Introduction to Manufacturing, AGE-1320

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Spring-2026

Industrial and Workshop Safety

Chapter Outline

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

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

2. Hazard Types

Hazard Types

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

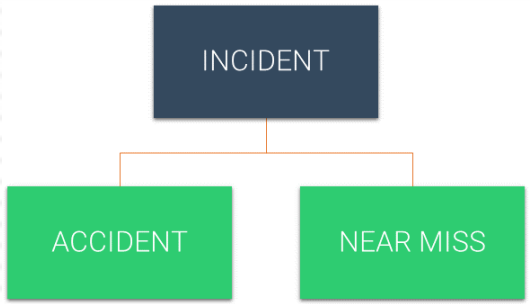
Extreme Temperatures

Musculoskeletal Disorders

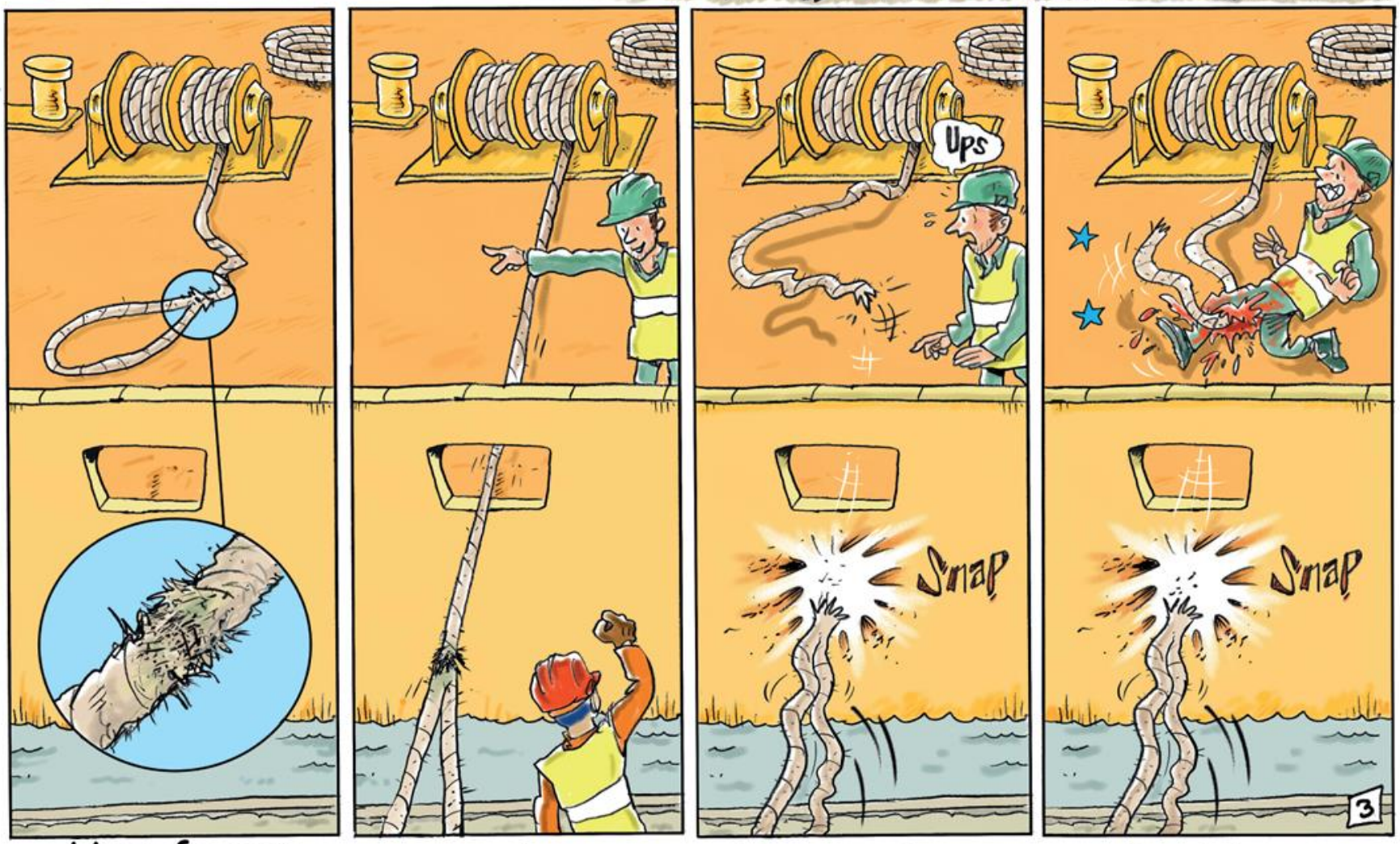
Hazard Types

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



Unsafe condition. • Unsafe act • Near miss • Accident

3. Hazard Identification

Hazard Identification

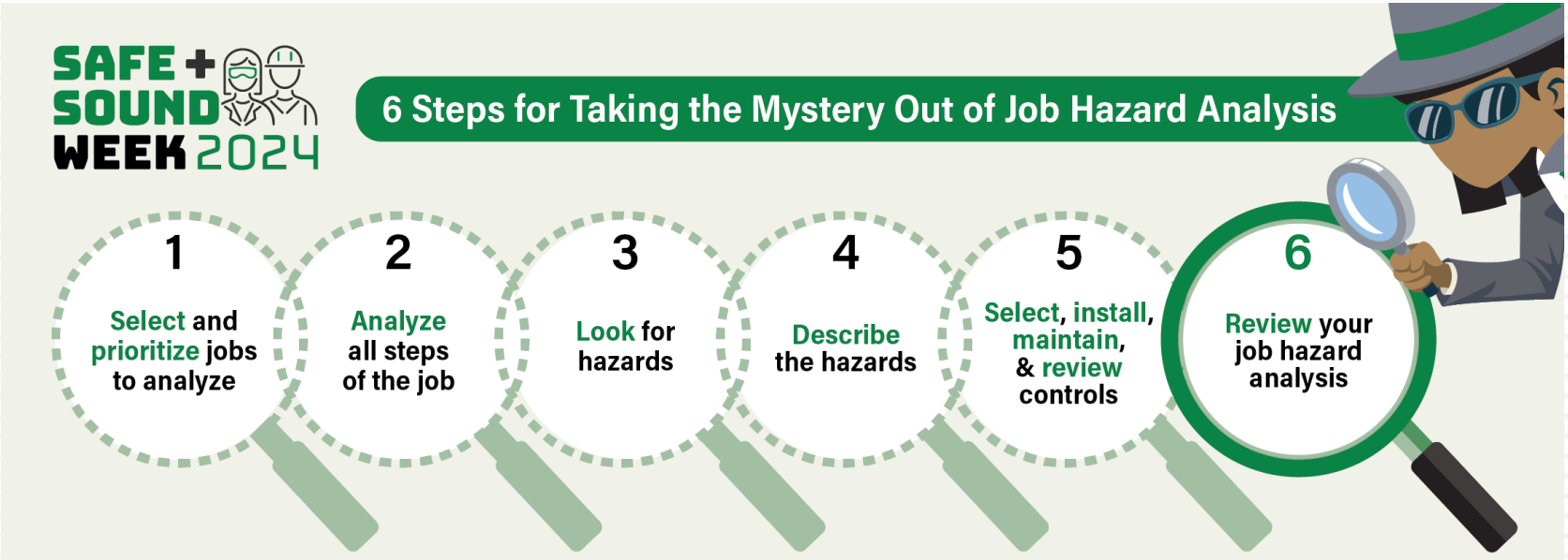
Hazard Identification Methods

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

Hazard Identification

Job Hazard Analysis (JHA)

