



Introduction to Manufacturing, AGE-1320
Ahmed M. El-Sherbeeney, PhD
Spring-2026

Industrial and Workshop Safety

Chapter Outline

2

1. **Importance of safety**
2. **Hazard types**
3. **Hazard identification**
4. **Risk assessment**
5. **Personal Protective Equipment (PPE)**
6. **Machine safety**
7. **Safety codes and standards**
8. **Workshop safety practices**
9. **Safety culture and behavior**

1. Importance of Safety



Importance of Safety



4

Why Safety Matters in MFG

- Protects workers from injury and illness
- Improves productivity and quality
- Reduces downtime and equipment damage
- Required by safety regulations and industry standards
- Promotes long-term sustainability and professionalism

Most common workplace accidents

According to the **HSE's report on non-fatal injuries during 2018/19**, the most common causes of accidents at work are:



Slips, trips or falls on the same level

29%



Handling, lifting or carrying

20%



Being struck by moving object

10%



Acts of violence

8%



Falls from height

8%

2. Hazard Types



Hazard Types

6

Common Manufacturing Hazards

- Mechanical hazards (moving machinery, rotating parts)
- Electrical hazards (shock, arc flash)
- Chemical hazards (fumes, vapors, spills)
- Fire and explosion hazards
- Noise, vibration, and heat
- Slips, trips, and falls



Electrical Risk



Abrasion & Scrapes



Chemicals Burns



Viral Infections



Impact Risk



Cut Risk



Extreme Temperatures



Musculoskeletal Disorders

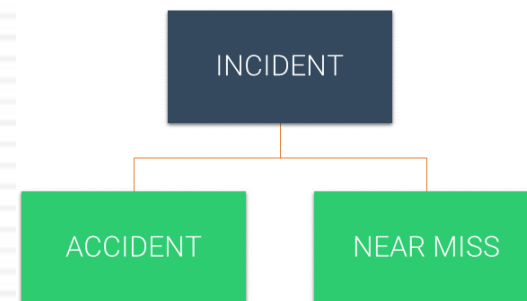


Hazard Types

7

Hazard vs Risk

- **Hazard:** a source of potential harm
- **Risk:** the likelihood and severity of harm from a hazard
- **Incident:** Unplanned event that causes loss
- **Near-miss:** Event with no injury but potential for harm

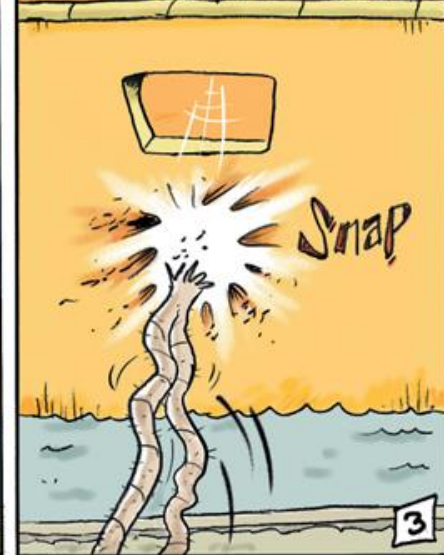
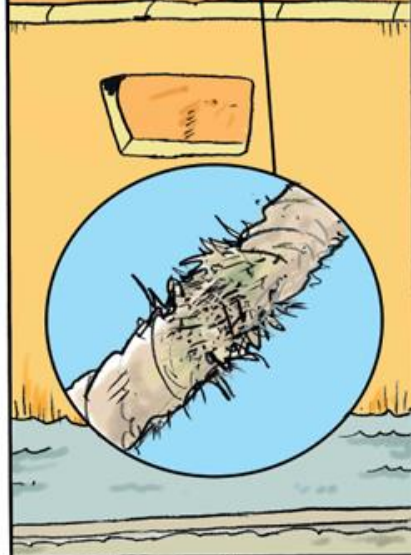
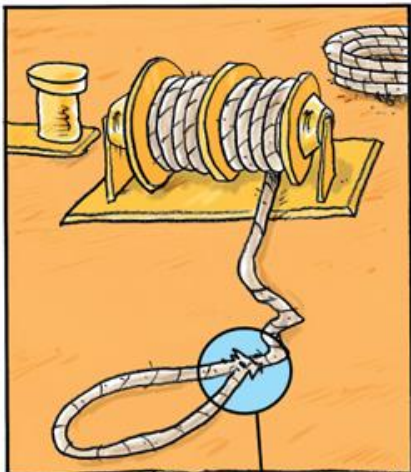


The weak rope



SEAH/ELTH
© 2014/15

8



3

Unsafe condition.

