

Organic Solvents

Volatile Organic Compounds



Organic Solvents - Uses

- Cleaning / degreasing
- Paints
- Adhesives



Organic Solvents

- Exposure
 - inhalation of vapours / mists
 - skin / eye contact with liquid
 - skin absorption
- Generic hazards
- Specific hazards



Solvents - Generic Hazards

- Skin irritation
- Defatting of skin - dermatitis
- Respiratory irritation
- Narcosis
 - inhalation
 - skin absorption
- Neurotoxicity
- Organ damage



CNS Effects - Narcosis

- Motor
 - fatigue, tremor, incoordination
- Sensory
 - visual, auditory
- Cognitive
 - short and long term memory, intellectual ability
- Mood
 - depression, apathy, irritability, depression



Narcosis

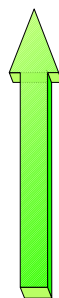
Effect increases with:

- the number of carbon atoms
- the number of carbon containing side groups
- halogenation
- presence of alcohol groups
- degree of unsaturation



Narcosis

- Halogenated compounds
- Ethers
- Esters
- Organic acids
- Alcohols
- Alkenes
- Alkanes



Increasing effect



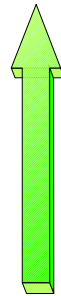
Irritation

- Extraction of fat / lipids from cell membranes
- Increased effect with
 - number of functional groups
 - unsaturated compounds



Irritation

- Amines
- Organic acids
- Aldehydes / ketones
- Alcohols
- Alkanes



Increasing effect



n-Hexane

- Alkanes generally low toxicity substances
- n-hexane associated with peripheral neuritis
- Sensory loss and motor weakness



Glycol Ethers

- Used in laquers, varnishes, inks, dyes, automotive products
- Reproductive effects
- Peripheral neuritis
- Not all compounds necessarily have these effects



Epoxy Compounds

- Potent skin sensitisers
- Respiratory sensitisation - if inhaled
 - generally not volatile
 - can be present in some paint mists



Halogenated Hydrocarbons

- Irritant
- Narcotic
- Liver and kidney damage
- Some are carcinogens
 - trichloroethylene, carbon tetrachloride
- Toxicity increases with number of halogen atoms



Halogenated Hydrocarbons

- Carbon tetrachloride
- Trichloroethylene
- Dichloromethane
- 1,1,2 trichloroethane
- 1,1,1 trichloroethane



Increasing toxicity



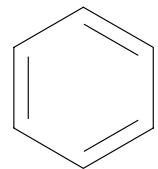
Vinyl Chloride Monomer (VCM)

- Liver cancer
 - angiosarcoma
 - proven human carcinogen
- Chronic liver and spleen damage
- Skin / soft tissue / bone degeneration
- Acute CNS effects



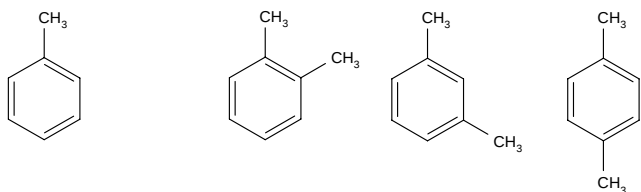
Benzene

- Target organ - haematopoietic system
- Aplastic anaemia
- Leukaemia
- Genotoxic



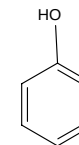
Toluene and Xylene

- Irritation and narcosis



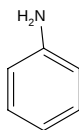
Phenol

- Denatures protein - powerful corrosive
- Readily absorbed through skin
- Kidney damage
- Genotoxic?



