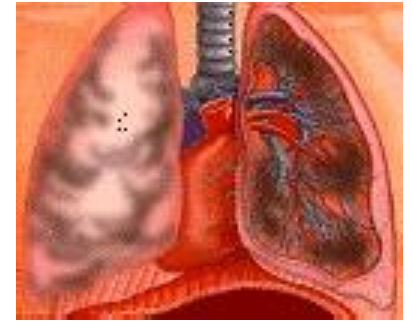


# ACUTE INHALATION INJURY BY CHEMICALS

# LUNG OEDEMA



Fluid cumulation in the extravasal compartment of the lungs:

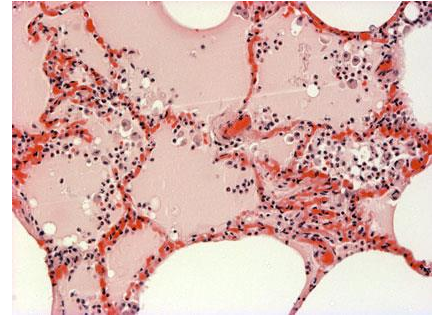
1) interstitial

2) alveolar

- **cardiogenic edema**- changes of hydrostatic or oncotic pressure (left hearth failure,...)
- **non-cardiogenic edema (ALI – acute lung injury, may lead to Adult Respiratory Distress Syndrome)**

# Non-cardiogenic oedema

## -damage of the membrane



- damage of alveolar epithelial cells type I and type II
- degradation of the surfactant at the surface of alveolar cells - **insufficiency of the surfactant**  
atelectatic areas
- increased permeability and **destruction of the alveolo-capillar membrane**
- neutrophil migration and pro-inflammatory and cytotoxic mediators release
- hyaline membranes formation and fibrosis, **hypoxemia.**
- **Mortality rate in ARDS 30-40 %!**

# A. VAPOURS AND GASES

- RESULT DEPENDS STRONGLY ON SOLUBILITY OF  
IN WATER

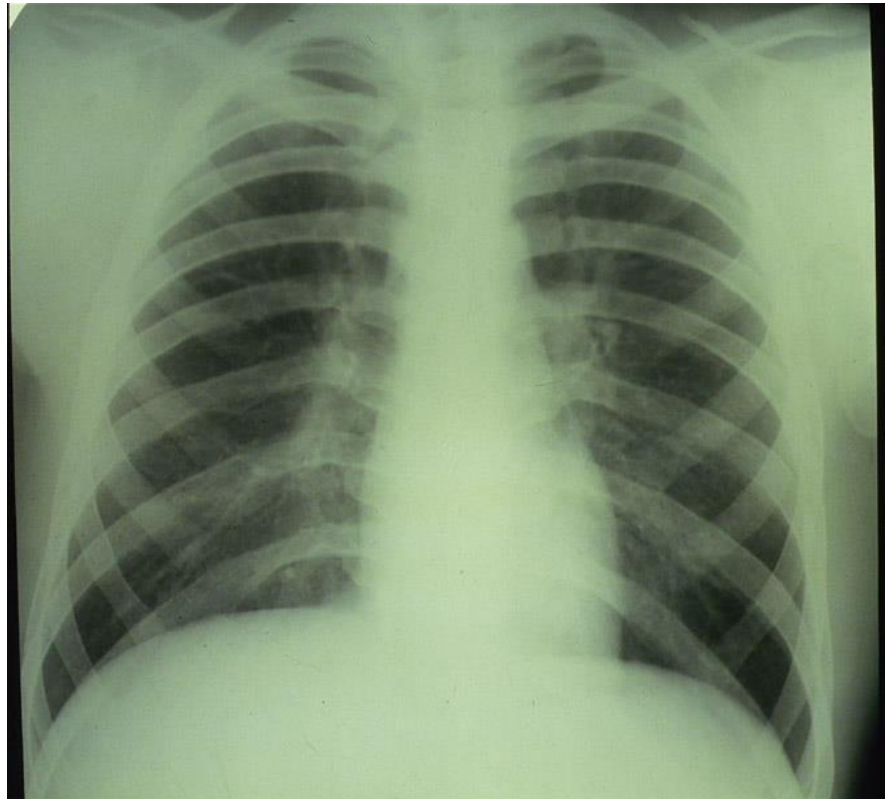
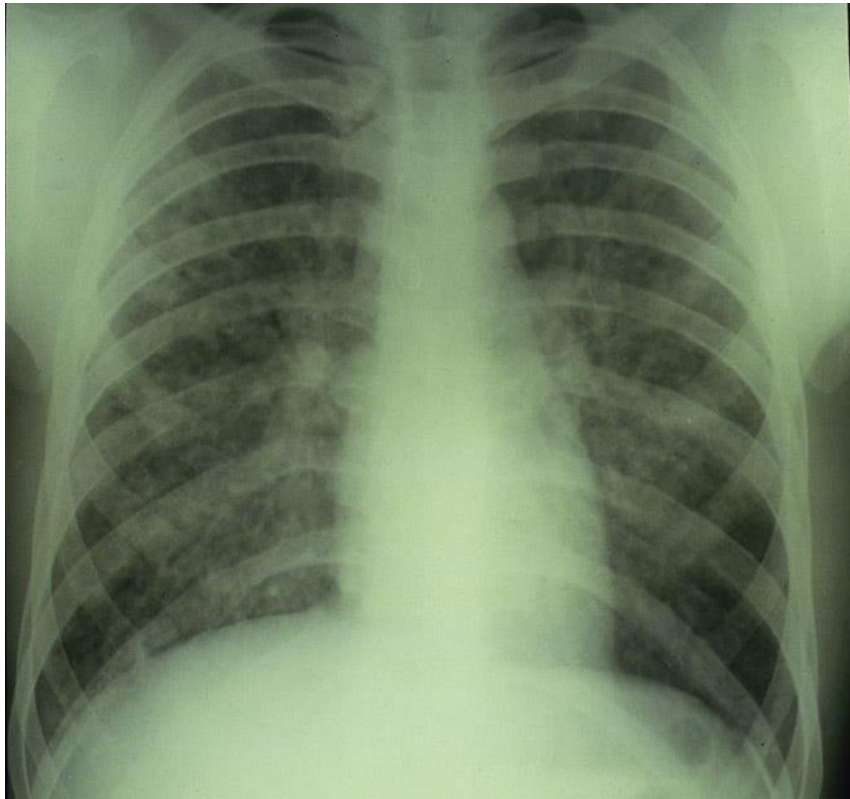
# HIGHLY WATER SOLUBLE COMPOUNDS

