



Health, Safety and Environment (HSE) in Industrial Installations

**Target: 2nd Year Engineering
Students**

Instructor: Dr. GRINE Wassila

The background is a collage of four images. Top-left: A hand holding a globe of the Earth. Top-right: A worker in a white lab coat and blue gloves. Middle-right: Two workers in grey shirts and yellow hard hats looking at a tablet. Bottom: A worker in a blue uniform and yellow hard hat working on a blue structure.

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 3: Environmental Management in Industrial Facilities

Date: 17/12/2025

18H00-19H30



Evolution of Environmental Thinking in Industry

The Transformation Journey: From Pollution to Responsibility

Stage 1: The Age of Indifference (Pre-1970)

- The science and Philosophy: "Business as usual"
- Practice: Focus on production at any cost
- Model: Purely linear (Take - Make - Dispose)

Stage 2: The Treatment Era (1970-1990)

- Philosophy: "Cleaning up the mess"
- Practice: End-of-pipe treatment
- Problem: High costs, transferring the problem (from air to water)

Stage 3: The Prevention Era (1990-2010)

- Philosophy: "Prevention is better than cure"
- Practice: Cleaner Production
- Focus: Resource efficiency, waste reduction at source

Stage 4: The Sustainability Era (2010-Present)

- Philosophy: "Integrated responsibility"
- Practice: Comprehensive Environmental Management
- Model: Circular (Design - Make - Use - Return)

Environmental Management System (EMS)

1. Core Definition

What is EMS?

A sustainable organizational framework that links policies, procedures, and resources to achieve environmental objectives.

A continuous process, not a one-time project.

2. Practical Essence - Not Just a Program

Full Integration: The environmental dimension in every decision – from purchasing to production.

Organizational Culture: A new way of thinking, not just procedures.

Dual Benefit: Protects the environment and enhances efficiency.

Strategic Transformation - EMS as a Lever: From → To
Legal Burden → Competitive Advantage
Additional Costs → Sustainable Financial Savings
Mandatory Responsibility → Marketing Opportunity
Potential Risks → Smart Investment

3. Why is EMS Essential? - Four Key Reasons

A. Legal Compliance 🏛️

- **Avoiding Violations:** Fines and shutdown penalties.
- **Proactivity:** Preparing before laws change.
- **Compliance Documentation:** Tangible evidence of commitment.

B. Market Advantages 📈

- **Consumer Demand:** 68% prefer eco-friendly products.
- **Entry Threshold:** ISO 14001 is a requirement for exporting and contracting with global companies.
- **Brand Differentiation:** A real competitive advantage.

C. Financial Savings 💰

- **Energy and Water:** 30%-40% savings on operational costs.
- **Raw Materials:** 25% reduction in waste through process optimization.
- **Waste:** Reduction in disposal and treatment costs.

D. Reputation and Trust 🌟

- **Community Trust:** Positive relationship with the surroundings.
- **Talent Attraction:** Better employees are drawn to responsible organizations.
- **Investment Appeal:** Investors prefer sustainable companies.

The Continuous Improvement PDCA Cycle in ISO 14001

P - Plan (Smart Planning)

- Focus: Deep understanding before starting
- Foundation: Identify high-impact risks first
- Output: Practical, realistic action plan with timelines and budget

D - Do (Organized Implementation)

- Principle: Integration into daily work, not a separate addition
- Requirements: Clear responsibility + Adequate training + Appropriate resources
- Goal: Transform plans into tangible actions

C - Check (Honest Evaluation)

- Approach: Measurement with numbers, not impressions
- Transparency: Acknowledging mistakes and learning from them
- Comparison: Against our objectives and against global best practices

A - Act (Continuous Learning)

- Correction: Addressing root causes, not surface symptoms
- Institutionalization: Turning lessons into permanent policies and procedures
- Development: Continuously updating the system with new changes

The Big Picture:

Plan → Do → Check → Act → Improve → Return to Plan
(A continuous, never-ending cycle)

ISO 14001 is not a rigid certificate, but an organizational way of life for continuous environmental improvement. Success is not about achieving perfection, but about learning from every experience and evolving continuously.

