

MEM261 : CHAPTER 1 WORKSHOP PRACTICE II

An introduction to safe practice, hazard control and emergency procedure in the mechanical engineering workshop.

Chapter Outline

- 1 **1.1** Introduction — the purpose and goals of workshop safety
- 2 **1.2** General Workshop Safety Rules, incl.
1.2.1 rules for machines
- 3 **1.3** Industrial Safety — key definitions and concepts
- 4 **1.4** Occupational Hazard and Control, incl.
1.4.1 PPE
- 5 **1.5** Fire Safety — extinguisher classification
- 6 **1.6** Important Workshop Signage, and chapter summary

OBJECTIVES & LEARNING OUTCOMES

By the end of this chapter, you will be able to:

01

Explain workshop safety

Acquire knowledge of the safety precautions required while working in the mechanical workshop.

02

Use protective wear

Select and correctly use personal protective equipment appropriate to the task at hand.

03

Classify safety equipment

Identify and understand workshop safety equipment, for example fire extinguishers.

1.1 INTRODUCTION

Why Workshop Safety Matters

The need for safety underpins the general goals of engineering practice. Every rule in this chapter serves one of the aims below.

- 1 Reduce accidents
- 2 Control or eliminate hazards
- 3 Develop new methods and techniques to improve safety
- 4 Maximize returns on safety efforts
- 5 Maximize public confidence with respect to product and service safety

Engineering safety goals exist to protect people first, and equipment, product and reputation second.

Guiding principle

1.2 GENERAL WORKSHOP SAFETY RULES

Basic Safety Rules

1. Before you can use equipment and machines, or attempt practical work in a workshop, you must understand these **basic rules** — they protect you and everyone around you.

1 Restricted access

Free access to workshop areas is restricted to authorised personnel only.



2 Follow instructions

Always listen carefully to the workshop supervisor (SIR/MADAM/DR) and follow their instructions.



1.2 GENERAL WORKSHOP SAFETY RULES

Basic Safety Rules

2. Safety in a machine shop divided into **two**:

1 Prevents worker injury

One category of machine-shop safety practice: those **that prevent injury to workers.**

2 Prevents equipment damage

The other category: those practices **that prevent damage to machines and equipment.**

1.2 GENERAL WORKSHOP SAFETY RULES

Basic Safety Rules: Before Entering the Workshop

1

Wear the required PPE

Students must arrive at each session on time, with proper dress code – Personal Protective Equipment :lab coat and shoes. Slippers are not allowed.
- it is your first line of defence.



2

Dress appropriately

Jewellery and loose clothing are prohibited. Long hair must be completely covered, and this applies especially to female students.



1.2 GENERAL WORKSHOP SAFETY RULES

Basic Safety Rules: Before Entering the Workshop

3 Enter the laboratory

Students are not allowed to enter the laboratory without permission from the lecturer, assistant lecturer, or assistant engineer, working alone or unsupervised in laboratories is forbidden.

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4 Bags

Bags are not allowed in the laboratories.

1.2 GENERAL WORKSHOP SAFETY RULES

Rules of Conduct in the Workshop

- 1** Read the instructions carefully and follow the laboratory procedures. Do not touch anything that you are not completely familiar with.
- 2** Familiarise yourself with all equipment and tools used in the workshop before you begin work.



- 3** Personal Protective Equipment (PPE) is provided and must be used wherever it is necessary.
- 4** Students are not allowed to run the machines when you are sleepy or under medication.
- 5** Students are not allowed to eat, drink or smoke while working in the workshop And are not allowed to run the machines with your hands wet.

1.2 GENERAL WORKSHOP SAFETY RULES

Rules of Conduct in the Workshop

6 Report any defective equipment to the workshop supervisor immediately.

7 Do not run in the workshop — you could collide with another student and cause an accident.



8 Always be patient. Never rush in the workshop.

1.2 GENERAL WORKSHOP SAFETY RULES ·

CONTINUED

Housekeeping and Tool Care

- 1** **Keep gangways clear, clean and neat before and after the workshop activities.** Any oil spillage, grease, etc. must be cleaned up immediately.
- 2** **Clean as you go.** Tools and equipment must be cleaned.
Keep the work area clean of all materials except those needed for your work.
- 3** **Return equipment.** Precision measuring equipment, drills, etc. must be replaced in their cabinets after each working day.
- 4** **Carry tools safely.** When carrying tools, sharp edges should be pointed downwards.