- Prognosis: in most cases a complete recovery
- Ammonia
- Formaldehyde
- Hydrogen chloride
- Chlorine
- Hydrogen fluoride
- Sulphur dioxide

# HIGHLY WATER SOLUBLE COMPOUNDS

- Readily absorbed by the upper respiratory tract, rapidly produce their primary effect on moist mucous membranes –in the eyes, nose, throat- have warning properties:
- Low levels: conjunctivitis, rhinitis, skin erythema, sore throat, cough, wheezing
- High levels: cornea damage, laryngeal oedema, abrupt airway obstruction, tracheobronchitis, ARDS

# Lung oedema after inhalation of chlorine



# POORLY WATER SOLUBLE COMPOUNDS

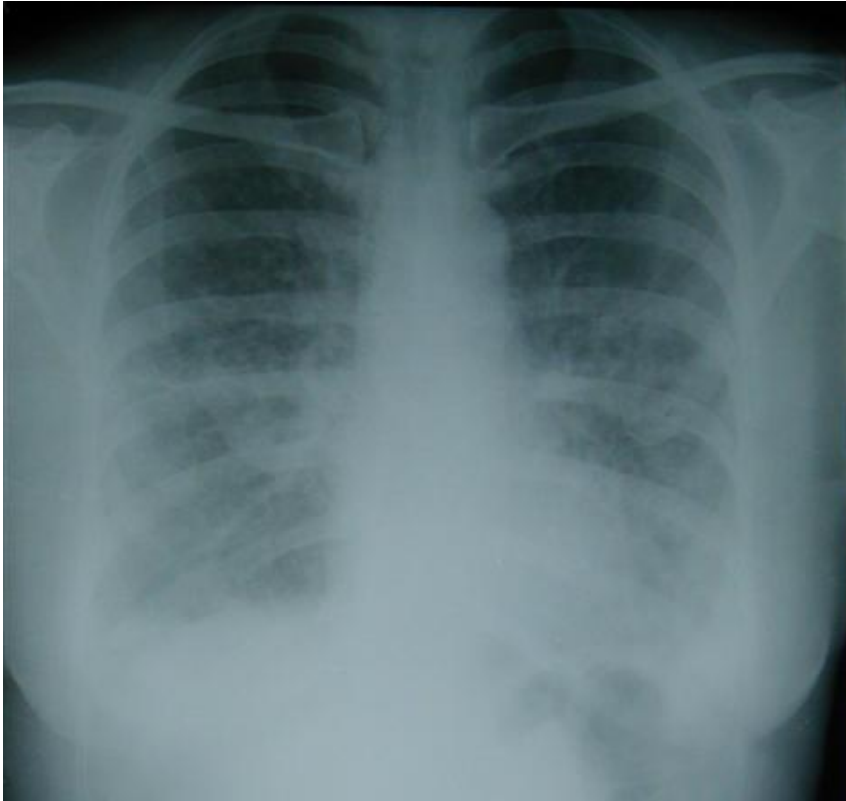
- Nitric oxide
- Nitrogen oxide – burning of N containing materials (polyurethane, isocyanates)
- Phosgene –  $\text{COCl}_2$  - burning of Cl containing materials (PVC, solvents,...)
- Ozone
- SEQUELS: in small part of patients – bronchiectasis, bronchiolitis obliterans, persistent asthma, pulmonary fibrosis.



