The Royal Australasian College of Physicians

Australasian Faculty of Occupational and Environmental Medicine

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Occupational Hygiene Principles

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Overview

Occupational Hygiene Principles

Respiratory Protection

Hand protection - gloves
Overview

**Occupational Hygiene Principles**

- What is the goal of Occupational Hygiene?
- What is hazard and risk?
- How does an Occupational Hygienist assess the risk to the worker’s health?
- What are the controls to manage risk?
Occupational Hygiene
What is the goal of Occupational Hygiene?

To protect the worker’s health by the identification, assessment and control of workplace hazards.
A hazard is something that can harm your health.

Risk is the chance of harm occurring under specific circumstances.
Occupational Hygiene

What is the hazard here?

Is the risk of chemical exposure high or low?
What workplace hazards can cause employee illness/disease?

**Chemical**

**Physical, eg: noise, heat stress…**

**Ergonomics, eg: manual handling**

**Biological, eg: legionella…**

**Radiation**

**Other**
Occupational Hygiene
What workplace hazards can cause employee illness/disease at your site?

**Solvent based paint factory**

Over exposure to chemicals may cause:

- Male and female reproductive issues, eg: toluene solvent
- Lung damage/cancer: inhalation of hazardous powders
- Dermatitis/irritation: skin contact with solvent
- Dizziness/headaches/nausea: inhalation of solvent vapour
- Eye damage: chemical splash to eye
- Asthma symptoms: inhalation isocyanate paint spray
Occupational Hygiene

What workplace hazards can cause employee illness/disease?

Health issues may occur when the hazard comes in contact with the body.

How can chemicals enter the body?

- Inhalation
- Skin contact
- Ingestion
Occupational Hygiene

How does an Occupational Hygienist assess the risk to workers health?

How can workplace hazards be identified?

Observation of tasks
Employee concerns
Management of Change process
Audits to check compliance with regulations
Risk assessments
Occupational Hygiene

How does an Occupational Hygienist assess the risk to workers health?

The higher the level of exposure (dose) the higher the risk to the worker’s health.

The level of exposure (dose) is measured and compared to Occupational Exposure limits (OEL).
Occupational Hygiene

How does an Occupational Hygienist assess the risk to workers health?

Occupational Exposure Limits (OEL) are international airborne chemical concentration levels that would result in no adverse health effect to most people.

Each chemical has its own Occupational Exposure Limit (OEL).

Other hazards also have OEL, eg: Noise………. 
Occupational Hygiene
How does an Occupational Hygienist assess the risk to workers health?

How is the airborne concentration of solvent vapour measured?
Occupational Hygiene
How does an Occupational Hygienist assess the risk to workers health?

Measurement of Hazard – Degree of exposure

What sampling details need to be recorded?

- Name of person wearing the monitor.
- Flow rate of pump (mL/minute)
- Time pump ran for (minutes)
- PPE worn
- Task done
- Engineering controls used
Occupational Hygiene
How does an Occupational Hygienist assess the risk to workers health?

Measurement of Hazard – Degree of exposure

\[
\frac{mg}{m^3} \rightarrow \text{Lab result}
\]

\[
\text{Sampling (Flow rate x Time)}
\]

The two together give the concentration of exposure
Occupational Hygiene
How does an Occupational Hygienist assess the risk to workers health?

Measurement of Hazard – Degree of exposure

The measured concentration of solvent in the air is compared to the Occupational Exposure Limit (OEL) for that particular solvent.
Occupational Hygiene

How does an Occupational Hygienist assess the risk to workers health?

Measurement of Hazard – Degree of exposure

To be confident that the concentration of solvent vapour in the air is not at a level that may harm health, the sampling result should be below 50% of the OEL.
Occupational Hygiene
How does an Occupational Hygienist assess the risk to workers health?

**Measurement of Hazard – Degree of exposure**
Some chemicals like solvents can have 2 OELs.

Why?

**STEL** Short term exposure limit, 15-30 minute task. (mg/m3)

**TWA** Time weighted average – exposure averaged over 8 hours. (mg/m3)
Occupational Hygiene
How does an Occupational Hygienist assess the risk to workers health?

**Measurement of Hazard – Degree of exposure (Dose)**

The risk of the worker’s health being affected by inhalation of the vapours is dependent on the amount inhaled or degree of exposure (dose).

The higher the dose the higher the risk of the worker’s health being affected.
Occupational Hygiene
How are dusts measured?
Particle size is important

What is the significance of “small” versus “large” particles?

• Differ in toxicity

• Deposition location in the respiratory system

• Occupational Exposure limits (OEL) set based on where it’s deposited

• Require different sampling methods
Particle size consideration

- Particle size determines the deposition site within the respiratory tract and the subsequent health effects.
Occupational Hygiene

How does an Occupational Hygienist assess the risk to workers health?