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



4. Risk Assessment

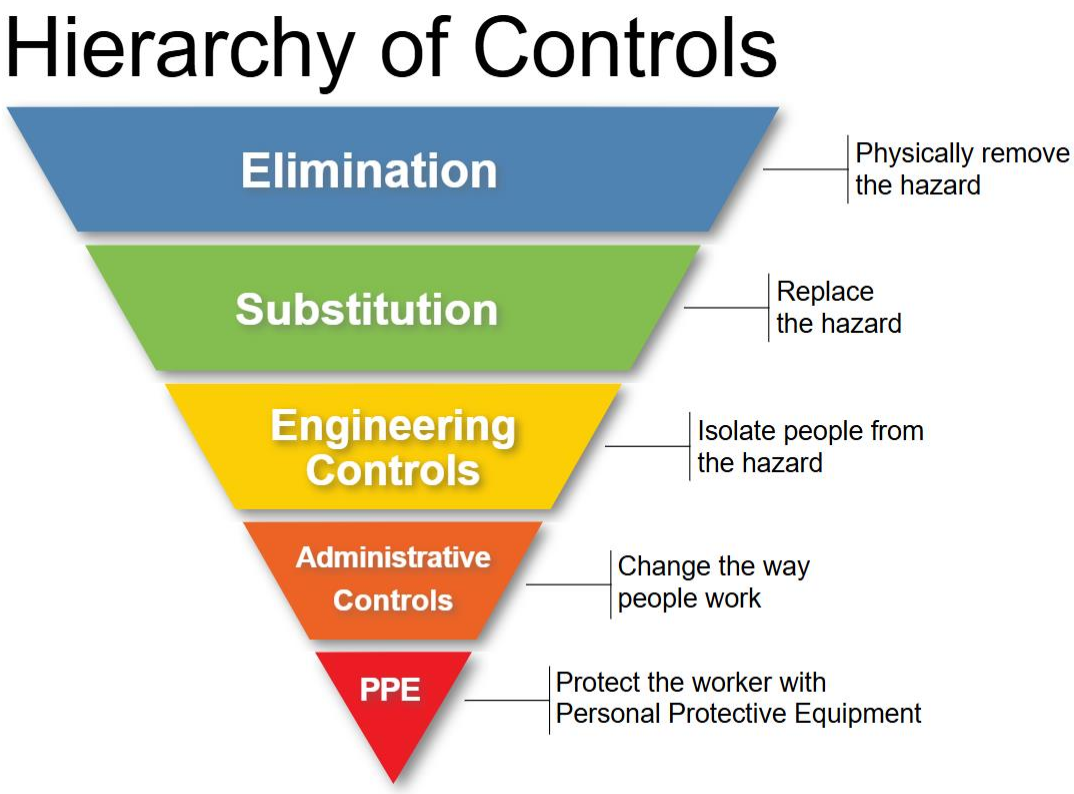
Risk Assessment

The Hierarchy of Controls

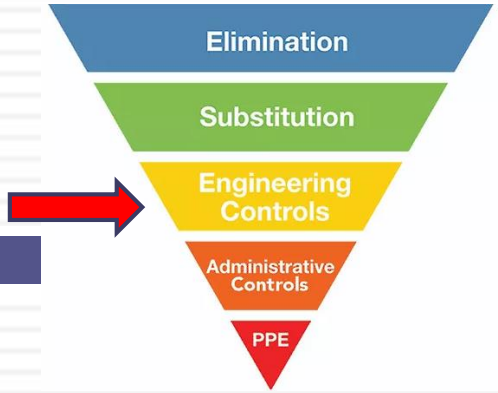
1. Elimination
2. Substitution
3. Engineering controls
4. Administrative controls
5. PPE