• Unsafe act • Near miss • Accident

3. Hazard Identification



Hazard Identification



10

Hazard Identification Methods

- Regular inspections
- Reviewing past incidents
- Worker feedback
- Safety checklists
- Reviewing Safety Data Sheets (SDS)
- Studying equipment manuals



Hazard Identification

11

Job Hazard Analysis (JHA)

- Break job into steps
- Identify hazards for each step
- Determine **controls**
- Review regularly

**SAFE +
SOUND
WEEK 2024**



6 Steps for Taking the Mystery Out of Job Hazard Analysis



4. Risk Assessment



Risk Assessment



13

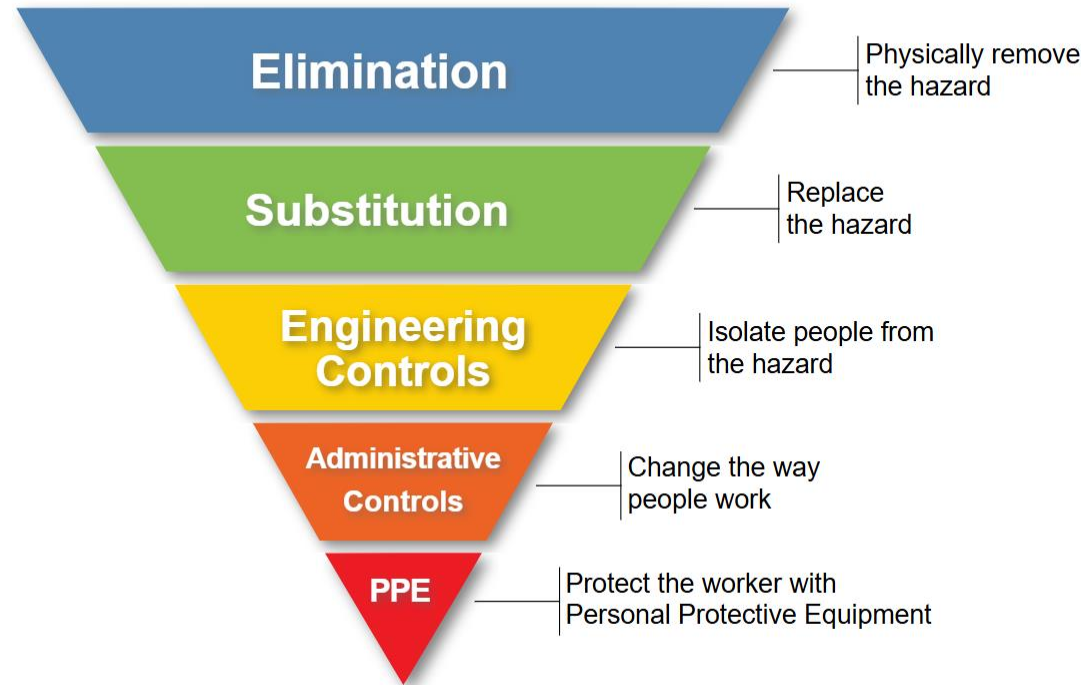


The Hierarchy of Controls

1. Elimination
2. Substitution
3. Engineering controls
4. Administrative controls
5. PPE

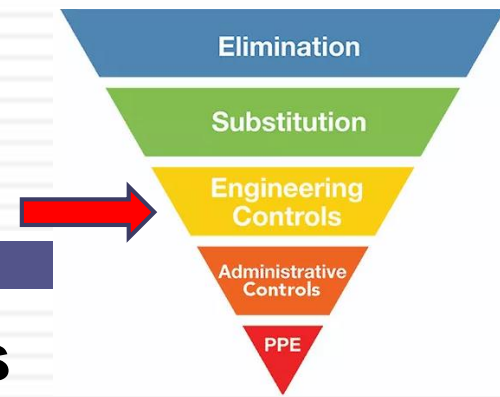


Hierarchy of Controls



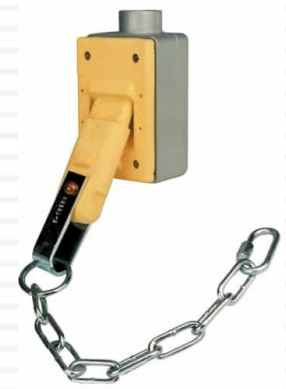
Risk Assessment

14



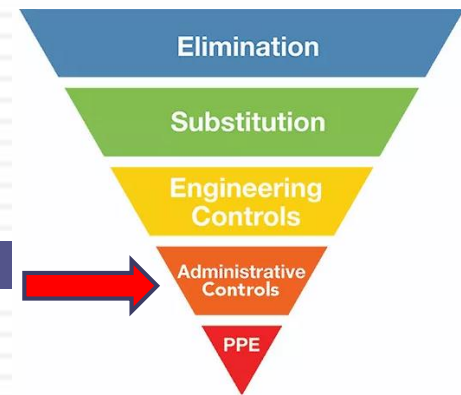
Engineering Controls in Workshops

- ❑ Machine guards
- ❑ Barriers and enclosures
- ❑ Ventilation systems
- ❑ Noise dampening
- ❑ Interlocks



Risk Assessment

15



Administrative Controls

- Training
- Standard operating procedures
- Warning signs
- Rotating shifts to reduce fatigue
- Limiting access to hazardous areas

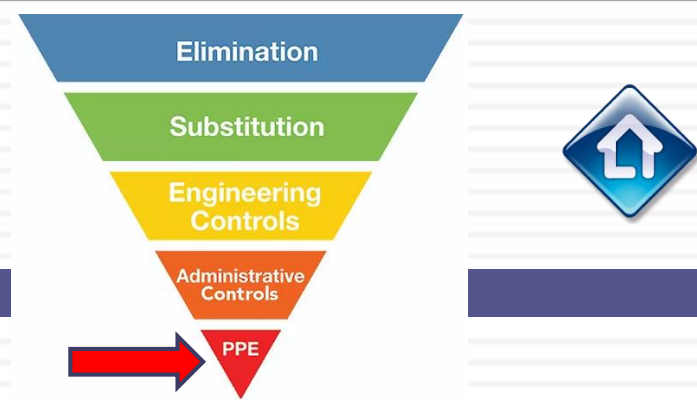


5. Personal Protective Equipment (PPE)



Personal Protective Equipment (PPE)

17



What is PPE?

