not belong to any of the emergency services to the scene.



Decontamination

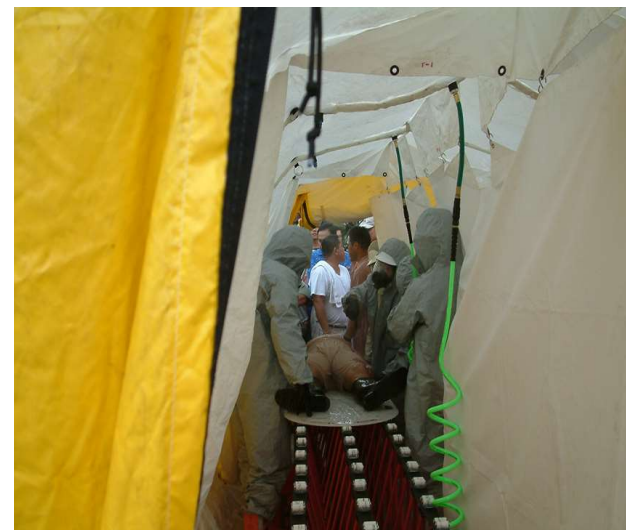
- The decontamination facilities are usually set up at the outer edge of Hot Zone or in the Warm zone. The sooner the victim is decontaminated, the sooner he can be transferred to the Cold zone for further evaluation and treatment.
 - To prevent further exposure of victims to hazardous materials.
 - The medical personnel present should be dressed in appropriate PPE and avoid secondary contamination.
 - An effective decontamination can be achieved by removing the patient's clothing and washing with soap and water.
 - To reduce the contamination to a level that is not a threat to the patient and the medical personnel
 - The run-off from the decontamination process can be collected by a proper container that allow for safe disposal and further analysis if necessary.

Decontamination

**Incident
commanders will
decide whether
Decontamination is
necessary**



Decontamination



Treatment





- Usually begins in the warm zone at the scene.
- Treatment is may begin in the hot zone in some extreme conditions simple airway opening maneuvers and bleeding control.
- A Poison Control Centre should be available to provide advice on antidote treatment.





**CBRNE Planning
in
HOSPITALS**

Hospital CBRN Planning

Access Control	Hard	Mobile	Distance from incident site
Security personnel	   		
CBRNE Response Plan			
Exercises/drills			
Medical personnel			
Establishments			
Equipment			
Morgue facilities			
Aftermath decontamination			



Hospital CBRN Planning

Access Control

**Security
personnel**

Police support

CBRNE
Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue
facilities

Aftermath
decontamination



Hospital CBRN Planning

- Access Control
- Security personnel
- CBRNE Response Plan**
- Exercises/drills
- Medical personnel
- Establishments
- Equipment
- Morgue facilities
- Aftermath decontamination

Small, flexible, realistic, updated, anthropocentric

Plan is nothing! Planning is everything!



Hospital CBRN Planning

Access Control

Security personnel

CBRNE Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue facilities

Aftermath decontamination

Table-top

Field (day/night)

Between hospitals

Local & Regional

International



Hospital CBRN Planning

Access Control

Security personnel

CBRNE Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue facilities

Aftermath decontamination

Motivation

Education

Continuous training

Fixed or Deployable

ALL medical specialties will be involved

Ignorance generates fear

Training leads to excellence



Hospital CBRN Planning

Access Control

Security personnel

CBRNE Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue facilities

Aftermath decontamination



Decon facilities:
Fixed or deployable?

Collaboration with
local fire service

Radiation rooms
Isolation rooms



Hospital CBRN Planning

Fencing

Security personnel

CBRNE Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue facilities

Aftermath decontamination



PPE: "B", "C", PAPR*

Medical:
Usual – Critical – CBRN

Communications

Stockpile:
Medical – CBRN



* Powered Air Purifying Respirator

Hospital CBRN Planning

Fencing

Security personnel

CBRNE Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue facilities

Aftermath decontamination



Fixed Deployable



Hospital CBRN Defense

Fencing

Security personnel

CBRNE Response Plan

Exercises/drills

Medical personnel

Establishments

Equipment

Morgue facilities



Sensitive electronics



Aftermath decontamination

Outside surfaces

Interior

Ground

Vehicles

Equipment:
Normal – Sensitive

PPE

Hospital Response to Chemical Incidents: Challenges

- Need special preparations in hospital plans.
- Is the hospital will be responding or receiving one.
- Exposed to danger of contamination.
- Shortage of staff and insufficient drugs, equipment, and medical supplies.
- No forewarning to this type of incidents in most cases.
- An urgent need for protective equipment, decontamination and isolation of patients.

Hospital Response

Major tasks in this phase is preparation of key areas and reception of the first influx of victims.

