Hazard Communication & Right-to-Know Laws

for Pedagogues and School Staff

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Toxicology
Toxicology is the study of the harmful effects of chemicals on biological systems
Chemicals are part of everyday life.
How do Chemicals Enter The Body?

**Inhalation**
You can breathe toxic dusts, gases, or fumes.
These can harm your respiratory system or pass from your lungs into your bloodstream and harm another part of your body.

**Absorption**
Toxic liquids can cause damage if they come into contact with your skin or eyes.
Some toxic liquids can pass through your skin and enter the bloodstream and cause harm to another part of the body.

**Ingestion**
Toxic substances can get into your body if you eat or smoke without washing contaminated hands.

**Injection**
Toxic substances can get into your body if you eat or smoke without washing contaminated hands.
Physical Manifestations of Chemicals
Vapors

- The gaseous form of substances that are normally in the solid or liquid state at room temperature.
- The vapor can be changed back to the solid or liquid state either by increasing or decreasing the temperature alone.
- Vapors can be inhaled

Gases

- Gases can be inhaled
- Some gases are:
  - easy to detect
  - some are odorless and colorless
  - some even deaden your sense of smell
Solids

- A solid is a material which retains its form, such as a stone.

- Most solids are generally not hazardous since they are not likely to be absorbed into the body.

- Examples of hazardous solids:
  - Moth balls – *inhalation hazard*
  - Rodent bait – *ingestion hazard*
Dusts

- Dusts are tiny solid particles that can be inhaled.
- Larger dust particles are trapped in the mucous and hairs of the nose and windpipe.
- Smaller dust particles can be breathed deeply into the lungs.

Fumes

- Fumes are formed when a solid, especially metals, are heated to very high temperatures and become vaporized.
  - Example: welding fumes
- Fumes can be inhaled.
Basic Defense Mechanisms
The Respiratory System

Upper Respiratory System
- Coughing
- Sneezing
- Nose hairs
- Mucous

Alveoli Level
- Immune System
  - macrophages

Lower Respiratory System
- Cilia
- Mucous
- Muco-ciliary escalator
Skin

- Largest body organ
- Waterproof protective layer against:
  - Organisms
  - Chemicals
- Overexposure to solvents denaturizes the skin, leading to:
  - Cuts
  - Breaks
  - Dry skin
Dose-Response Relationship

The greater the amount of a substance that enters the body, the greater is the health effect on the body.
Types of Health Effects
This is another word for allergy

Some people are allergic to a particular substance while others are not

Allergic responses may not have an effect after the initial exposure, but later contact with the substance may cause an allergy to develop

Two or more agents that act together to produce a total effect greater than the sum of the separate effects.

Example:
- ethanol + chlorine = chloroform
- ammonia + bleach = chlorine gas
The effects of multiple chemicals at a time or the effects of the different hazards may be additive.

Examples:
- $3 + 6 = 9$
- Colorants-inorganic or organic matter to color compounds.

Interaction of two chemicals in which the resultant toxic effect is lower than the chemicals’ individual actions.

Example includes:
- Methanol and ethanol exposure.
Mutagens

- Mutagens causes a change in the genetic make-up of a cell
- In reproductive cells (sperm or eggs), the mutagen can cause sterility or birth defects
  - Example: x-rays

Teratogens

- These substances cause malformations or birth defects by damaging the developing embryo
- Example: Thalidomyde
Carcinogens

- Cancer causing agents
- A chemical is considered to be a carcinogen if it has been positively evaluated by:
  - International Agency for Research on Cancer (IARC),
  - Annual Report on Carcinogens, by the National Toxicology Program (NTP)
  - OSHA

Example: Asbestos

Target Organs

- The organ of the body most affected by the exposure to a particular substance.
- Target organs are body organs that are affected by exposure to hazardous chemical, physical, or biological agent.
- Example:
  - Mercury – neurological
  - Hepatitis - liver
## Types of Target Organ Effects

<table>
<thead>
<tr>
<th>Category</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEPATOXINS</td>
<td>liver</td>
</tr>
<tr>
<td>NEPHROTOXINS</td>
<td>kidney</td>
</tr>
<tr>
<td>NEUROTOXINS</td>
<td>nervous system damage</td>
</tr>
<tr>
<td>PULMONARY</td>
<td>lung damage</td>
</tr>
<tr>
<td>HEMATOPOIETIC</td>
<td>blood system damage</td>
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<tr>
<td>REPRODUCTIVE TOXINS</td>
<td>reproductive system</td>
</tr>
<tr>
<td>CUTANEOUS HAZARDS</td>
<td>skin damage</td>
</tr>
<tr>
<td>OPTICAL HAZARDS</td>
<td>eye damage</td>
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</tbody>
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Exposure Assessment & Control
Biological Threshold Level

Some substances have measurable exposure levels below which most people will not likely show any health effects.

**PEL - Permissible Exposure Levels**
An exposure limit published and enforced by OSHA as a legal standard.

**TLV - Threshold Limit Value**
A time-weighted average guideline concentration under which most people can work consistently for 8 hours a day for 40 hours with no harmful effects.
Determining Exposure
Practical Clues to Exposure

- **Settled Dust**
- **Particles in Nose**
- **Immediate symptoms**
- **Odor**
  - Not reliable as a warning clue
- **Taste**
Environmental Monitoring

Air Sampling
Performed by an Industrial Hygienist

Area Sampling
Analyzed by a laboratory

Direct Reading
Immediate quantification of air pollutant

Personal Air Sampling
Worn by workers to measure individual's actual exposure
Biological Monitoring

Chemical levels and/or its breakdown products are measured
Example: blood lead levels
Controlling Exposure
Methods of Controlling Exposure

1. Engineering Controls
   - Remove the hazard at the source

2. Administrative Controls
   - Reduce exposure by changing job task or policies

3. Personal Protective Equipment
   - Used after Engineering & Administrative Controls have failed
Engineering Controls
Reduce the hazard at the source of exposure

Reducing exposure at the source
(noise dampeners)

Limiting Exposure

Wet Methods

General Ventilation

Local Exhaust

Isolation at the source of exposure
(construction dusts)

Isolation

Switching to a less Hazardous product

Fume Hood of intake placed over the source

General circulation and replacement of fresh air
Administrative Controls

Seek to control employees’ exposure by changing the way a task is performed

- Training employees on workplace exposures
- Time rotation based on task
- Establishing safety policies
- Workplace hygiene
- Proper waste disposal
Personal Protective Equipment (PPE)

Should be used when engineering controls are ineffective

Employees wear PPE to protect them from their environment

- gloves
- aprons
- respirators
- boots
- Protective clothing
- ear protection
- goggles