- Equipment worn to minimize exposure to hazards
- Used when other controls cannot fully remove risk
- Must be selected based on hazard type



Personal Protective Equipment (PPE)

18

1. Head and Eye Protection

- ❑ Hard hats for falling object protection
- ❑ Safety glasses for impact
- ❑ Goggles for chemicals
- ❑ Face shields for grinding or cutting



Personal Protective Equipment (PPE)

19

2. Hearing and Respiratory Protection

- ❑ Earplugs and earmuffs
- ❑ Respirators for dust and fumes
- ❑ Fit testing is required for tight-fitting masks



NOISE LEVELS BY DECIBELS

Pneumatic Precision Drill	119
Hammer Drill	114
Chain Saw	110
Spray Painter	105
Hand Drill	98
NIOSH Recommended Exposure Limit	85
Normal Conversation	60
Whisper	30



Personal Protective Equipment (PPE)

20

3. Hand and Body Protection

- ❑ Cut-resistant gloves
- ❑ Heat-resistant gloves
- ❑ Chemical-resistant aprons
- ❑ Flame-resistant clothing



Personal Protective Equipment (PPE)

21

4. Foot Protection and Visibility

- ❑ Safety shoes with toe protection
- ❑ Slip-resistant soles
- ❑ High-visibility vests
- ❑ Metatarsal guards



Personal Protective Equipment (PPE)

22

Proper PPE Use and Limitations

- Must fit properly
- Must be inspected before use
- Must be replaced when damaged
- PPE does not eliminate the hazard

Rules for using Personal Protective Equipment (PPE)