1.2 GENERAL WORKSHOP SAFETY RULES ·

CONTINUED

1

Tools and equipment

Tools and equipment must not be removed from the workshop without permission from the workshop supervisor.

2

Evacuate for fire

In the event of a fire, leave the building immediately and proceed to the assembly point.

3

Report everything

All unusual incidents — cuts, burns, direct chemical exposure — and emergencies must be reported to the supervisor, whether or not injury resulted.

1.2.1 SAFETY RULES FOR MACHINES USED IN THE WORKSHOP

Operating Machines Safely

- 1 Read the Lab sheet procedure carefully and follow the safety and machining procedures.
- 2 When working with rotating spindles, jewellery and loose clothing are prohibited, and long hair must be completely covered.



- 3 When learning how to use a machine, listen very carefully to all instructions given by the workshop supervisor — ask questions if you do not fully understand.
- 4 Ensure that you are circuit and equipment connections are correct before turning “ON” the power supply.
- 5 Use the appropriate machine for the work to be done.

1.2.1 SAFETY RULES FOR MACHINES USED IN THE WORKSHOP

Operating Machines Safely

6

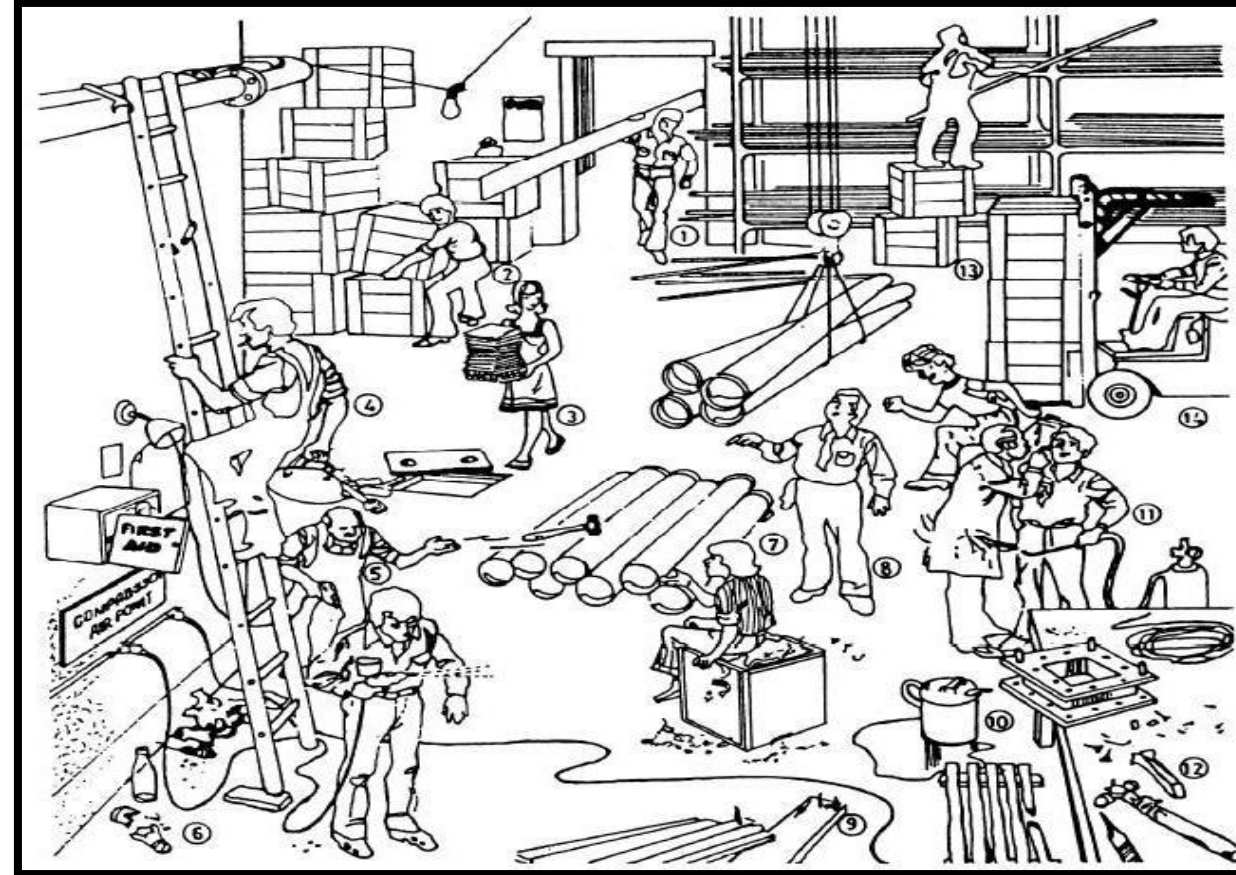
No machine may be used, and no work undertaken, unless the supervisor is satisfied that you are capable of doing so safely.