Aniline

- Methaemoglobin formation
- Mutagen
- Carcinogen



Anaesthetic Gases

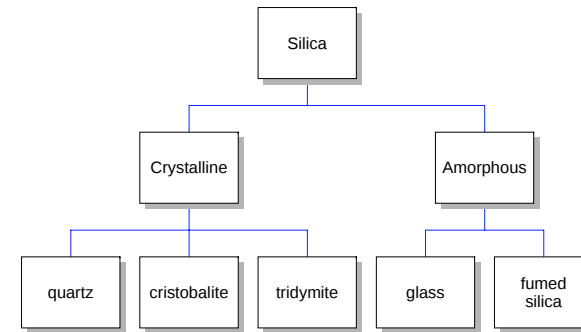
- Nitrous oxides; halogenated compounds
- Associated with reproductive effects in women



Mineral dusts

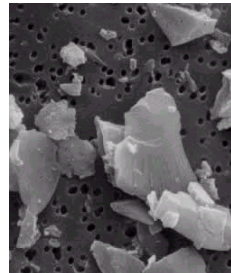


Silica

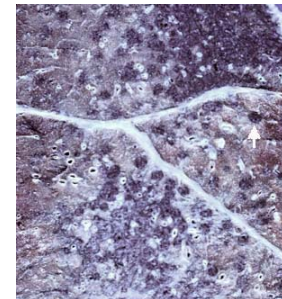


Crystalline Silica

- Lung fibrosis
- Carcinogen



Silicosis



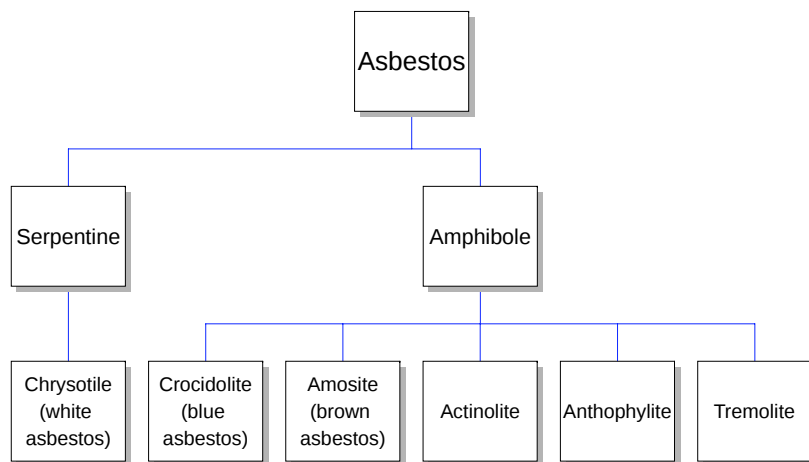
Slice of lung from a 61-year-old ceramics worker

Shows diffuse pleural fibrosis (upper right)
note multiple, hard, black silicotic nodules



What is Asbestos?

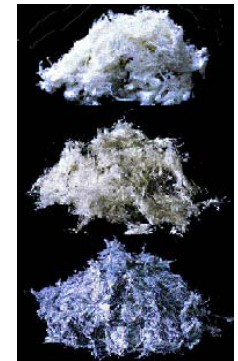
- Mineral fibres
- Naturally occurring
- Silicates
- Widely used
- 6 million tons imported into UK since 1880



Main Types of Asbestos

- Chrysotile (white asbestos)
- Crocidolite (blue asbestos)
- Amosite (brown asbestos)

n.b. Colour is **not** a reliable guide to the identification of the type of asbestos



Asbestos

- Risk related to exposure
- Damage only caused if fibres reach deep lung
- Only very fine fibres can reach deep lung
- Asbestos breaks along length of fibre
- Once in deep lung, fibres remain there for a long time