1 Know which PPE is required for your work role.

2 Use the PPE in the manner you have been trained to use it.



3 Ensure your equipment fits comfortably.

4 Be fully trained in the use of your specific PPE.



5 Do not misuse or damage the clothing you have been provided.

6 Ensure proper care and maintenance of the PPE.



7 Notify your employer immediately if you notice any damage



6. Machine Safety



Machine Safety



24

Machine Safety Principles

- ❑ Read machine manuals
- ❑ Never bypass guards
- ❑ Verify tool condition before use
- ❑ Use correct speeds and feeds
- ❑ Keep hands and clothing away from moving parts



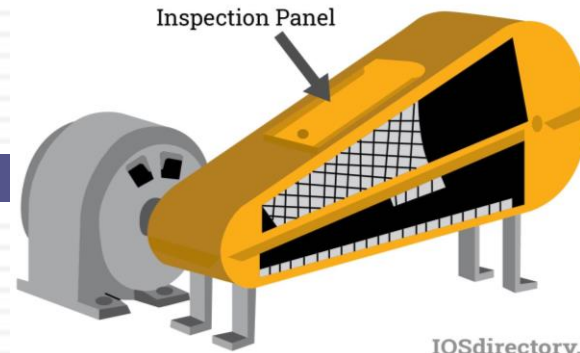
Machine Safety

25

Types of Machine Guards

- ❑ Fixed guard
- ❑ Interlocked guard
- ❑ Adjustable guard
- ❑ Self-adjusting guard

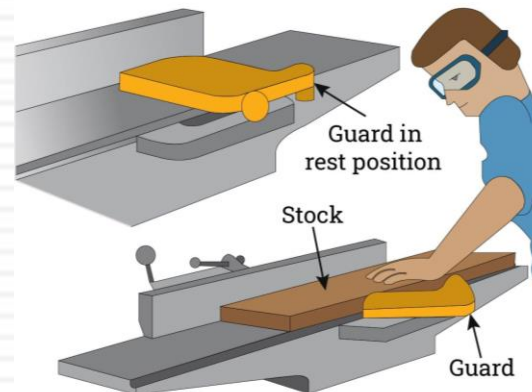
Fixed Machine Guard



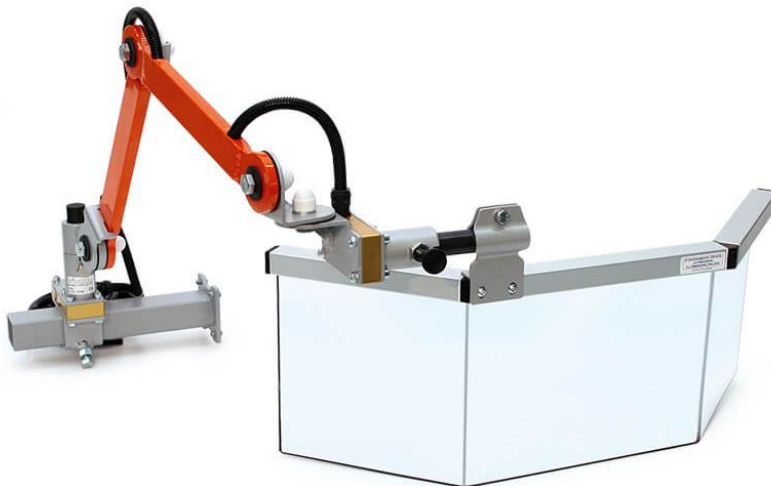
IQSdirectory.com



Self-Adjusting Guard On Jointer



IQSdirectory.com



Machine Safety

26

Lockout–Tagout (LOTO)

- Ensures machines cannot be powered during maintenance
- Prevents accidental startup
- Uses locks, tags, and isolation devices



7. Safety Codes and Standards



Safety Codes and Standards



28

Safety Codes Overview

- Provide guidance on safe work practices
- Define responsibilities of employers and workers
- Used worldwide to ensure consistent safety performance