7

If a machine is fitted with guards, they must be used. Equipment should never be used if the safety guards have been removed.

8

Ensure that switches are “OFF”, the plugs are unplugged, and the working area is cleaned before you leave the workshop.



1.3 INDUSTRIAL SAFETY

Key Definitions — Events

Core concepts and definitions that frame every safety discussion in this course.

Accident

An undesired circumstance which gives rise to ill-health or injury, damage to property, plant, products or the environment, production losses, or increased liabilities.

Incident

Undesired circumstances and 'near misses' which could cause accidents.

Ill Health

Acute and chronic ill health caused by physical, chemical or biological agents, as well as adverse effects on mental health.

1.3 INDUSTRIAL SAFETY

Key Definitions — Hazard, Risk & Safety

Hazard

The potential to cause harm — including ill health and injury, damage to property, plant, products or the environment, production losses, or increased liabilities.

Risk

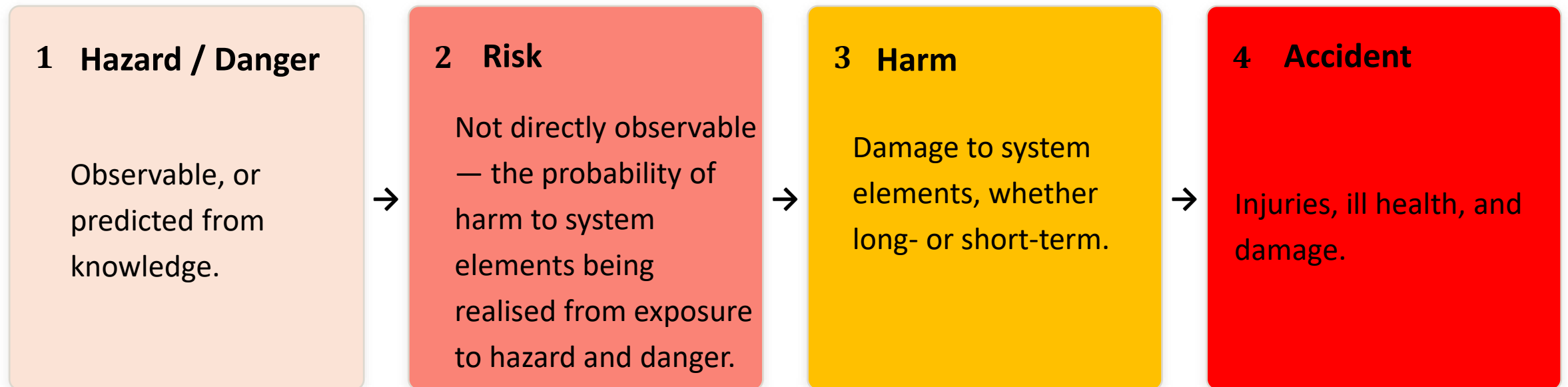
The likelihood that a specified undesired event will occur, due to the realisation of a hazard by, or during, work activities or by the products and services those activities create.

Safety

The 'control of accidental loss.'

1.3 INDUSTRIAL SAFETY · OSH CONCEPT

From Hazard to Accident: The OSH Chain



1.3 INDUSTRIAL SAFETY

Why Accidents Must Be Prevented

M

Moral / Humane

No one comes to work to be injured or killed.

