

Managing Chemical Biological and Psychological Risks Occupational Health

Lecture Title:
Control Vs Failure

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**Undergraduate Diploma in
Occupational Health and Safety**

Controlled



Failure



Our job is to ensure our that we never experience the image on the right

AREC Model

A → ANTICIPATE what could go wrong

R → RECOGNIZE the hazards present

E → EVALUATE the risks (probability × severity)

C → CONTROL the exposures (hierarchy of controls)

This systematic approach forms the basis of all professional risk management



Potential to cause harm will actually occur



Hazard is fixed. Risk is manageable.

The hazard of a chemical cannot be changed, but the risk can be controlled by managing exposure.

Probability that harm



Risk = Hazard X Exposure

If either factor is zero, risk is zero

			Example
High Hazard	Zero Exposure	Zero Risk	Sealed radioactive source in lead container
Low Hazard	High Exposure	Low Risk	Drinking water consumed daily
High Hazard	High Exposure	High Risk	Open benzene container in poorly ventilated room

Every control measure either:

- Reduces the HAZARD (Elimination/Substitution)
- Reduces EXPOSURE (Engineering/Admin/PPE)

Flammability



Definition: The ability of a substance to ignite and burn

FLASH POINT: The lowest temperature at which a liquid gives off sufficient vapour to form an ignitable mixture with air.

- Below flash point → Not flammable
- Above flash point → Flammable

CONSULTANT'S CHECKLIST:

- ☐ Ignition sources controlled? (electrical, static, smoking, hot work)
- ☐ Storage in approved flammable cabinets?
- ☐ Bonding and grounding for transfers?
- ☐ Segregation from oxidizers?
- ☐ Quantity limits observed?

TOXICITY

DEFINITION: The ability of a substance to cause adverse health effects.



Two main Classifications

ACUTE TOXICITY

Effects occur immediately or shortly after exposure

Single exposure event

Skull and crossbones pictogram

Examples: Cyanide, carbon monoxide, chlorine gas

Action: Emergency response, first aid, exposure limits

CHRONIC TOXICITY

Effects occur after repeated exposure over time

Long latency period (years or decades)

Health hazard pictogram (silhouette with star)

Examples: Benzene (leukemia), asbestos (mesothelioma), silica (silicosis)