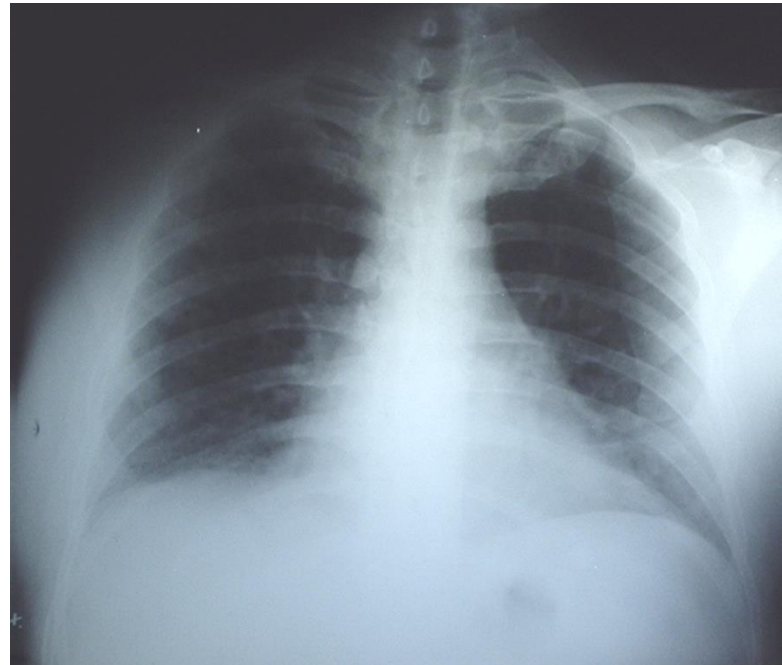
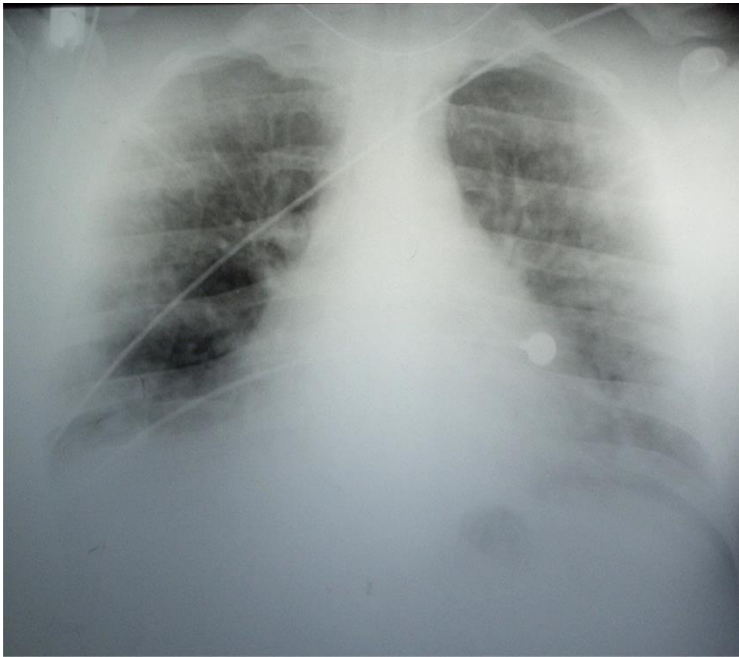
## POORLY WATER SOLUBLE COMPOUNDS