C

Cost

Accidents cost organisations money — in downtime, retraining and replacement.

L

Legislation

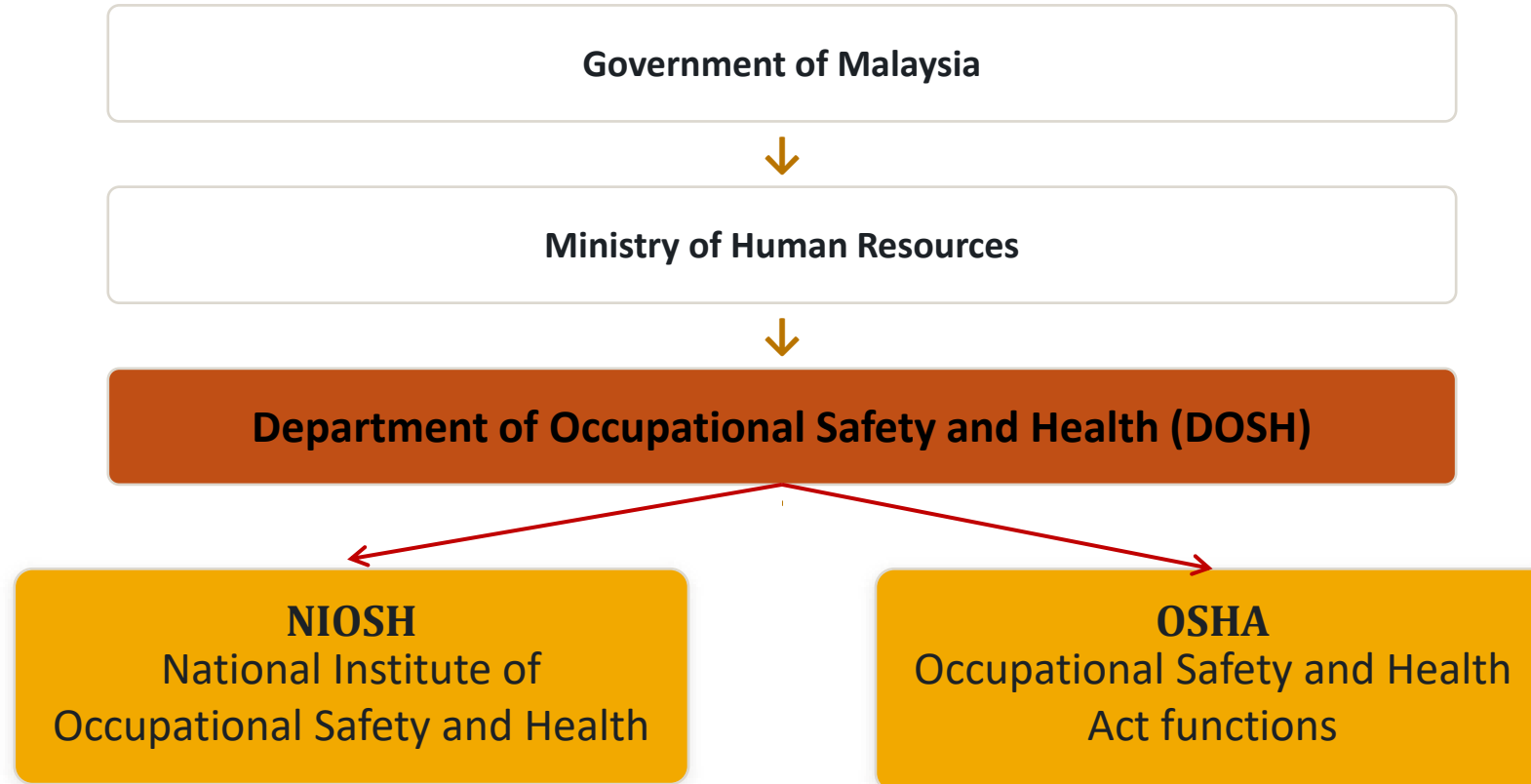
Organisations carry a legal obligation to prevent workplace accidents.