Long-term monitoring, health surveillance, records

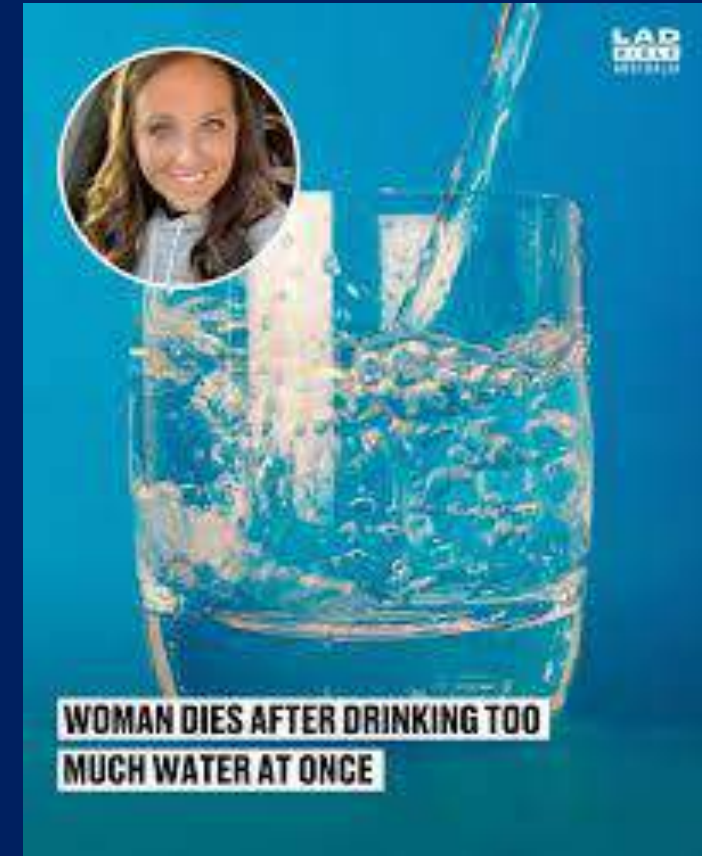
The Dose makes the poison



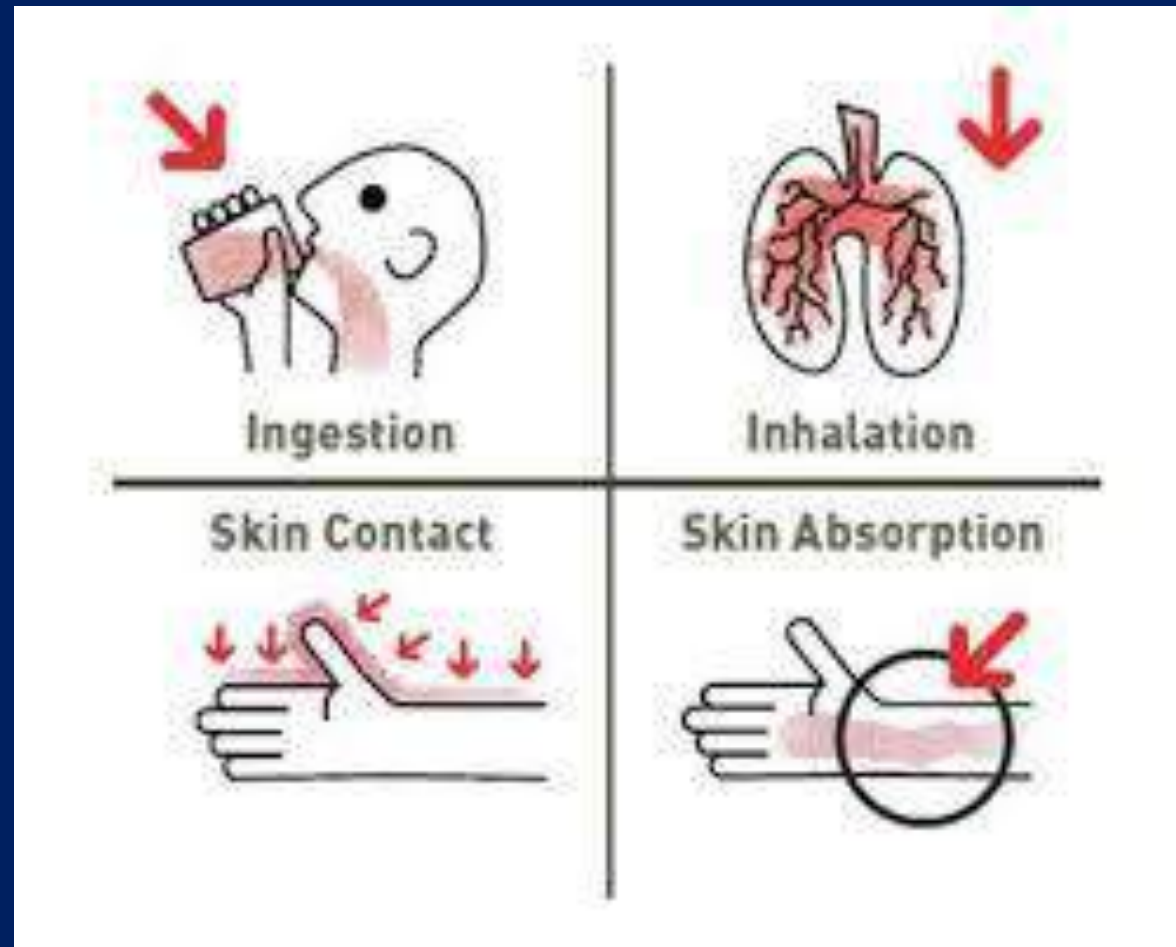
All things are poison and nothing
is without poison; the dose alone
makes a thing not poison –
Paracelsus (1493-1541)

