Health, Safety and Environment (HSE) in Industrial Installations

Target: 2nd Year Engineering Students

Instructor: Dr. GRINE Wassila

Chapter 2: Occupational Health and Environmental Protection

Description: Protecting Worker Health and Ecosystems in Industrial Operations

Five-Session Roadmap

- **Session 1:** Introduction to Occupational Health & Work-Related Diseases
- **Session 2:** Industrial Hygiene & Environmental Monitoring
- **Session 3:** Environmental Management in Industrial Facilities
- **Session 4:** Industrial Waste Management
- **Session 5:** Sustainability & Sustainable Development - Integrated Case Study

SESSION 1: Introduction to Occupational Health & Work-Related Diseases

Date: 03/12/2025

18H00-19H30

Why Occupational Health Matters?

- **The Silent Epidemic:** Occupational diseases develop slowly over years of chronic exposure, unlike accidents which have immediate effects.
- **Case Study:** Asbestos-related diseases (mesothelioma) - exposure in the 1970s manifests as disease after 30-40 years.

Key Difference:

- **Safety** ← Preventing immediate accidents (e.g., falls, electrical shocks, fires/explosions, machinery injuries)
- **Health** ← Preventing chronic exposure leading to long-term diseases (e.g., chemical poisoning, noise-induced hearing loss, respiratory diseases from dust, ergonomic disorders)
- Both are complementary for worker protection, but require different prevention strategies due to the nature of their temporal impact.

Hazard vs. Health Effect - The Exposure Pathway

Exposure Pathway: From Hazard to Health Effect

Basic Model:

Source → Pathway → Receiver

Breakdown:

1. Source - The Hazardous Agent:

- **Chemical:** Vapors, dusts, gases
- **Physical:** Noise, radiation, heat
- **Biological:** Bacteria, viruses

2. Pathway - Transmission Route:

- Inhalation (lungs)
- Dermal absorption (skin)
- Ingestion (mouth)
- Auditory (ear)

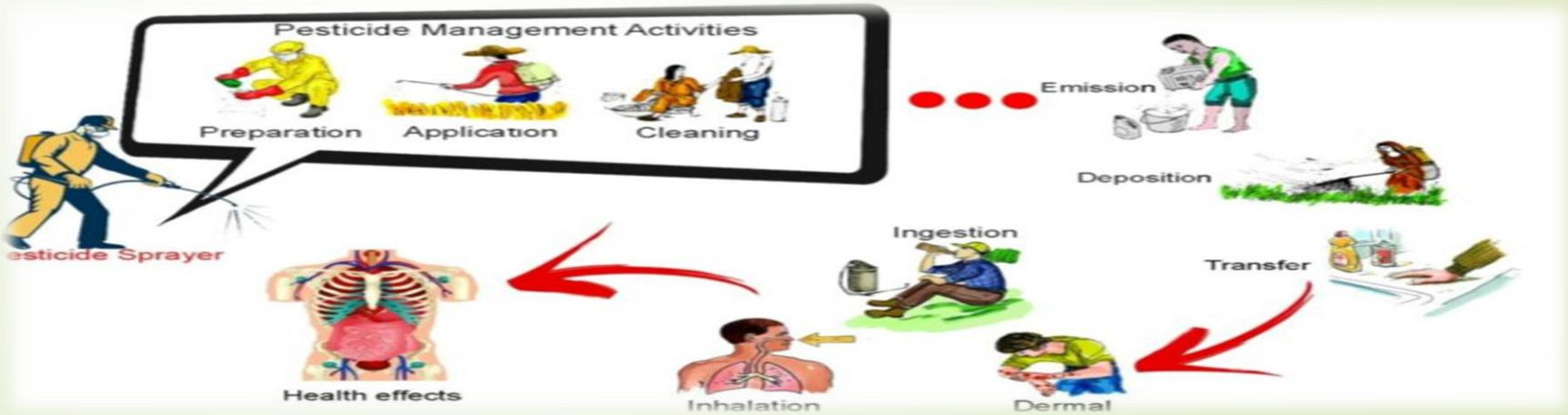
3. Receiver - The Body & Effect:

