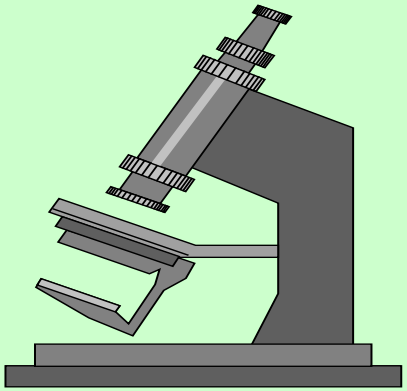
Technical aspects of chemical warfare defense



Lesson topic 4.1

Enabling Objectives

- ☆ Perform buddy aid and self aid procedures
- Select the treatments of chemical warfare agents
- Classify chemical agents by physical state, physiological action or tactical use
- Select the physiological symptoms of chemical warfare agents

Chemical Defense Terms, Classifications and definitions

- Hydrolysis
  - Decomposition in water
  - Formation of a new substance
  - Changes/dilutes
- Detoxification
  - Rate at which the body will counteract effects of a poisonous substance
  - Exposure time
  - Dose & concentration

Chemical Defense Terms, Classifications and definitions

- Persistence
  - How long the agent is effective after used
  - Physical properties
  - Volatility, gas, solid or liquid
- Weather conditions
  - Wind speed, heat, rain, etc.

Chemical Defense Terms, Classifications and definitions

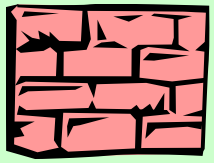
- dissemination
  - Explosive/nonexplosive munitions
- Percutaneous
  - enter through skin
- Non-percutaneous
  - respiratory tract, ingestion, injure the eyes but not the skin

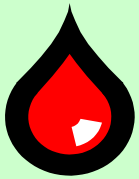
Chemical Defense Terms, Classifications and definitions

- Tactical use
  - How agents are used against personnel
- Physical State
  - stored or disseminated
- Physiological action
  - physical effect
- Cumulative
  - Repeated exposures (additive effect)

Chemical Defense Terms, Classifications and definitions

- Casualty agents
  - agents cause death or severe injury
- Incapacitating agents
  - agents Produce temporary physiological and/or psychological effects
- Physical state
  - Solid
  - Liquid
  - Gas or vapor





Chemical Agents

- Nerve
  - Tactical use
    - Casualty agent
  - Deadliest
  - GA, GB, and GD:
  - Agents for quick casualties
  - VX: Agents for delayed casualties

Nerve

- Dispersed
  - Artillery, mortar, rocket
  - Aircraft spray
  - Bombs/bomblets & missiles

Physical state

- GA
  - Colorless to light brown liquids
- GB
  - Colorless liquids, no odor in pure state
- GD
  - Colorless liquids, Fruity odor of camphor
- VX:
  - Amber colored oil

Persistency

- Disseminated in persistent & non-persistent form
- G Agents, Liquid form 1 - 2 days
- V Agents, 1 - 2 weeks, persistent

Physiological actions

- General Physiological action
  - Absorbed through any body surface
  - Impacts entire nervous system
  - Inhibits or blocks the action of cholinesterase
  - Results in a build up of acetylcholine
  - Must have an even balance of these two enzymes for the muscle system to function
  - Death due to respiratory failure

Physiological actions

- Mild symptoms
  - pinpointed pupils/blurred vision
  - Runny nose
  - Salivation/drooling
  - Difficulty in breathing
  - Excessive sweating

Physiological Actions

- Severe symptoms
  - Nausea & Vomiting
  - Cramps
  - Involuntary defecation & urination
  - Twitching & jerking of muscles
  - Headaches
  - Strange/confused behavior
  - Violent convulsions
  - Cessation of breathing, death

Nerve agent

- Rate of action
  - Rapid, death may occur within 15 minutes
- Rate of detoxification
  - Slight, body can detoxify slowly
  - Cumulative


AUTO–INJECTORS USED BY THE U.S. ARMED FORCES:
PRALIDOXIME CHLORIDE INJECTION
AtroPen® Auto-Injector
INJECTORS
TRAINING DEVICES
2
1
MARK I
NERVE AGENT ANTIDOTE KIT
NERVE AGENT ANTIDOTE
TRAINING KIT, MARK I