Even a “near miss” hurts productivity

It costs time and money to retrain a new worker • new workers are initially less productive than experienced ones • goods or equipment lost must be replaced • other workers feel afraid or unhappy working somewhere that could injure or kill them — and this harms productivity.

1.3 INDUSTRIAL SAFETY

Occupational Safety & Health Governance in Malaysia



1.3 INDUSTRIAL SAFETY

The Role of DOSH

1 Standard setting

Standards on safety, health and welfare are reviewed, drafted and finalised from time to time, so they stay relevant to workplace conditions.

2 Policy study

Existing OSH policies are studied periodically to assess how well they meet their objectives, and revised where needed.

3 Drafting regulations

New regulations, codes of practice and guidelines are drafted and amended to help industry meet its obligations under the Act.

4 Enforcement

Enforcement activities protect the safety, health and welfare of workers under the Acts listed opposite.

Enforced under

- Occupational Safety and Health Act 1994 (Act 514)
- Factories and Machinery Act 1967 (Act 139)
- Petroleum (Safety Measures) Act 1984 (Act 302)

Enforcement activities by DOSH include:

- i. Approval & authorization
- ii. Registration
- iii. Certification
- v. Inspection
- vi. Investigation
- vii. iv. Litigation

1.3 INDUSTRIAL SAFETY

NIOSH — National Institute of Occupational Safety and Health

NIOSH supports Malaysia's OSH system through five core responsibilities:

1

Training

Delivering OSH training programmes across industry.

2

Examination

Administering competency and certification examinations.

3

Information services

Publishing and disseminating OSH information.

4

Research & development

Advancing OSH knowledge and practice.

5

Consultation

Advising organisations on OSH matters.

OSHA — Objectives, Scope & Application

Objectives

- Secure the safety, health and welfare of persons at work against risks arising from work activities.
- Protect persons at a place of work, other than those at work, against similar risks.

Scope

Covers all working personnel, except:

- **Armed Forces**
- **Crew of merchant ships**

Applies across industries including:

Manufacturing

Mining & Quarrying

Construction

Agriculture, Forestry & Fishing

Utilities

Wholesale & Retail Trade

Finance & Insurance

Transport, Storage & Communication

Hotels & Restaurants

Real Estate & Business Services

Public Service & Statutory Authorities

1.4 OCCUPATIONAL HAZARD AND CONTROL

What Is a Hazard?

Hazard: a substance or condition with the potential to cause injury in a given environment or situation.

- **Industrial hazards** may be defined as any condition/ substance produced by **industries** that may cause injury or death to personnel or loss of product or property.
- **Safety** in simple terms means **freedom from the occurrence of risk or injury or loss**. Industrial safety refers to the protection of workers from the danger of industrial accidents.
- **Hazard** is a potential of substance to cause damage

Risk: the probability that harm will occur under defined conditions of exposure to a hazard.

- In some **industrial** plants, by the nature of their activities and the substances they use, constitute hazards which are all the greater when they are **located** close to **residential** areas and their residents are particularly exposed in the events for accidents.

1.4 OCCUPATIONAL HAZARD AND CONTROL

Types of Industrial Hazards

Identifying industrial hazards, and the hierarchy of controls used to manage them.

- 1 Mechanical hazards (press machines and other machinery)
- 2 Electrical hazards
- 3 Safe use of lifts and escalators
- 4 Noise and vibration hazards
- 5 Radiation, pressurized environments and thermal stress
- 6 Transport activities and gas cylinder safety
- 7 Fire safety in buildings (Fire Services Act, Building Law)
- 8 Safety at construction sites
- 9 Chemical hazards and chemical safety management

1.4 OCCUPATIONAL HAZARD AND CONTROL

What Is a Hazard?