Most effective

Least effective

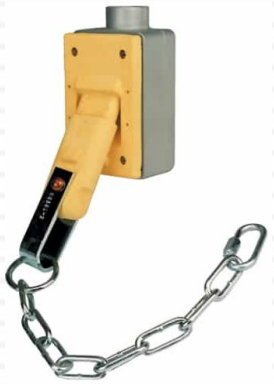


Risk Assessment

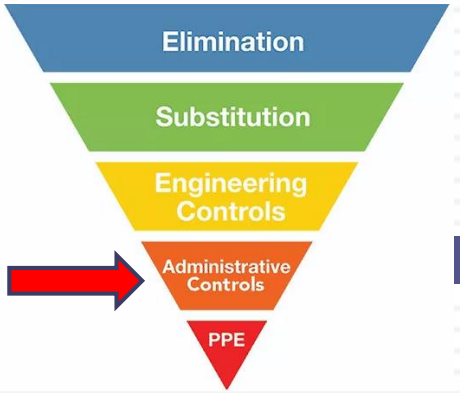


Engineering Controls in Workshops

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



Risk Assessment

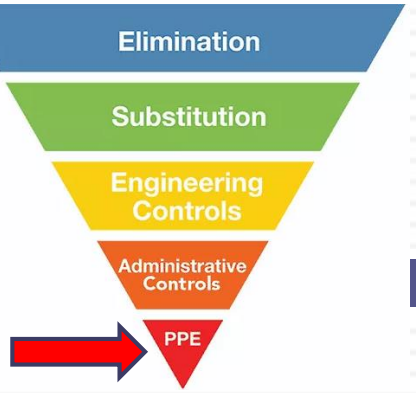


Administrative Controls

- 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)



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)

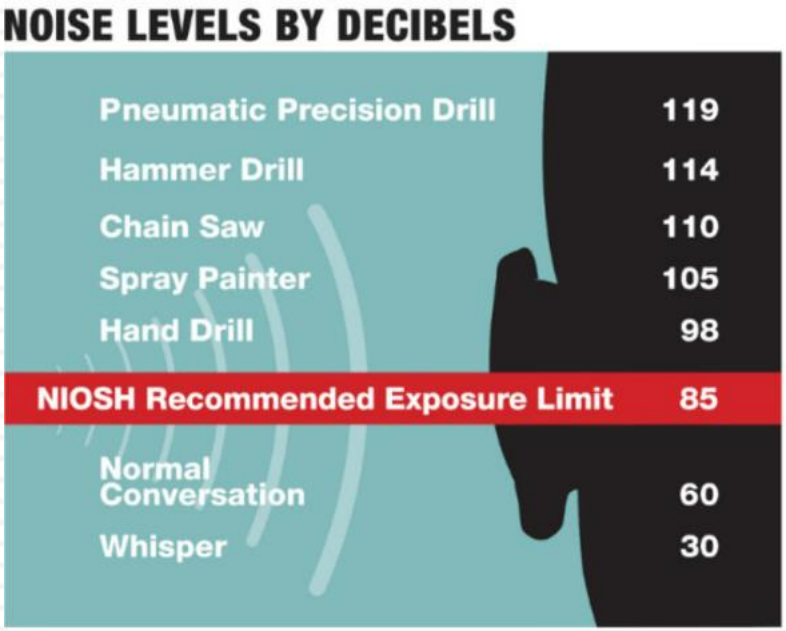
1. Head and Eye Protection

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

Personal Protective Equipment (PPE)

2. Hearing and Respiratory Protection

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



Personal Protective Equipment (PPE)

3. Hand and Body Protection

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

Personal Protective Equipment (PPE)

4. Foot Protection and Visibility

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

Personal Protective Equipment (PPE)