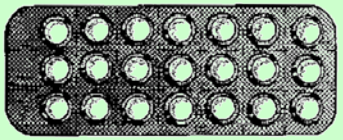
Nerve agent Pretreatment

- Nerve Agent Pyridostigmine bromide Pretreatment Tablet (NAPP)
  - 21 tablets
  - 7 day supply
  - 1 tablet every 8 hours
- Protects enzyme in the body from nerve agents
- Antidote enhancer

NAPP

- If you miss a dose, it will not be made up
  - Do not take 2 tablets at once
- Start over, 1 tablet every 8 hours
- Taking more than 1 tablet at a time does not provide additional protection
- It may be more hazardous if there is exposure to a nerve agent

(A) SAMPLE OUTER WRAPPER.


(B) SAMPLE PYRIDOSTIGMINE BROMIDE TABLETS.

NAPP OVERDOSE SYMPTOMS

- Abdominal cramps
- Nausea
- Diarrhea
- Occasional skin rash
- Weakness
- Dimmed or blurred vision due to pinpointed pupils
- If any of the signs occur; consult medical personnel

Nerve agent antidotes

- Atropine auto injector
  - Stored in cool, dry spaces
  - Carried in mask carrier when issued
  - Issued 3 auto injectors

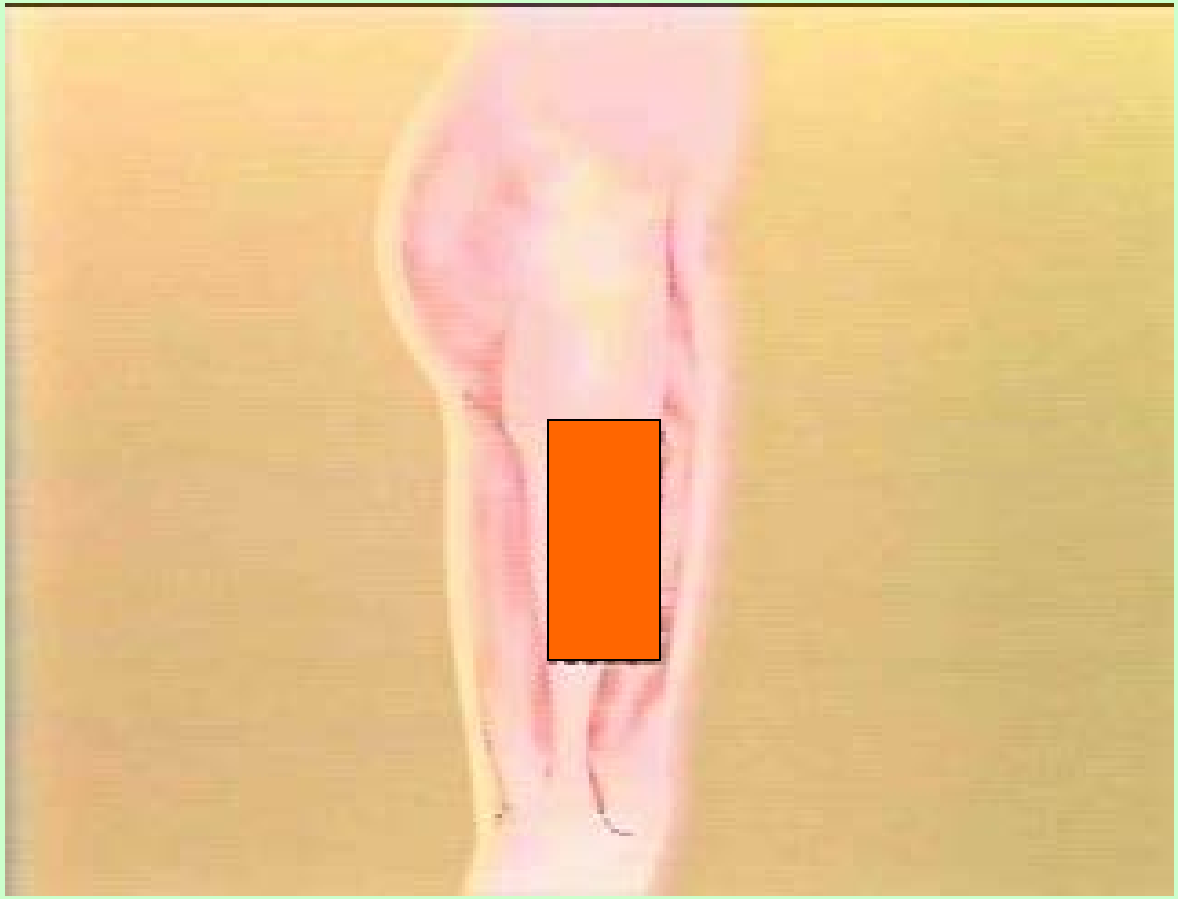
Antropine Injector

- Characteristics
  - Yellow end is safety cap
  - Green body with yellow stripes
  - Green end is injector end

Antropine Injector

- Administration
  - Remove the yellow safety cap & press the green injector end into the outer thigh
  - Hold for 10 seconds
  - Place used Auto injector in front smock pocket

Administration



Nerve agent antidotes

- 2-Pam Chloride, (Enzyme reactivation)
  - Gray ridged safety cap
  - Black end is injector end
  - Stored with atropine
  - 3 Auto injectors will be issued

2PAM Chloride

- Remove gray ridged safety cap
- Press black injector end to the outer thigh
- Same area as the atropine injection
- Hold for 10 seconds
- Place used Auto injector in front smock pocket

CANA

- CANA (Convulsion Antidote for Nerve Agents)