- **Target organs:** Lungs, liver, kidneys, nervous system
- **Effects:** Cellular damage, chronic diseases

Illustrative Examples:

- Silica dust → Inhalation → Pulmonary fibrosis (silicosis)
- Machine noise → Ear → Permanent hearing loss
- Chemical solvents → Skin → Liver and kidney damage

Prevention Principle: Control the source or interrupt the pathway before the hazard reaches the worker.



Major Occupational Disease Families

1. **Respiratory Diseases:** Pneumoconiosis (Silicosis, Asbestosis), Occupational Asthma
2. **Skin Diseases:** Dermatitis, Chemical Burns
3. **Musculoskeletal Disorders:** Back injuries, Carpal Tunnel Syndrome
4. **Hearing Loss:** Noise-Induced Hearing Loss (NIHL)
5. **Poisoning & Systemic Effects:** Heavy metal poisoning, Solvent effects on organs

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Interactive Activity - Disease Detective

Scenario: "A worker in a battery manufacturing plant reports chronic fatigue, abdominal pain, and mood changes."

Group Task (15 minutes):

1. What could be the hazardous exposure?
2. What is the likely disease?
3. What medical tests would you recommend?
4. Suggest preventive measures.

Hints: Think about battery components: Lead, Acid, Plastics

Solutions for the Interactive Activity

1. Likely Hazardous Exposure:

Inhalation or ingestion of lead dust/fumes from battery components

2. Probable Disease:

Chronic Lead Poisoning

3. Recommended Medical Tests:

- Blood Lead Level (BLL) test
- Zinc Protoporphyrin (ZPP) test
- Kidney function tests
- Complete Blood Count (CBC)

4. Preventive Measures:

Substitution: Use less toxic alternatives where possible

Engineering Controls: Efficient local and general ventilation systems

Administrative Controls: Reduced exposure time, job rotation, strict hygiene policies