Proper PPE Use and Limitations

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

6. Machine Safety

Machine Safety

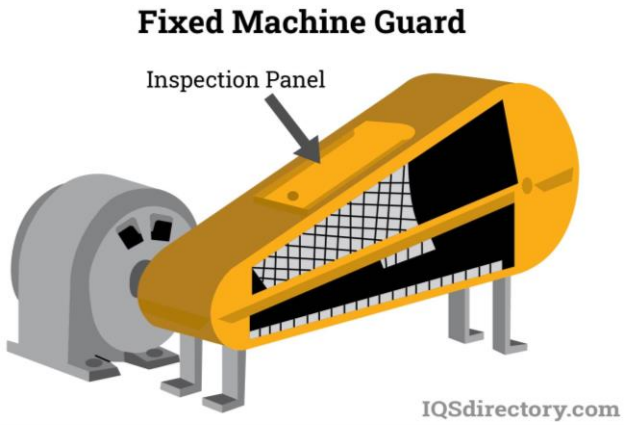
Machine Safety Principles

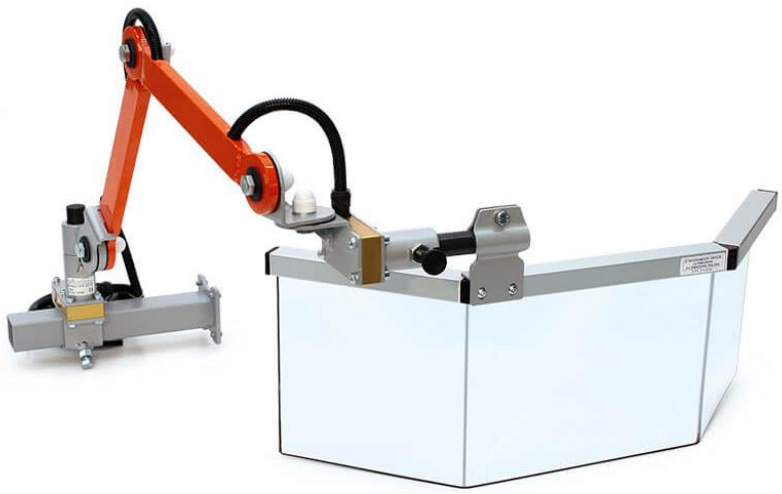
- Read machine manuals
- Never bypass guards
- Verify tool condition before use
- Use correct speeds and feeds
- Keep hands and clothing away from moving parts

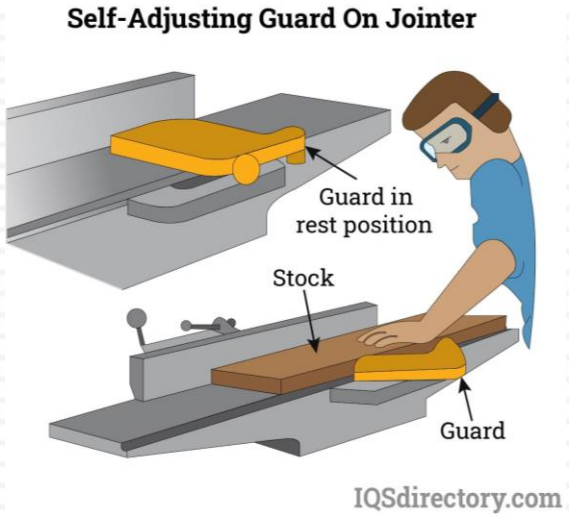
Machine Safety

Types of Machine Guards

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







Machine Safety

Lockout–Tagout (LOTO)