Even water is toxic if consumed in extreme excess (hyponatremia)

<https://www.today.com/health/news/water-intoxication-death-rcna99472>



Routes of Exposure



1. Inhalation (most common in occupational settings)
2. Skin absorption (many organic solvents)
3. Injection (needlestick, high-pressure equipment)
4. Ingestion (poor hygiene practices)

Corrosive



DEFINITION: Destroys living tissue on contact.

TYPES:

- ACIDS: Sulfuric acid, hydrochloric acid, nitric acid
- BASES (Alkalis): Sodium hydroxide, potassium hydroxide, ammonia
- Some oxidizers and dehydrating agents

KEY CHARACTERISTICS:

- Immediate damage upon contact
- Often irreversible (scarring, permanent eye damage)
- Can damage equipment and facilities
- Vapors can be corrosive to respiratory tract

Environmental



DEFINITION: Toxic to aquatic life or otherwise harmful to the environment.

KEY IMPLICATIONS:

- Disposal requires special arrangements
- Spill control must prevent environmental release
- Drain protection essential
- May trigger additional regulations (e.g., SEVESO, Control of Major Accident Hazards)

Seveso Disaster (1976)



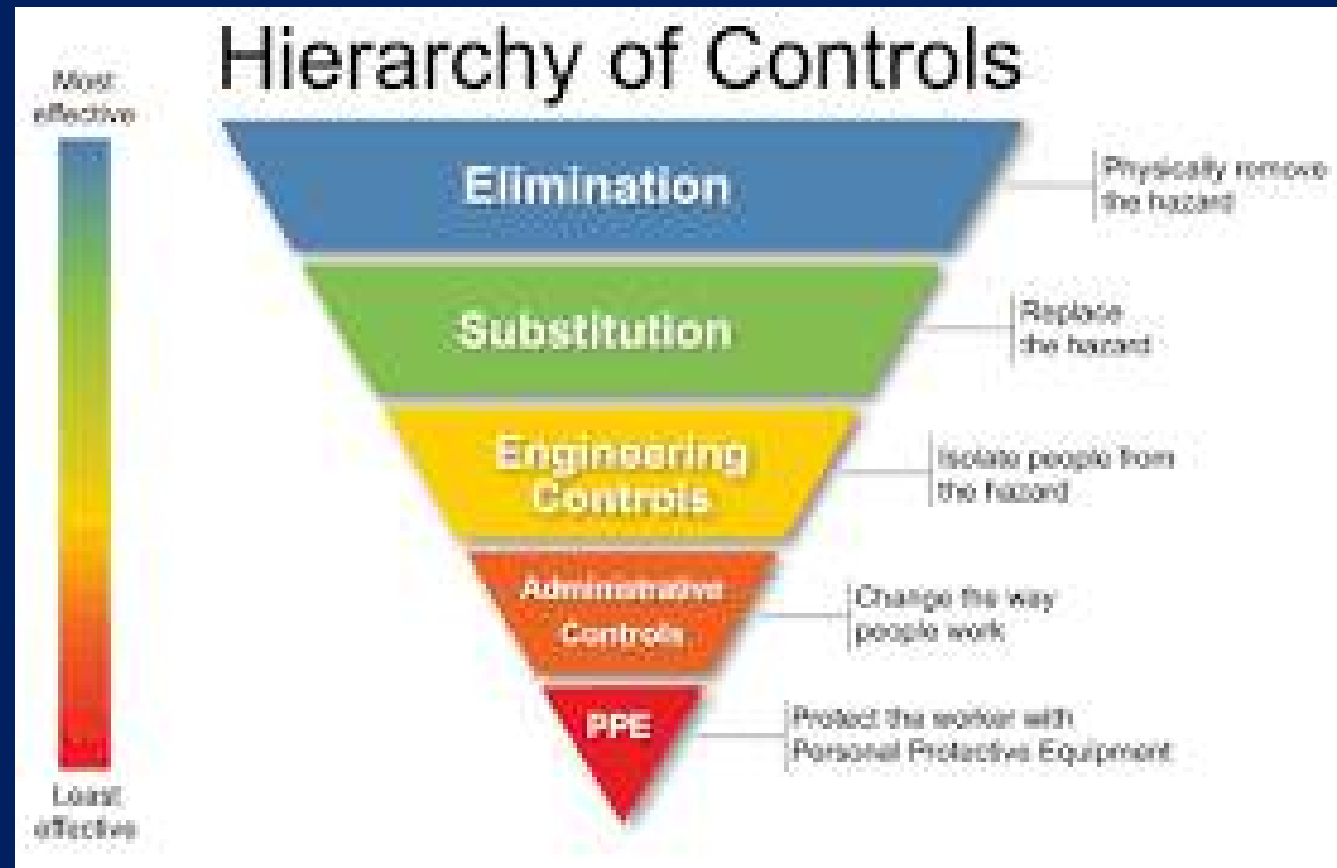
<https://www.youtube.com/watch?v=CdJ3ewJJOic>