- not absorbed by the upper respiratory tract, can be inhaled deeply into the lungs,
- exposure is also usually longer.
- Damage: because of poor warning effects is the exposure usually higher:
- chemical pneumonitis,
- Adult Respiratory Distress Syndrome and death is more common.
- Typical is delayed onset of damage- 5-8 hours

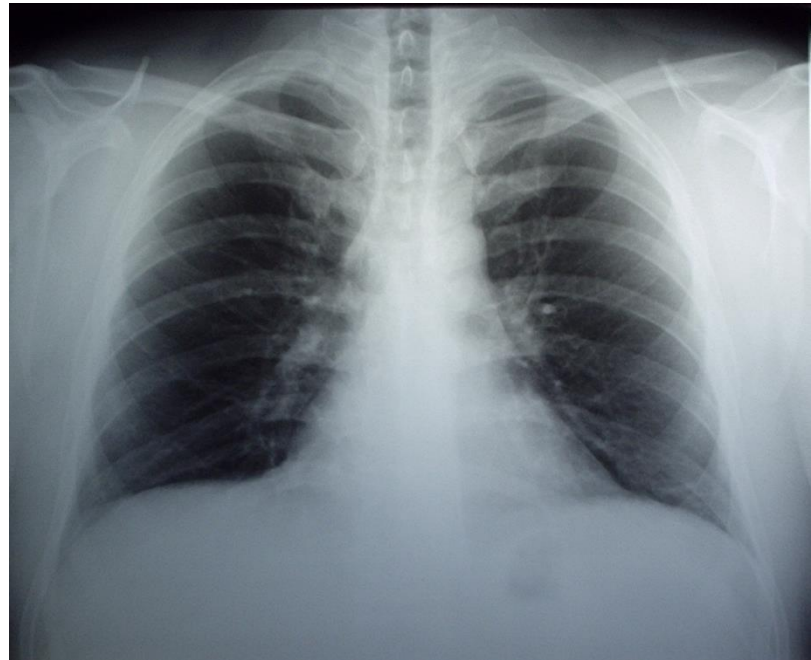
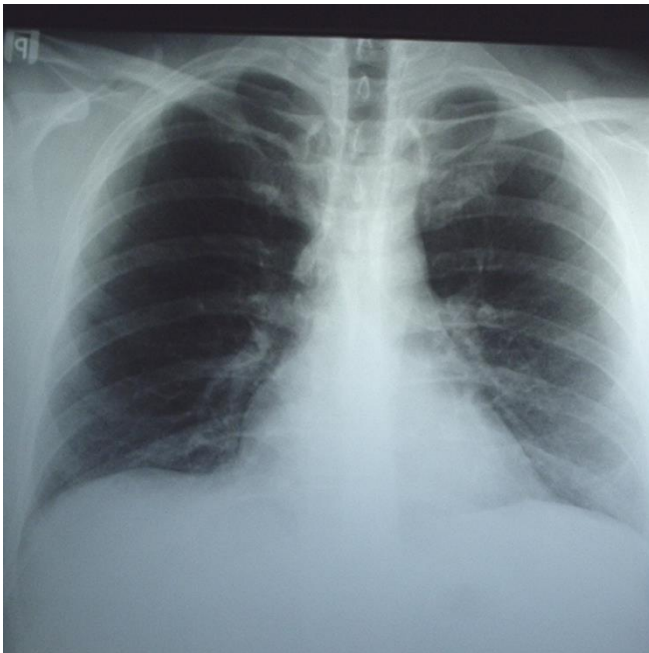
# Lung edema after nitric acid vapours



Lung oedema after accident after  
phosgene exposure ( $\text{COCl}_2$ )  
Day 1 and 2



Lung oedema after accident after  
phosgene exposure ( $\text{COCl}_2$ )  
Day 3 and recovery (9 months later)



# MANAGEMENT

- Depending
- 1) on the estimation of the severity of exposure  
(type of compound, concentration, length)
- 2) on the clinical status
- Fresh air
- Restriction of any physical activity

# TREATMENT

## Asymptomatic patient:

- After low exposure: observation for 6 hours at least
- oxygen, inhalation of saline solution
- After hazardous exposure: observation for 12 hours at least

## Symptomatic treatment:

- In bronchospasm and  $\text{SaO}_2$  under 94% bronchodilators (salbutamol), N-acetylcysteine
- In case of lung edema:
- diuretics, optimal fluids management, mechanic ventilation, positive-end-expiratory pressure (PEEP)
- Treatment of ARDS: systemic corticosteroids – methylprednisolone (efficacy ??)
- In case of symptoms of inflammation: antibiotics
- Statins?(immunomodulatory, antioxidant, anti-inflammatory, effect). Mesenchymal stem cells???