CODE VERSUS STANDARD

Model that is
adaptable by law

Set of technical
definitions,
specifications, and
guidelines

Clarifies what
needs to be done

Clarifies how
something should
be done

Can be adopted
into law

Is not legalized

Examples include
International
Building Code and
ASME Boiler and
Vessel Code

Examples include
ASTM
International
standards and ISO
standard

Pediaa.com

Safety Codes and Standards

29

Major International Standards

- ❑ OSHA (United States)
- ❑ ISO 45001 (Occupational health and safety)
- ❑ IEC electrical safety standards
- ❑ Fire protection standards (NFPA)



International
Electrotechnical
Commission



Safety Codes and Standards

30

Employer and Worker Responsibilities

- Employer must:
 - ▣ Provide safe workplace
 - ▣ Train workers
 - ▣ Provide PPE

- Worker must:
 - ▣ Follow safety procedures
 - ▣ Use PPE correctly
 - ▣ Report hazards and incidents

HEALTH & SAFETY

RESPONSIBILITIES

EMPLOYER RESPONSIBILITIES

-  Provide a safe workplace (free from hazards).
-  Conduct risk assessments and implement control measures
-  Provide PPE (Personal Protective Equipment) where necessary
-  Ensure safety training & awareness programs
-  Maintain safe machinery, equipment, and tools
-  Develop and enforce safety policies & procedures
-  Report and investigate accidents and near misses
-  Provide first aid and emergency arrangements
-  Encourage safety culture and worker participation

EMPLOYEE RESPONSIBILITIES

-  Follow safety rules and procedures set by employer
-  Use PPE properly and maintain it
-  Report hazards, unsafe acts, and conditions immediately
-  Do not misuse or tamper with safety equipment
-  Take reasonable care of own health and safety
-  Co-operate with employer on safety measures
-  Participate in safety training & drills
-  Report injuries, incidents, or ill-health quickly
-  Promote safe behaviour among co-workers

8. Workshop Safety Practices



Workshop Safety Practices



32

Housekeeping and Organization

- Keep floors clear
- Store tools properly
- Clean spills immediately
- Maintain clear walkways

HOUSEKEEPING & WORKPLACE SAFETY

HAZARD IDENTIFICATION



Recognizing and reporting workplace safety hazards

SLIP, TRIP & FALL PREVENTION



Practices to prevent slips, trips, and falls in the workplace

PROPER STORAGE



Guidelines for storing materials and equipment safely

CLEANING PRACTICES



Effective cleaning techniques to maintain workplace order

ELION

Workshop Safety Practices

33

Chemical Safety

- Use [SDS](#) for chemicals
- Store flammable materials properly
- Ensure good ventilation
- Label containers clearly

The diagram shows a Safety Data Sheet (SDS) label for Sodium Hydroxide with six numbered callouts pointing to specific parts of the label:

- 1 - Product Identifier:** Points to the text "SODIUM HYDROXIDE".
- 2 - Signal Word:** Points to the red box containing the word "DANGER".
- 3 - Hazard Statement:** Points to the text "CAUSES SEVERE SKIN BURNS AND EYE DAMAGE. MAY BE CORROSIVE TO METALS.".
- 6 - Pictogram:** Points to the hazard pictogram showing a hand being corroded by a liquid.
- 4 - Precautionary Statement:** Points to the "PREVENTION" section, which includes instructions like "Do not breathe dust/fume/gas/mist/vapor or spray. Wash hands thoroughly after handling."
- 5 - Suppliers Identification:** Points to the "DISPOSAL" section, which includes instructions like "Dispose of contents/containers to a licensed chemical disposal agency in accordance with local/regional/national regulations."

CHEMICAL SAFETY



UNDERSTAND THE CHEMICAL
Read the label and Safety Data Sheet (SDS)



WEAR APPROPRIATE PPE
Use gloves, goggles, and lab coat



USE PROPER STORAGE AND LABELING
Store in a labeled, compatible container



WORK IN A WELL-VENTILATED AREA
Use fume hood for ventilation



AVOID IGNITION SOURCES
Keep away from open flames and sparks



DO NOT EAT, DRINK, OR SMOKE
Prohibited in areas where chemicals are used



PRACTICE GOOD HYGIENE
Wash hands thoroughly after handling



BE PREPARED FOR EMERGENCIES
Know the locations of emergency equipment



DISPOSE OF CHEMICALS SAFELY
Follow local regulations for disposal



GET TRAINED AND STAY INFORMED
Attend chemical safety training

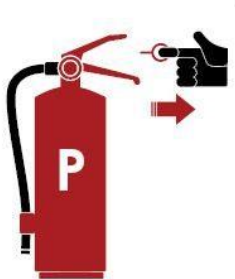
Workshop Safety Practices

34

Fire Safety

- Know fire extinguisher types
- Keep exits unblocked
- Remove ignition sources
- Proper storage of flammable liquids