  - 10mg Diazepam
  - Black end is injector end
  - Gray safety cap
  - Ridges of the CANA injector distinguish it from other injectors
  - 1 injector issued
  - **Buddy aid only**

2 PAM Chloride & Atropine auto injectors

Chemical Agents

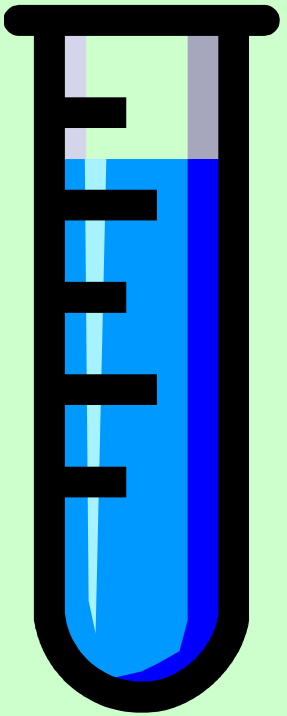
- Blister agents
  - Tactical use: casualty agent
  - Causes incapacitation
  - Death by infection
  - Could supplement nerve agents

Blister

- Main groups
  - Mustards (H)
  - Lewiste (L)
  - Phosgene oxime (CX)
- Dispersed by
  - Artillery, mortar, rockets
  - Aircraft spray
  - Bombs/bomblets

Physical state

- Most found as liquids
- Colorless to dark-brown
- Oily droplets
- Extremely persistent



Physiological actions

- Effect the eyes, the lungs & form blisters on the skin
- Eyes are more vulnerable than the skin
- Breathing passages very vulnerable
- Initially irritates cells
- Produces cell poisoning due to infections
- Symptoms vary depending upon agent

Mustards: H (Levinstein) HD (Distilled), HN (Nitrogen)

- No immediate pain
- Redness of skin will appear at the exposed areas only
- Occurs 4 - 6 hours after contact
- Thin skinned & warm moist areas are very susceptible
- Concentration of agent & exposed are important factors

Mustards: H (Levinstein) HD (Distilled), HN (Nitrogen)

- Eye exposure causes severe inflammation or damage
  - temporary or permanent
- Water filled blisters similar to burn blisters will appear within 1 - 2 days
- Healing time ranges from 3 - 8 weeks
- HD burns will heal more slowly

Mustards: H (Levinstein) HD (Distilled), HN (Nitrogen)

- Inhalation of mustard agents will damage the respiratory track which will then produce symptoms similar to those of choking agents (Discussed later).