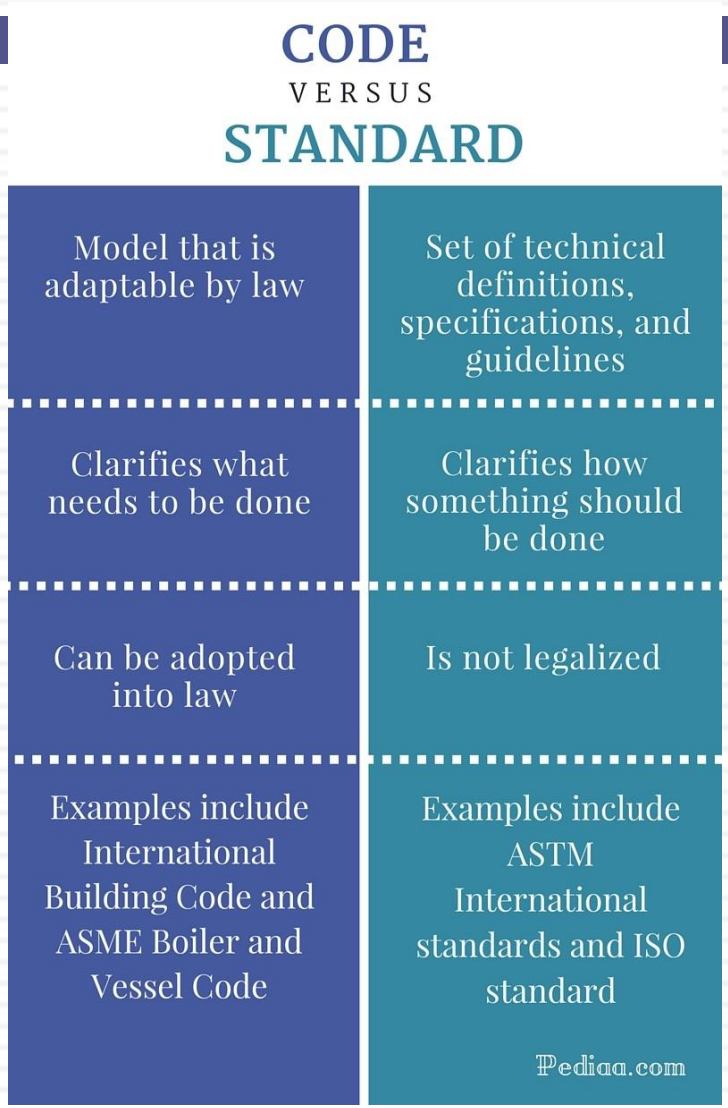
- Ensures machines cannot be powered during maintenance
- Prevents accidental startup
- Uses locks, tags, and isolation devices