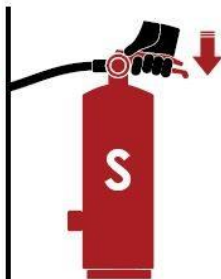
HOW TO USE A FIRE EXTINGUISHER



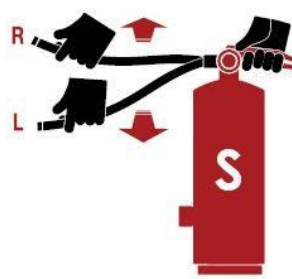
PULL
THE PIN



AIM
AT BASE OF FIRE



SQUEEZE
THE LEVER



SWEEP
FROM SIDE TO SIDE



WHAT ARE FIRE SAFETY RULES?



Carry Out a Fire
Risk Assessment



Provide Fire
Safety Training



Appoint a
Responsible Person



Maintain Equipment
and Systems



Implement Fire
Safety Measures



Have an
Emergency Plan

Workshop Safety Practices

35

Ergonomics and Manual Handling

- Use proper lifting technique
- Avoid awkward postures
- Reduce repetitive motions
- Use lifting aids when available



THE BACKSAFE 7 DON'TS

SLASH THE RISK OF SUFFERING BACK, NECK, SHOULDER & OTHER JOINT INJURIES BY 80-90%



Don't Bend Forward > 20°



Don't Bend Backward > 5°



Don't Twist > 20°



Don't Twist & Bend Forward > 20°



Don't Tilt > 20°



Don't Reach Out



Don't Jump

9. Safety Culture and Behavior



Safety Culture and Behavior



37

Importance of Safety Culture

- Encourages proactive reporting
- Reduces fear of speaking up
- Builds teamwork and vigilance
- Leads to fewer incidents



Safety Culture and Behavior

38

Unsafe Behaviors to Avoid

- Removing PPE
- Bypassing safety devices
- Rushing tasks
- Using damaged tools
- Ignoring warning signs

UNSAFE ACTS (BY PEOPLE)



Bypassing safety rules or equipment



Using defective tools



Horseplay or distractions



Working at height without a harness



Overloading machines



Overloading machines

UNSAFE CONDITIONS (IN THE ENVIRONMENT)



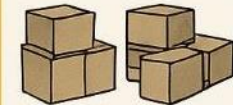
Poor lighting



Unprotected machinery



Faulty electrical wiring



Improper storage of materials



Leaking gases or chemicals

SAFE PROCEDURES (TO FOLLOW)



Always wear the correct PPE



Follow lockout/tagout procedures



Keep work areas clean and organized



Receive proper training before operating equipment



Follow all posted safety signs and instructions

**YOUR SAFETY IS IN YOUR HANDS –
REPORT, PREVENT, PROTECT!**

Safety Culture and Behavior

39

Daily Safety Checklist

- Am I wearing PPE?
- Are tools in good condition?
- Are guards in place?
- Are walkways clear?
- Are emergency exits visible?

10 Items That Should Be On Your Safety Checklist



1 No Broken Windows, Doors Or Openings



2 All Floor Surfaces Are Clean

3 No Tripping Hazards



4 No Unhygienic Waste Present

5 Toilets And Change Rooms Should Be Clean And Hygienic



6 Exit Routes Must Be Clearly Marked

7 Fire Equipment Must Be Clearly Demarcated



8 Work Areas Are Clean And Tidy

9 Safe Stacking And Storage

10 Machine Safeguarding



Safety Culture and Behavior

40

Summary

- Safety protects workers, equipment, and productivity
- PPE is the last line of defense
- Hazard identification is ongoing
- Safe behavior is essential
- Hazard activity:



Importance of Industrial Safety



Personal Protective Equipment (PPE)
is not designed to
protect against unsafe
behaviors.