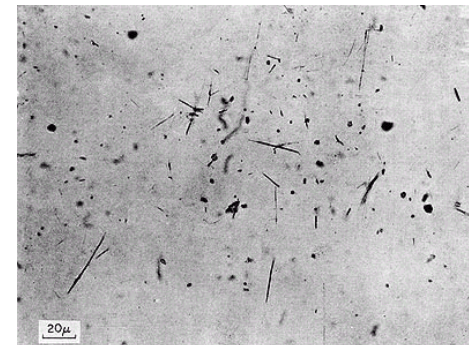
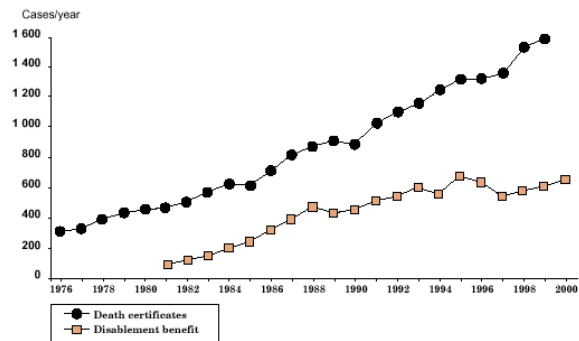


Asbestos - Health Effects

- Asbestosis
- Lung cancer
- Mesothelioma
- Pleural plaques



Mesothelioma



Crocidolite fibres in lung tissue

Metals and their compounds

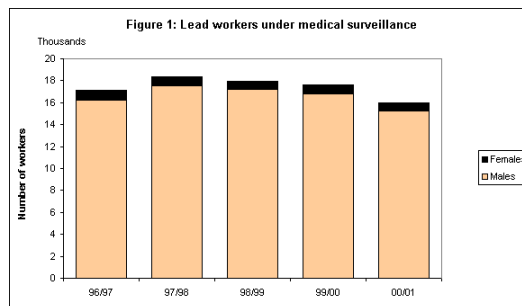


Lead

- anemia
- kidney damage
- peripheral neuropathy
- encephalopathy
- neurobehavioural effects
- effects reproductive system (men and women)
- teratogen



Lead



Mercury

- kidney damage
- gastrointestinal damage
- psychosis



Metals and their compounds (continued)

■ Chromium

- ▶ Cr VI most hazardous
- ▶ corrosive
- ▶ sensitiser
- ▶ lung cancer

■ Nickel

- ▶ sensitiser
- ▶ nasal cancer



Metals and their compounds (continued)

■ Beryllium

- ▶ skin lesions
- ▶ acute pneumonitis
- ▶ Berylliosis
- ▶ carcinogen ?

■ Cadmium

- ▶ acute pneumonitis
- ▶ kidney damage
- ▶ emphysema
- ▶ carcinogen ?

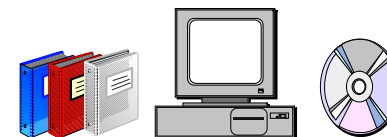


Information Sources



Information Sources

- Suppliers information
- HSE Publications
- Criteria documents
- Toxicology texts and journals
- On-line databases
- CD-ROMs
- Internet



HSE Publications

- EH64 - Summary Criteria for Occupational Exposure Limits
- Toxicity reviews and criteria documents
- Guidance notes
- Other publications
- Web site
- HSE line



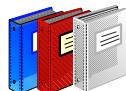
Criteria Documents

- EH64
- Documentation of the TLVs
- NIOSH Criteria Documents
- IARC
- WHO



Text Books

- Patty's Industrial Hygiene and Toxicology
- Sax's Dangerous Properties of Industrial Materials
- ILO Encyclopaedia of Occupational Health and Safety



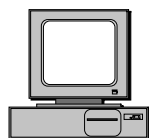
Journals

- Annals of Occupational Hygiene
- Journal of Occupational and Environmental Hygiene



On-Line Databases

- Medline
- Toxnet
 - Toxline
 - Hazardous Substances DataBase (HSDB)
 - Chemline
- Registry of Toxic Effects of Chemical Substances (RTECS)
- HSE Line



CD-ROMs

- Databases and Textbooks
- Publishers include:
 - Silver Platter
 - MicroInfo
 - Barbour Index
 - CCOHS
 - NIOSH