## B. METALS AND METALLOIDS

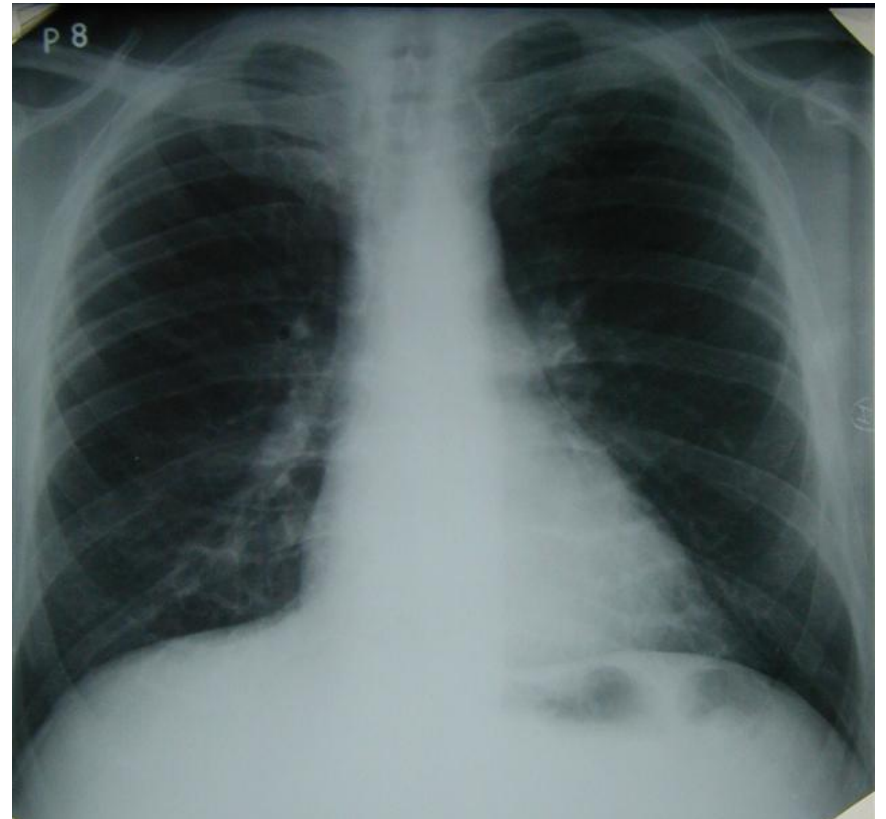


## B. IRRITATION METALS of the RESPIRATORY SYSTEM

- MERCURY
  - VANADIUM
  - etc...
- 
- Irritation of the airways,
  - heavy metal pneumonitis,
  - lung edema, ARDS
  - bronchial asthma



# Inhal. injury after inhalation of Hg vapours



# METAL FUME FEVER



ZINC OXIDE

COPPER, and some other metal oxides...

# METAL FUME FEVER- 1

- Acute febrile illness with **good prognosis** - associated with inhalation of respirable particles of **ZINC OXIDE** and some other metal oxides:
- welding, melting, flame-cutting galvanized metal or brass foundry operations
- Wrong practice – these metals should never be welded without masks with air supply!!

# METAL FUME FEVER- 2

- Mechanism: unknown, probably immunologic (cytokine-mediated),
- early in the week (Monday fever)
- Symptoms: after 4-6 hours – during the shift or after exposure: fever, metal taste, myalgias, weakness, mild dyspnoea, sweating
- = flu-like symptoms
- Treatment: symptomatic
- Prognosis: good, no sequels

# C. PETROLEUM DISTILLATES

gasoline, naphtha, „lamp oil“



## C. PETROLEUM DISTILLATES

- ACUTE INHALATION EXPOSURE (after accident in a confined space): Chemical pneumonitis – rare, bilaterally  
**COMPLICATION OF ASPIRATION (VERY FREQUENT!!): no vomiting induction, no gastric lavage!!!**
- low viscosity products
- impaired lung fluid surfactant function, alveolar instability, distal airway closure, hypoxemia,
- one-sided-bronchopneumonia -
- (predilection localization - right low!)
- Chest X-ray, antibiotics