7. Safety Codes and Standards

Safety Codes and Standards

Safety Codes Overview

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



Safety Codes and Standards

Major International Standards

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

OSHA® Occupational Safety and Health Administration
www.osha.gov

International Organization for Standardization ISO 45001

IEC® International Electrotechnical Commission

NFPA® National Fire Protection Association

Safety Codes and Standards

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

8. Workshop Safety Practices

Workshop Safety Practices

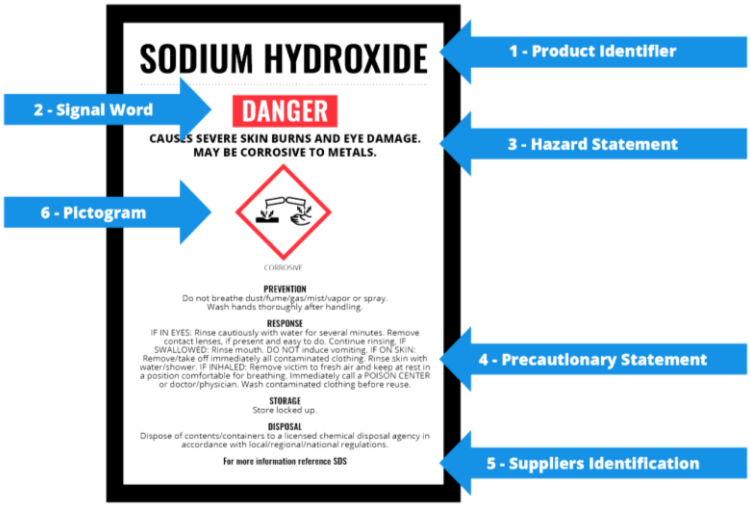
Housekeeping and Organization

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

Workshop Safety Practices

Chemical Safety

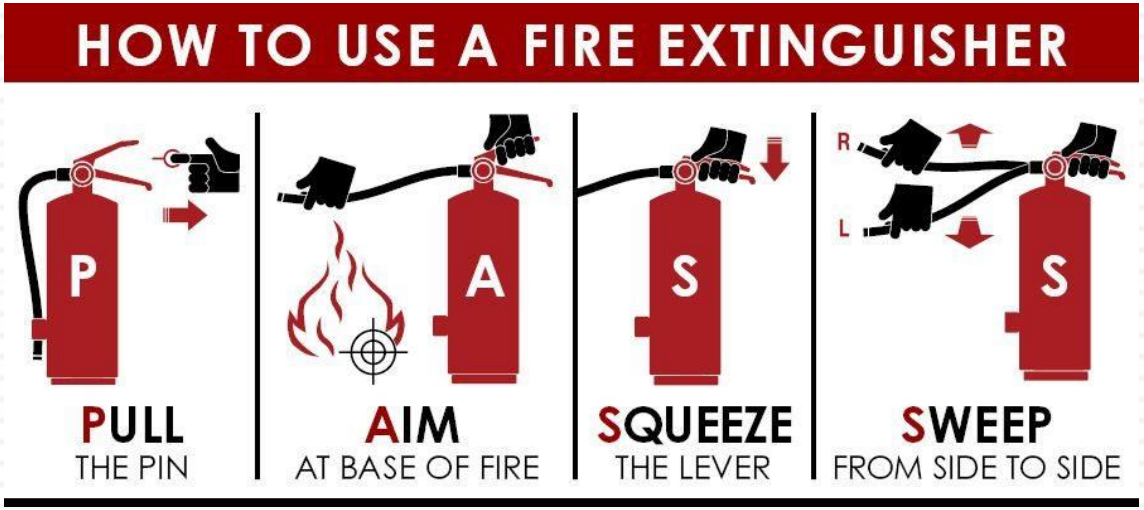
- Use SDS for chemicals
- Store flammable materials properly
- Ensure good ventilation
- Label containers clearly



Workshop Safety Practices

Fire Safety

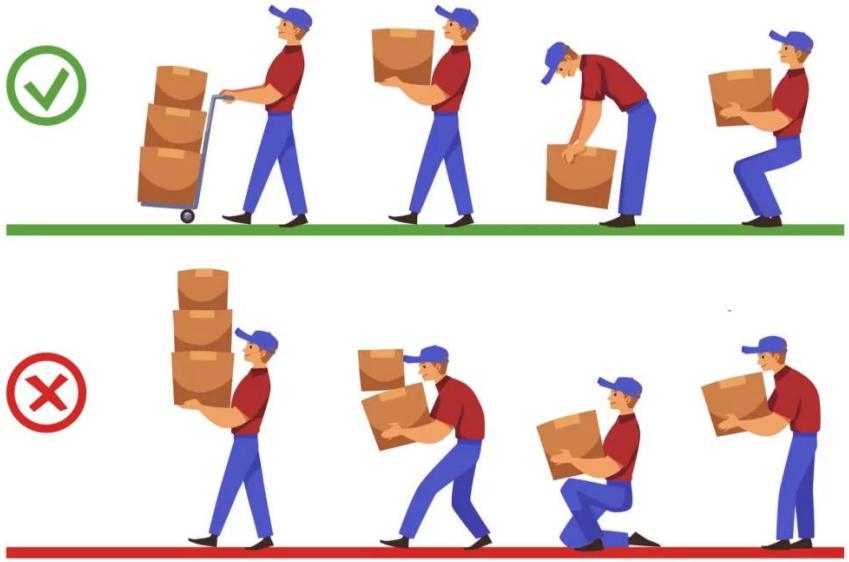
- Know fire extinguisher types
- Keep exits unblocked
- Remove ignition sources
- Proper storage of flammable liquids



Workshop Safety Practices

Ergonomics and Manual Handling

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



9. Safety Culture and Behavior

Safety Culture and Behavior

Importance of Safety Culture

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

Safety Culture and Behavior

Unsafe Behaviors to Avoid

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

Safety Culture and Behavior

Daily Safety Checklist

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

Safety Culture and Behavior

Summary

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