Corby Town



[https://www.youtube.com/watch?
v=9BLDiKxNrbo](https://www.youtube.com/watch?v=9BLDiKxNrbo)

Hierarchy of Control



Hierarchy of Control

Elimination :- Remove the hazard entirely from the workplace

EXAMPLE:

- Using mechanical fasteners instead of solvent-based adhesives
- Water jet cutting instead of chemical etching
- Purchasing pre-cleaned parts instead of cleaning on-site

Advantages	Disadvantages
No Chemical = No Hazard = Nor Risk	May require process design
No ongoing control costs	May not be technically feasible
No compliance burden	May introduce other hazards

Hierarchy of Control

- Substitution :- Replace the hazardous chemical with a less hazardous alternative

EXAMPLE:

- Benzene → Toluene (less carcinogenic)
- Solvent-based paint → Water-based paint
- Asbestos insulation → Mineral wool

Advantages	Disadvantages
Reduces hazard at source	New chemical may have different hazards to manage
Often reduces PPE and ventilation requirements	May affect product quality or process efficiency
May reduce waste disposal costs	May require requalification or customer approval

Hierarchy of Control

- Engineering Controls: Physical modifications to the workplace that isolate the hazard from the worker.



Admin

Change how people work through procedures, policies, and training

EXAMPLES:

- Safe operating procedures (SOPs)
- Warning signs and labels
- Job rotation to reduce exposure time
- Training and competency programs
- Permit-to-work systems
- Supervision and monitoring



PPE



Case Study 1- Seabreeze Bistro Bar, Grill and Restaurant

Seabreeze Bistro” is a mid-sized seafood restaurant located in a busy coastal town. It serves around 120 customers daily and employs 15 staff members. The kitchen uses standard commercial cleaning chemicals, including degreasers and disinfectants.

On a busy Saturday evening, a kitchen staff member mistakenly stored a highly concentrated industrial cleaner (alkaline degreaser) in a reused, unlabeled food container. During food prep, another employee used this container, believing it held cooking oil to prepare a batch of garlic butter sauce. The contaminated sauce was served with multiple dishes over a 2-hour period.



Seabreeze Bistro Bar, Grill and Restaurant

- What type of chemical caused the incident in the restaurant?
- How did the chemical end up in the food?
- Suggest a training program outline for new staff to prevent similar incidents.
- What emergency response plan should be in place for chemical contamination?
- If you were the restaurant manager, what immediate steps would you take after discovering the incident?





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