Environmental Aspects vs. Environmental Impacts

Critical Distinction for Effective Practice:

1. Environmental Aspect (What We Control)

Definition: An element of our processes with potential interaction with the environment

Characteristics:

- Direct and measurable
- Within our site boundaries
- We can control it

Practical Examples:

- Amount of fuel consumed
- Volume of waste generated
- Concentration of emissions from a stack

2. Environmental Impact (What We Mitigate)

Definition: The change that occurs in the environment due to our aspect

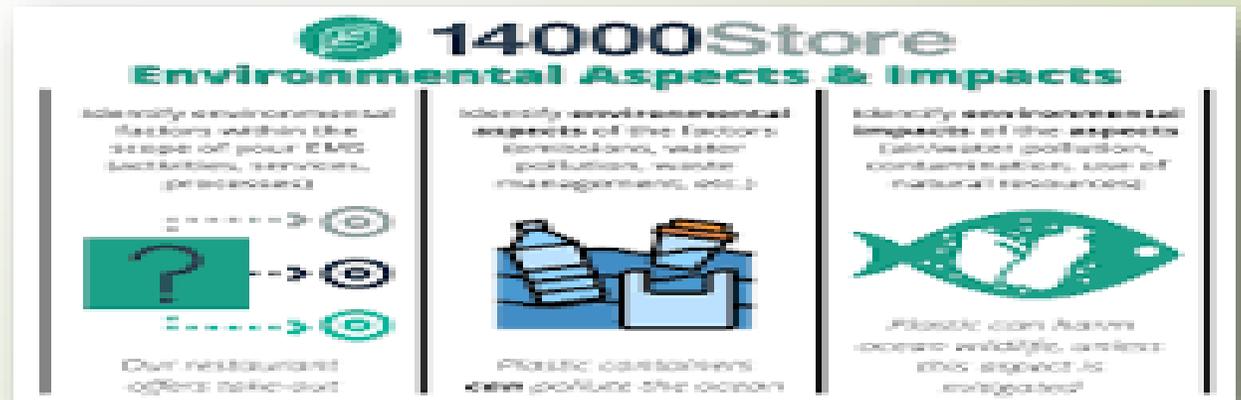
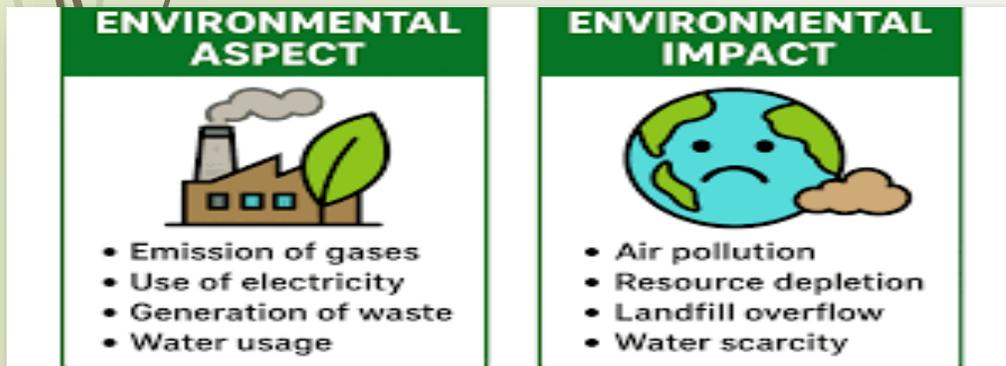
Characteristics:

- May be cumulative or delayed
- Often outside our site boundaries
- We are responsible for it

Real Examples:

- Increase in global carbon emissions
- Groundwater pollution
- Loss of biodiversity

Golden Rule: *We control aspects to mitigate impacts*



Environmental Aspects Analysis

Practical Methodology: Complete Environmental Inventory

Step 1: Understanding Processes (Detailed Mapping)

- Material flow mapping from input to output
- Identifying key transformation points
- Documenting normal and emergency operating conditions

Step 2: Measuring Inputs (What Comes In)

Raw Materials: Quantities, purity, supply sources

Energy: Electricity, fuel, steam - efficiency and waste

Water: Consumption, quality, reuse

Step 3: Measuring Outputs (What Goes Out)

Products: Percentage, defects, lifespan

Emissions: Air (direct, indirect), noise, heat

Waste: Solid, liquid, hazardous - composition, volume, cost

Step 4: Significance Assessment (Strategic Filter)

Criteria: Impact, frequency, legal sensitivity, reputation risks

Priorities: Focus on the 20% that cause 80% of the impact



Practical Activity - Identifying Aspects and Impacts

Scenario: "Vegetable canning factory."

Main Processes:

1. **Vegetable Receiving:** Cleaning, sorting, storage
2. **Manufacturing:** Cutting, cooking, canning
3. **Packaging:** Packaging, storage, shipping
4. **Support:** Maintenance, cleaning, energy management

Additional Information:

- Uses 1000 m³ of water daily
- Generates 5 tons of organic waste daily
- Operates 24 hours using fuel boilers
- Close to a residential area

Task :

1. For each process, identify two main environmental aspects
2. For each aspect, describe the potential environmental impact
3. Rank aspects by priority using:
 - Impact magnitude (1-10)
 - Probability (1-10)
 - Community sensitivity (1-5)