Workplace hazards can come from a **wide range of sources**. General examples include any **substance, material, process, practice**, etc. that has the ability to cause harm or adverse health effect to a person under certain conditions. See Table 1

Workplace Hazard	Example of Hazard	Example of Harm Caused
Thing	Knife	Cut
Substance	Benzene	Leukemia
Material	Asbestos	Mesothelioma
Source of energy	Electricity	Shock, electrocution
Condition	Wet floor	Slips, falls
Process	Welding	Metal fume fever
Practice	Hard rock mining	Silicosis

1.4 OCCUPATIONAL HAZARD AND CONTROL

Categories of Workplace Hazards

WORK ENVIRONMENT Adequate Access Air Conditioning Confined Spaces Temperature Extremes (including skin contact) Heat (inc. fire, flames) Cold Lighting Mental Stress Dehydration Falls, trips, slips etc. Falling objects Working at Heights Kinetic Energy The body hitting objects Hit by moving objects Explosion Penetrating objects Vibration Pressure – pneumatic, hydraulic Acoustic/Noise	MANUAL HANDLING Muscular Stress Lifting, carrying Other handling Without handling Repetitive movement Ergonomics CHEMICAL Flammable Toxic Corrosive Oxidizer Compressed Gases BIOLOGICAL Microbiological Animal tissue/fluids Human tissue Human Blood and fluids Pathogenic Zoonotic	IONIZING RADIATION Radioactive Materials OTHER TYPES OF RADIATION Laser Ultraviolet Infrared Radiofrequency Microwave Electromagnetic Field MAJOR EVENT Student activities function Public event Violence Hold up Intoxicated students Firearms / Weapons Food Poisoning	ENERGY Electrical Gravity MECHANICAL Vehicles Mobile and Fixed Plant Powered Equipment Non-Powered Equipment ENVIRONMENTAL Air Release Sewer Release Release to Property PROPERTY Structural Collapse Structural Damage Utility Failure Utility Disruption Water Damage	NATURAL Lightning Rain Storm Flooding Sun Wind ANIMAL / INSECT Bites/ Stings Research Animals OTHER Working Alone Remote location	
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1.4 OCCUPATIONAL HAZARD AND CONTROL

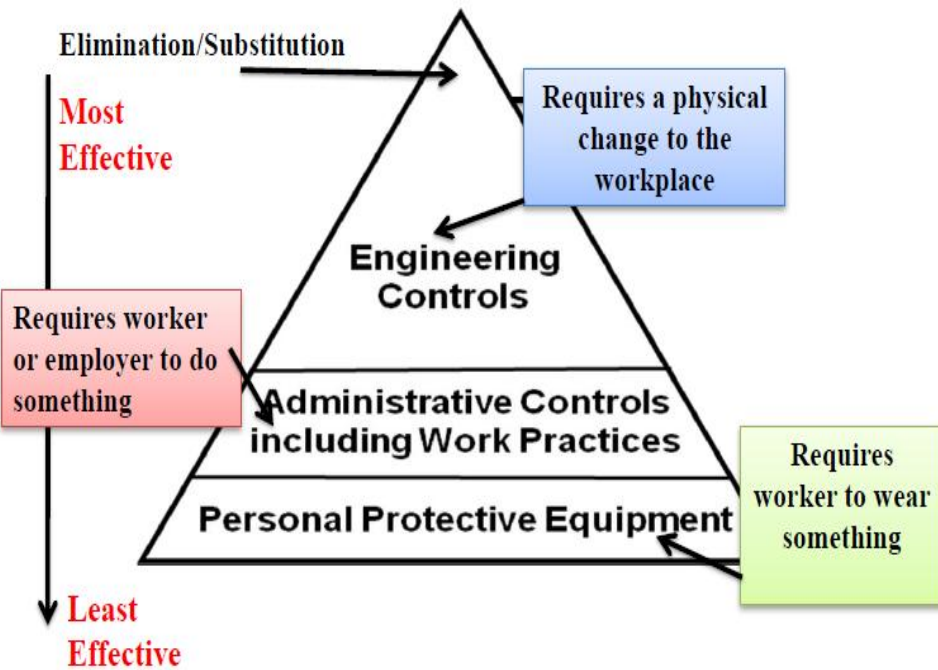
Identifying Hazards at the Workplace

- 1 Observe your workplace
- 2 Investigate complaints from workers
- 3 Examine accident and near-miss records
- 4 Examine sickness figures
- 5 Use simple surveys to ask co-workers about health and safety concerns
- 6 Use checklists to help inspect your workplace
- 7 Learn the results of inspections by the employer, the union, or anyone else
- 8 Read reports or other information about your workplace