Tasks:

- Notification / Declaration Plans
- Plan Activation
- Command and Control
- Surge Capacity
- Establishing Main Areas
- Contamination Containment
- Supplies Staff Needs
- Documentation and Patient Tracking
- Relatives and Families
- Volunteers
- Early Recovery

Agent Identification

- During the chemical incident, the chemical agent must be identified, either through **clinical manifestations, or using special detection devices.**
- The evidences that support preliminary diagnosis of a chemical injury are:
 - Strong odors
 - Unknown liquids on the body
 - Respiratory complaints
 - Eye and mucous membranes complaints
 - Chemical burns
 - Neurological complaints

Agent Identification (cont.)

To identify the agent, it will be helpful to acquire data on the following points:

- The physical state of the material
- Affected parts of the body
- Effect of the hazardous material on the functions of the body .
- Severity of the injury
- Time course of the symptoms

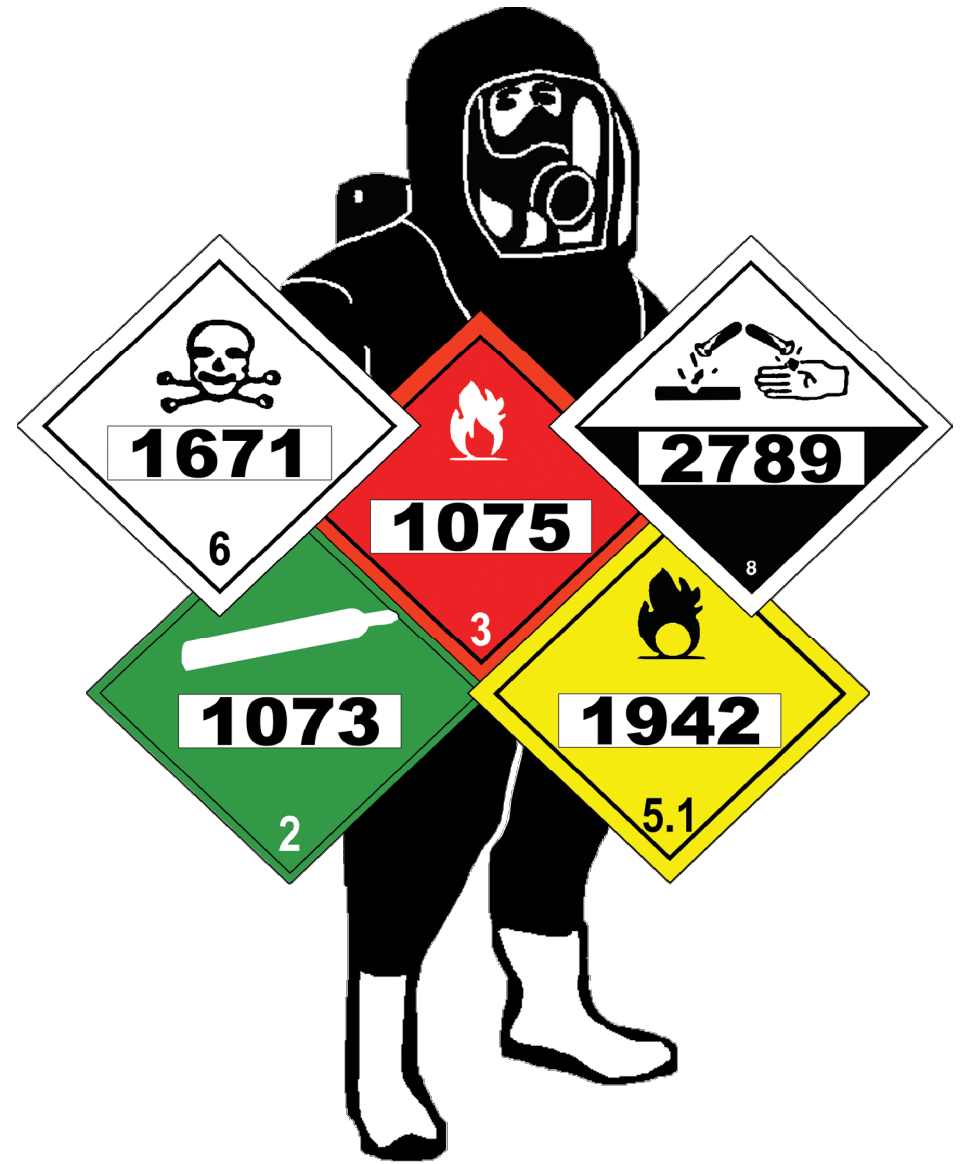
Treatment

- Some patients will require treatment with antidote, yet **the majority will need only symptomatic treatment.**
- **Decontamination, Antidotes and Oxygenation makes up the main lines of treating chemically contaminated casualties.**
- The most important therapeutic element in chemical incidents is decontamination.
- Antidotes are powerful tools only when the agent is recognized and the antidotes are readily available.

Medications and specific equipment:

- Nerve agent meds:
 - Atropine
 - Pralidoxime
 - Scopolamine
 - Benzodiazepines
 - Eye drops
 - β 1 agonist, inhaled
- Cyanide meds:
 - Na nitrite
 - Na thiosulfate
 - Bicarbonate
- Mustard:
 - Burn care meds and dressings
 - Eye drops
 - β 1 agonist, inhaled

THANK YOU



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