



Education and Culture

# Leonardo da Vinci

**Course: Health, Safety and Environment**  
**Module 6**

## MODULE 6

### *Objective:*

Know and understand the hazards by chemical components

### *Scope:*

Understand how chemical elements behave and their symbols

### *Expected results:*

Know the different symbols for chemical elements

### *General.*

Injury can be caused by chemicals only if they reach sensitive parts of a person or other living organism at a sufficiently high concentration and for a sufficient length of time.

Thus, injury depends upon the physicochemical properties of the potentially toxic substances, the exact nature of the exposure circumstances, and the health and developmental state of the person or organism at risk.

Major routes of exposure are through the skin (topical), through the lungs (inhalation), or through the gastrointestinal tract (ingestion). In general, for exposure to any given concentration of a substance for a given time, inhalation is likely to cause more harm than ingestion which, in turn, will be more harmful than topical exposure.

### **Skin absorption**

Many people do not realise that chemicals can penetrate healthy intact skin and so this fact should be emphasized.

Amongst the chemicals that are absorbed through the skin are aniline, hydrogen cyanide, some steroid hormones, organic mercury compounds, nitrobenzene, organophosphate compounds and phenol.

Some chemicals, such as phenol, can be lethal if absorbed for a sufficient time from a fairly small area (a few square centimetres) of skin. If protective clothing is being worn, it must be remembered that absorption through the skin of any chemical which gets inside the clothing will be even faster.

### **Inhalation**

Gases and vapours are easily inhaled but inhalation of particles depends upon their size and shape. The smaller the particle, the further into the respiratory tract it can go.

Dusts with an effective aerodynamic diameter of between 0.5 and 10 micrometres (the respirable fraction, the PM10 fraction) can persist in the alveoli and respiratory bronchioles after deposition there.

Peak retention depends upon aerodynamic shape but seems to be mainly of those particles with an effective aerodynamic diameter of between 1 and 2 micrometers. Particles of effective aerodynamic diameter less than 1 micrometre tend to be breathed out again and do not persist either in the alveoli or enter the gut (see below).

*Remember:* The effective aerodynamic diameter is defined as the diameter in micrometers of a spherical particle of unit density which falls at the same speed as the particle under consideration.

Dusts of larger diameter either do not penetrate the lungs or lodge further up in the bronchioles and bronchi where cilia (the mucociliary clearance mechanism) can return them to the pharynx and from there to the oesophagus.

From the oesophagus dusts are excreted through the gut in the normal way: it is possible that particles entering the gut in this way may cause poisoning as though they had been ingested in the food.

A large proportion of dust breathed in will enter the gut directly and may affect the gut directly by reacting with it chemically or indirectly from contamination with micro-organisms. As already mentioned, some constituents of dust may be absorbed from the gut and cause systemic effects.

Physical irritation by dust particles or fibres can cause very serious adverse health effects but most effects depend upon the solids being dissolved. Special consideration should be given to asbestos fibres which may lodge in the lung and cause fibrosis and cancer even though they are insoluble and therefore not classical toxicants: similar care should also be taken with manmade mineral fibres.

Identification of chemical and hazardous material.

The Supplier must decide whether or not chemicals are hazardous and, if they are, they must be allocated a category of danger and one or more risk phrases or risk combinations.

Explosive, **E**

(Chemicals that explode)



Oxidising, **O**

(Chemicals that react exothermally with other chemicals)



Extremely Flammable, **F+**, or Highly Flammable, **F**, or Flammable

(Chemicals that have an extremely low flash point and boiling point, and gases that catch fire in contact with air OR chemicals that may catch fire in contact with air, only need brief contact with an ignition source, have a very low flash point or evolve highly flammable gases in contact with water.)



Very Toxic ,T+, or Toxic, T.

(Chemicals that at very low levels cause damage to health OR Chemicals that at low levels cause damage to health)



Harmful

(Chemicals that may cause damage to health)



Corrosive , C

(Chemicals that may destroy living tissue on contact)



Irritant, Xi

(Chemicals that may cause inflammation to the skin or other mucous membranes)



Sensitising, Xn or Xi



Carcinogenic, Categories 1 and 2, T

Carcinogenic, Category 3, Xn

(Chemicals that may cause cancer or increase its incidence)



Mutagenic, Categories 1 and 2, T

Mutagenic, Category 3, Xn

(Chemicals that induce heritable genetic defects or increase their incidence)



Toxic for Reproduction, Categories 1 and 2, T

Toxic for Reproduction, Category 3, Xn

(Chemicals that produce or increase the incidence of non-heritable effects in progeny and/or an impairment in reproductive functions or capacity)



Dangerous for the Environment, N

(Chemicals that may present an immediate or delayed danger to one or more components of the environment)