Lewisite (L)

- Immediate pain upon contact
- Eye exposure will produce searing sensation
- **EYES MUST BE DECONTAMINATED IMMEDIATELY (WITHIN 1 MIN), OR PERMANENT DAMAGE MAY OCCUR**

Lewisite (L)

- Reddening of exposed skin areas will occur within 30 min
- Blisters will form in approximately 12 hours with skin burns much deeper
- If inhaled, injuries & symptoms similar to choking agents will occur
- Death may result within minutes

Phosgene Oxime (CX)

- Immediate pain on contact (bee sting)
- Irritation to eyes & nasal membranes
- Exposed skin bleaches in 30 seconds & will later be surrounded by a red ring/welt
- Bleached areas darken in 24 hours
- Scab formation occurs after 1 week
- Healing time, 2 months

Rate of action

- Little or no pain at the time of exposure with most blister agents
- Lewisite (L) & phosgene oxime (CX) cause immediate pain on contact
- All blister agents react almost immediately

MUSTARD AGENT

Rate of detoxification

- Extremely slow, Effects are cumulative
- Self aid/Buddy aid
  - Don mask & clothing
  - Liquid contamination must be washed from the eye immediately
  - After 2 minutes, treatment is of little use

Choking Agents

- Phosgene (CG) & Diphosgene (DP)
  - Tactical use: Casualty agent
  - Used extensively during WW-I accounted for 80% of all fatal chemical agent casualties
  - Much less effective than nerve agents, but may be used for quick incapacitating effects

Phosgene (CG)

- Most dangerous member of the group
- Physical state
  - Normally found as a colorless gas
  - Odor, new mown hay, grass, or green corn

Physiological action

- Penetrates lungs causing them to fill with fluid
- Permanent lung damage
- Effects are confined to the lungs

Symptoms

- Uneasiness & fear
- Serious attacks of coughing producing large quantities of white/yellow or bloody frothy fluid
- Nausea, vomiting & gastric pain
- Breathing is quick, shallow & painful

Symptoms

- The pulse is fast and faint
- Shock followed by death through cardiac arrest or asphyxia
- "Dry-land Drowning"

Choking Agents

- Rate of action
  - Immediate or delayed
- Rate of detoxification
  - Not detoxified; cumulative
- Self aid/Buddy aid
  - Don protective mask

Blood Agents

- Tactical use: casualty agent
  - High concentration to cause death
  - Quick casualty effects
  - Typical blood agents
    - Hydrogen Cyanide (AC)
    - Cyanogen Chloride (CK)

Physical state

- Colorless liquids
- Odor of bitter almonds
- May irritate the eyes & nose
- Extremely non-persistent

Physiological action

- Absorbed by the mucous membranes & skin
- Penetrates lungs without causing injury
- Follows the same route as the oxygenated blood until it reaches the cell tissues
- Inhibits the ability of the cell walls to retain oxygen
- Death due to respiratory failure

Symptoms

- Increased breathing rate
- Headaches, dizziness & giddiness
- Faster pulse rate & pounding of the heart
- Flushed skin & lips

Advanced symptoms

- Convulsions
- Coma
- Death
- Rate of action
  - Immediate with death occurring from seconds to within fifteen minutes

Blood Agents

- Rate of detoxification
  - Rapid, effects are non-cumulative
- Self aid/Buddy aid
  - Don protective mask

Riot Control/Training Agents

Riot Control/Training Agents

- Temporarily irritating effects
- Two categories
  - Vomiting
  - Tearing

Vomiting compounds

- (Adamsite (DM), DA, and DC)
- Violent uncontrollable sneezing, cough, nausea, vomiting, and a general feeling of body discomfort

Tear producing compounds (CS, CN)

- Large flow of tears & intense eye pain
- Training & in riot control, although CS may also be used in combat
- Warm, moist skin, especially face, neck, ears & body folds are susceptible to irritation

Summary and Review

- Terms & classifications
- Nerve
- blister
- Blood
- Choking
- Riot Control, Training agents