1.4 OCCUPATIONAL HAZARD AND CONTROL

Hierarchy of Controls

Hierarchy of Controls



Most effective

Elimination & Substitution

Most effective — requires a physical change to the workplace

Engineering Controls

Requires a physical change to the workplace

Administrative Controls

Requires the worker or employer to do something

Personal Protective Equipment

Least effective — requires the worker to wear something

Least effective

1.4 OCCUPATIONAL HAZARD AND CONTROL

Eliminate/Substitution & Engineering Controls

Elimination & Substitution

At the source of the hazard:

Elimination — Getting rid of a hazardous job, tool, process, machine or substance entirely — e.g., a business decides to stop buying and cutting up scrapped bulk fuel tanks.

Substitution — Sometimes doing the same work in a less hazardous way is possible — e.g., replacing a hazardous chemical with a less hazardous one.

Engineering Controls

Redesign

Rework jobs or processes to be made safer, e.g. easier to hold or lift.

Automation

Use dangerous processes robotically, protecting workers from direct exposure.

Absorption & dilution

Absorb energy released, or dilute a hazard, e.g. ventilation systems dilute toxic gases.

Isolation

If a hazard cannot be eliminated, isolate it — e.g. store flammables away from work areas.

Barriers

Guarding that prevents contact with moving parts or hazardous zones.

1.4 OCCUPATIONAL HAZARD AND CONTROL

Administrative Controls

Administrative Controls

- 1 **Safe work procedures** expected practices, periodically reviewed and refreshed.
- 2 **Training & supervision** appropriate supervision helps identify hazards and evaluate work practices.
- 3 **Job rotation** reduces the time each worker is exposed to a hazard.
- 4 **Housekeeping** cleaning, waste disposal and spill cleanup keep hazards contained.
- 5 **Hygiene practices** shower and change clothing where applicable, to avoid taking toxic hazards home.

1.4.1 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE — the control of LAST RESORT

Purpose: to increase individual safety while performing a potentially hazardous task.

- 1 Eye protection
- 2 Hearing protection (mandatory above 85 dB for more than 8 hours)
- 3 Dust masks
- 4 Foot wear
- 5 Gloves
- 6 Laboratory coats
- 7 Body protection



1.5 FIRE SAFETY

Fire Extinguisher Classification

Every workshop must be equipped with a fire extinguisher. When selecting the appropriate type, the class of combustible material present must be considered.

CLASS A

RED

Combustible materials such as wood, cloth, paper, rubber and many plastics.

CLASS B

LIGHT YELLOW

Flammable liquids and gases, oils, greases, tars, oil-based paints, lacquers, some plastics.

CLASS C

BLACK / GREEN

Class A and/or B materials in the presence of live electrical equipment, motors, switches and wires.

CLASS D

LIGHT BLUE

Combustible metals such as magnesium, titanium, sodium, potassium, zirconium and lithium.

1.6 IMPORTANT WORKSHOP SIGNAGE

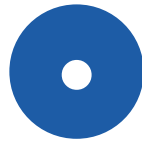
Reading Workshop Safety Signs

SAFETY FIRST · UTAMAKAN KESELAMATAN



Prohibition

Red circle with diagonal bar — e.g. No Admittance, No Naked Flame.



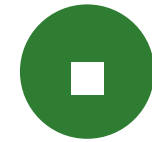
Mandatory

Blue circle — e.g. Wear Safety Glasses, Wear Safety Boots.



Warning

Yellow triangle — e.g. Danger, Keep Hands Clear of Moving Machinery.



Safe Condition

Green square — e.g. Fire Exit, First Aid Point, Assembly Point.



CHAPTER SUMMARY

- 1 **1.1** Workshop safety serves engineering's broader goals: fewer accidents, controlled hazards, and public confidence.
- 2 **1.2** General and machine-specific rules protect workers and equipment — from PPE and dress code, to guards and permissions.
- 3 **1.3** Accidents follow a chain: hazard → risk → harm → accident. Malaysia's OSH system (DOSHS, NIOSH, OSHA) governs this.
- 4 **1.4** Hazards are identified and managed through the hierarchy of controls — elimination first, PPE last.
- 5 **1.5 & 1.6** Fire extinguishers are matched to material class; signage communicates hazard and instruction at a glance.

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