**How are dusts measured?**

**Inhalable dust** <100 microns is able to enter the nose / mouth and upper respiratory tract.
Occupational Hygiene

How does an Occupational Hygienist assess the risk to workers health?

How are dusts measured?

Respirable dust <10 microns is able to enter the lower regions of the lungs.

Eg: Crystalline silica can deposit in the lungs and cause the lung disease silicosis
Occupational Hygiene

What are the controls to manage risk?

**Hierarchy of control**

**Eliminate the hazard (most effective)**

**Substitute the hazard with something less hazardous**

**Engineering controls, eg: ventilation**

**Administrative controls, eg: warning signs, job rotation**

**Personal Protective Equipment (least effective)**
Respiratory Protection

Inhalation Hazards

Dusts
• pigments, sanding and grinding.

Vapors
• evaporate easily at room temperature, solvents.

Aerosols
• vapors condensed into tiny airborne particles or droplets.

Mists and Sprays
• small droplets of liquid material suspended in the air; spray operations.

Gases
• can be invisible and becomes airborne at room temperature.

Fumes
• metal, plastic, or polymer under high heat
  • welding and soldering.
**Respiratory Protection**

**Use of a respirator**

**Key points when selecting a Respirator.**

- Consult an Occupational hygienist / respirator specialist.

- Is the environment Immediately Dangerous to Life and Health.

- What is the inhalation hazard and the concentration in the air.

- Is other PPE to be worn with the respirator?. Are there other hazards eg: chemical splash, is a full face protection required or is hearing protection also needed?

- What task is being performed while wearing the respirator, degree of exertion required (breathing rate). Limited work space?

- Does the type of respirator suit the worker, eg: does the worker have facial hair that may reduce the effectiveness of the respirator.
Key points when selecting a Respirator.

- Is the environment Immediately Dangerous to Life and Health.

Definition: US National Institute for Occupational Safety and Health (NIOSH).

“Is it likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment”.
**Respiratory Protection**

**Use of a respirator**

**What is a Respirator Protection Factor (PF)?**

The reduction in exposure that a particular respirator can provide.

\[
PF = \text{Ratio} : \text{ambient airborne concentration} / \text{concentration inhaled inside the respirator.}
\]

Required minimum protection factor is the ratio of: ambient airborne concentration / acceptable exposure level.

**Eg:** Ambient airborne concentration of chemical A is 100mg/m³ and the Occupational Exposure Limit for chemical A is 10mg/3 a respirator with a Protection Factor of > 10 would be required.
Respiratory Protection
Use of a respirator

Key points when selecting a Respirator.
• Is the environment Immediately Dangerous to Life and Health.

Example: entering a tank where there may be a lack of oxygen.

Self contained breathing apparatus (SCBA). Face piece seals to face and is fed with breathing air from the cylinder worn on the back.
Protection Factor = 100+
Respiratory Protection
Use of a respirator

How do I know if the respirator will protect the worker from the chemical concentration in the air?

Occupational Hygienist can measure the chemical concentration in the air. Result reported as: mg/m3

Occupational Hygienist can compare the measured result to the Occupational Exposure Limit (OEL) for that chemical.
Respiratory Protection
Use of a respirator

Air purifying half face respirator. Protection Factor up to 10.

Powered air purifying full face respirator. Protection Factor up to 100

Air supplied hood connects to a hose supplying breathing air. Protection Factor up to 100
Hand protection
Dermal hazards

Chemical
• Solvent, corrosives.....

Temperature
• Heat, cold

Sharps
• Cut resistance.

Mechanical
• Handling rough surfaces eg: prevent splinter handling wooden pallets.

Biological
• Medical use.
Key points when selecting a glove.

- Consult an Occupational hygienist / glove specialist. (eg: Glove companies have chemical breakthrough charts)
- What is the hazard?
- What is the time period exposed to the hazard?
- What is the task being performed. Level of exertion. Does the gloved hand need a high level of dexterity to perform the task?
- Do I want the glove to be disposable or re-useable?
- What length of glove, do I need wrist and forearm protection?
Hand protection - Chemical Splash Resistant Gloves

Nitrile disposable glove
Chemical resistance: good
Thickness: Thin
Finger Dexterity: Good
Exertion: light work, eg: laboratory

Nitrile re-useable glove
Chemical resistance: good
Thickness: Medium
Finger Dexterity: Fair
Exertion: light to moderate work, eg: laboratory and factory

Neoprene re-useable glove
Chemical resistance: good
Thickness: Thick
Finger Dexterity: Poor
Exertion: moderate to heavy work, eg: factory manual handling
Summary

The goal of Occupational Hygiene is to:

Protect the worker’s health by the:

Identification

Assessment

and Control of workplace hazards.