Tool: Environmental Significance Matrix



Brief Solution with Organized Matrix

1. Environmental Priority Matrix

#	Environmental Aspect	Impact	Priority	Main Action
1	Boiler energy consumption	High carbon emissions	★★★★★	Convert to renewable energy
2	Wash water pollution	Groundwater pollution	★★★★★	Water recycling system
3	Plastic waste	Long-term environmental pollution	★★★★	Reduce packaging + recycling

2. Quantitative Assessment Matrix

Aspect	Impact (10)	Probability (10)	Community (5)	Total
Energy	9	10	4	23
Water	8	9	5	22
Plastic	8	8	4	20
Chemicals	7	7	3	17
Steam	7	6	2	15

3. Quick Implementation Matrix

Priority	Aspect	Action	Time	Cost	Return
High	Energy	Renewable energy	6 months	● Medium	30% saving
High	Water	Recycling	4 months	● High	40% saving
High	Plastic	New design	3 months	● Low	50% reduction

4. Decision Matrix

● Immediate Treatment (Total ≥20):

- Boiler energy consumption
- Wash water pollution
- Plastic waste

● Short-term Treatment (Total 15-19):

- Chemical cleaning agents
- Lost cooking steam

● Routine Monitoring (Total <15):

- Vegetable waste
- Shipping emissions

5. Matrix Conclusion

Focus on only 3 aspects:

- Energy ← Improve efficiency
- Water ← Recycle and reuse
- Plastic ← Reduce and recycle

Principle: 20/80 rule

Result: Treating 20% of aspects solves 80% of environmental problems

"The matrix answers: What, Why, How, and When"

Pollution Prevention Strategies at Source

Smart Hierarchy (From Best to Least Effective)

Level 1: Prevention Through Design ★★★★★

- **Green Design:** Environmentally friendly products from the start
- **Modeling & Simulation:** Predicting problems before implementation
- **Supplier Selection:** Partners with strong environmental performance

Level 2: Process Improvement ★★★★★

- **Preventive Maintenance:** Preventing leaks and waste
- **Smart Monitoring:** Control systems for efficiency
- **Operator Training:** Improving behaviors and skills

Level 3: Internal Recycling ★★★

- **Closed Loops:** Reusing water, chemicals, materials
- **Energy Recovery:** Capturing waste heat and gases
- **Reuse:** Packaging, containers, materials

Level 4: End-of-Pipe Treatment ★★

- **Centralized Treatment:** Specialized treatment units
- **Responsible Disposal:** Through certified specialists
- **Continuous Monitoring:** Even after disposal

Core Principle:

"Start from the top: Prevent → Improve → Recycle → Treat"

Each step downward = Higher costs + Lower effectiveness

Success Example:

Algerian Chemical Plant:

- **Problem:** High costs for purchasing new solvents
- **Solution:** System for recycling used solvents
- **Result:** 30% reduction in operational costs
- **Period:** Return on investment within 8 months

Benefits of Implementing an Environmental Management System

Integrated Benefit Package:

1. Tangible Benefits (Direct Measurement) Financial Savings:

- **Energy:** 15-30% reduction
- **Water:** 20-50% reduction
- **Raw Materials:** 10-25% reduction
- **Waste:** 40-80% reduction in disposal costs

Cost Avoidance:

- Fines and violations
- Compensation and insurance
- Litigation and court cases

3. Operational Benefits (Internal Efficiency)

- Improved product quality
- Increased worker productivity
- Reduced breakdowns and downtime
- Improved work environment

2. Intangible Benefits (Strategic Value)

Competitive Position:

- Accreditation certificates (ISO 14001)
- Preference from major suppliers
- Opening international markets (especially Europe)
- Improved credit rating

Social Capital:

- Local community trust
- Attracting exceptional employees
- Positive relations with regulatory bodies
- Brand reputation

Real Case: An automobile company saved \$400 million through an integrated environmental program

Session 3 Summary

Key Ideas for Comprehension:

1. **Radical Transformation:** We are not in the era of "how much do we pollute?" but "how do we not pollute?"
2. **Systematic Approach:** Environmental management is not separate projects but an institutional culture
3. **Proactive Focus: Emphasizing preventing problems at their source, not treating symptoms**
4. **Integration:** Linking economic efficiency with environmental performance
5. **Responsibility:** Environment is not a side cost, but the essence of institutional sustainability

Practical Implementation Principles:

- **Start small:** Pilot project then expand
- **Share success:** Document and announce achievements
- **Involve everyone:** From top management to cleaning staff
- **Learn continuously:** Mistakes are sources of knowledge
- **Innovate:** Local solutions for local problems

Next Session: Industrial Waste Management - Practical application of environmental aspects management

«We do not inherit the Earth from our ancestors; we borrow it
from our children.»

نحن لا نرث الأرض من أسلافنا، بل نستعيرها من أبنائنا

Thank you all for your attention



Best Environmental Health and Safety Jobs