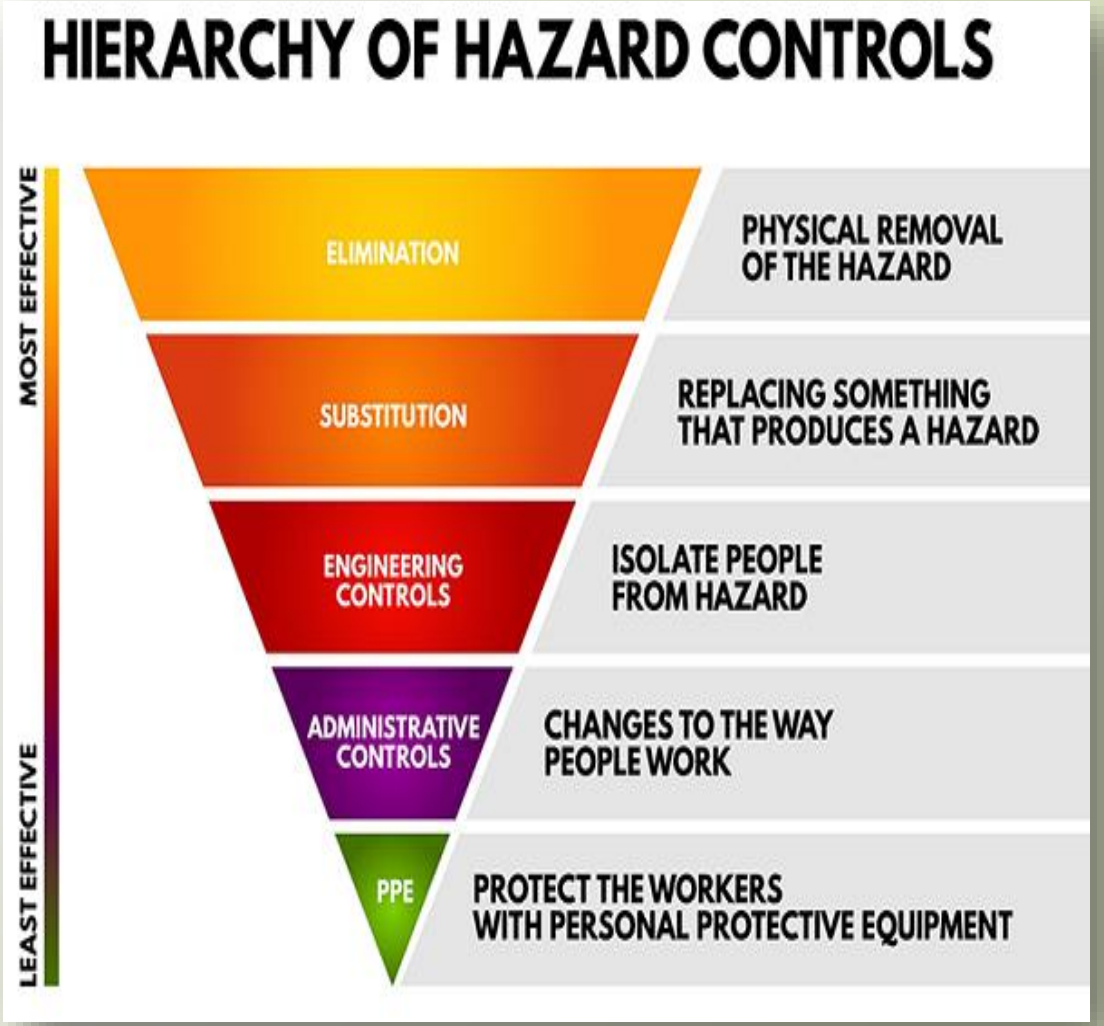
PPE: Appropriate respirators (N95 or higher), gloves, goggles, protective aprons

Regular medical surveillance program for workers

Worker training on lead hazards and prevention methods

Prevention Hierarchy for Health Hazards
Most Effective → Least Effective

1. **Elimination:** Remove hazardous substance (e.g., Use lead-free batteries)
2. **Substitution:** Replace with less toxic material
3. **Engineering Controls:** Local exhaust ventilation, Enclosures
4. **Administrative Controls:** Job rotation, Reduced exposure time
5. **PPE:** Respirators, Gloves (LAST LINE OF DEFENSE)



Case Study - Silicosis in Construction

Facts:

-Worker cutting concrete blocks for 10 years without proper protection

-**Symptoms:** Persistent cough, shortness of breath

-X-ray shows lung fibrosis

Group Analysis:

1. What went wrong?

2. Who failed? (Employer/Employee/System)

3. How could this have been prevented?

Medical Surveillance Programs

Components:

- Pre-employment medical exams
- Periodic health checkups
- Biological monitoring (Blood/Urine tests)
- Health records maintenance

Example: Regular lung function tests for welders.

Legal Framework - Algerian Context

- Law 90-11 relating to prevention of occupational risks and compensation
- Role of occupational physician (Médecin du Travail)
- Worker's right to know about health risks
- Employer's obligation for medical surveillance

Key Performance Indicators for Health

- Disease Incidence Rate: New cases per year
- Absenteeism Rate due to Illness
- Medical Surveillance Coverage Rate
- Biological Monitoring Compliance Rate

Session 1 Summary

Key Takeaways:

- Occupational diseases have delayed effects (years)
- Prevention requires understanding exposure pathways
- Medical surveillance is crucial for early detection
- Health protection uses same hierarchy as safety

Next Session: We will learn how to measure and monitor these health hazards through Industrial Hygiene.

«Prevent Today's Exposure — Avoid Tomorrow's Disease.»

امنع التعرض اليوم — تجنب المرض غدًا.

Thank you all for your attention