



# **Health, Safety and Environment (HSE) in Industrial Installations**

**Target: 2nd Year Engineering  
Students**

**Instructor: Dr. GRINE Wassila**

A photograph of two industrial workers in a factory setting. Both are wearing yellow hard hats, safety glasses, and white face masks. They are wearing orange high-visibility safety vests over blue long-sleeved shirts. The worker on the right is holding a walkie-talkie to his mouth and has a clipboard under his arm. The worker on the left is holding a smartphone. The background shows industrial structures and large windows.

# Chapter 1: Risk Assessment and Accident Analysis

Description: Introduction to Safety Systems for

Industrial Engineering

# Five-Session Roadmap

- **Session 1:** Introduction to HSE & Fundamental Concepts
- **Session 2:** Prevention Stakeholders & Safety Performance Indicators
- **Session 3:** Risk Analysis Methodology
- **Session 4:** Root Cause Analysis Methods
- **Session 5:** Risk Families & Integrated Case Study



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# SESSION 3: Risk Analysis Methodology

Date: 29/10/2025

14H50-16H20



# What is Risk Analysis?

**Definition:** Structured proactive process to identify hazards and estimate risks to implement prevention measures before accidents occur

**Iterative process:**

**Assessment → Action → Reassessment → Continuous Improvement**

**Why It Matters:**

- Prevents accidents and incidents
- Reduces costs and downtime
- Improves overall safety culture



# Practical Example: Controlling Noise Levels in the Workshop

## Assessment

- ❑ **Current Situation:** Noise level measurement = 90 decibels (exceeds permissible limit)
- ❑ **Analysis:** Identifying main noise sources (machinery, equipment, environment)

## Action

- ❑ **Measures:**
  - Installing sound insulation on machinery
  - Providing protective earplugs for workers
  - Adjusting work schedules to reduce exposure periods
- <https://www.youtube.com/watch?v=MO30K5jz1nY>

## Reassessment

- ❑ **New Results:** Noise level measurement after implementation = 75 decibels (within permissible limit)
- ❑ **Evaluation:** Examining effectiveness of measures and workers' compliance with equipment usage

## Continuous Improvement

- ❑ **Improvements:**
  - Training workers on proper use of earplugs
  - Enhancing quality of sound insulation
  - Introducing new technologies to reduce noise

# Risk Assessment



## Then We Restart the Cycle...

**New Assessment:** Continuous monitoring of noise levels

**New Action:** Developing additional measures as needed

**New Reassessment:** Periodic data analysis

**New Improvement:** Leveraging modern technologies

**Conclusion:** Safety is a Continuous Journey, Not a Destination

# Step 1 - Hazard Identification

## ☐ Methods & Tools:

- **Direct Observation** - Workplace walkthroughs
- **Safety Inspections** - Using checklists
- **Employee Interviews** - Talking to experienced workers
- **Job Safety Analysis (JSA)** - Step-by-step task analysis
- **Reviewing Safety Data Sheets (SDS)** - Chemical information
- **Incident Report Analysis** - Learning from past events



# Interactive Activity - Video Hazard Identification

- ▶  **Instructions:**

"Watch this short maintenance operation videos. In groups, list all hazards you observe and classify them by type."

- ▶ <https://www.youtube.com/watch?v=vqPMo-LXdfA> (Work safety - slips, trips & falls)

- ▶ [https://www.youtube.com/watch?v=XbEL\\_447oHg](https://www.youtube.com/watch?v=XbEL_447oHg) (Ladder Safety Training Video)

- ▶ **Time:** 10 minutes group work + 5 minutes sharing

# Analyse of Video

- ▶ Type: **Physical – Mechanical hazard** related to the work environment
- **Description:** This type of hazard is associated with accidents caused by movement or loss of balance in the workplace, such as:
  - ▶ Wet or slippery surfaces
  - ▶ Cables or tools placed on the floor
  - ▶ Unsafe ladders or platforms
  - ▶ Poor lighting or disorganized walkways
- **Preventive measures:**
  - ▶ Keep floors clean and dry.
  - ▶ Organize the workplace and remove obstacles.
  - ▶ Use warning signs such as “Wet Floor.”
  - ▶ Wear non-slip safety shoes.

- ▶ Type: **Physical – Mechanical Hazard**
- **Description:**

This type of hazard is related to accidents caused by **falling from heights** or **loss of balance while using ladders.**
- **Examples from the video:**
  - ▶ Using an unstable ladder or placing it on an uneven surface.
  - ▶ Climbing without maintaining three points of contact.
  - ▶ Carrying tools while climbing, which affects balance.
  - ▶ Using a damaged or inappropriate ladder for the task.
- **Preventive Measures:**
  - ▶ Ensure the ladder is firmly placed on a stable and dry surface.
  - ▶ Inspect the ladder before use.
  - ▶ Maintain three points of contact (two hands and one foot, or two feet and one hand).
  - ▶ Do not exceed the safe height limit of the ladder.
  - ▶ Wear slip-resistant safety shoes.

# Step 2 - Risk Assessment (The Matrix)

## Two Assessment Criteria:

### ► SEVERITY Scale:

1. **Negligible** - First aid injury
2. **Minor** - Medical treatment required
3. **Moderate** - Lost-time injury
4. **Major** - Permanent disability
5. **Catastrophic** - Single or multiple fatalities

### ► PROBABILITY Scale:

1. **Very Unlikely** - Exceptional circumstances
2. **Unlikely** - Remote possibility
3. **Possible** - Might occur occasionally
4. **Likely** - Probably will occur
5. **Almost Certain** - Frequent occurrence

# Risk Assessment Matrix

Probability / Severity	Negligible (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost Certain (5)	Medium (5)	High (10)	Very High (15)	Very High (20)	<b>Extreme (25)</b>
Likely (4)	Medium (4)	Medium (8)	High (12)	Very High (16)	Very High (20)
Possible (3)	Low (3)	Medium (6)	Medium (9)	High (12)	Very High (15)
Unlikely (2)	Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)
Very Unlikely (1)	<b>Negligible (1)</b>	Low (2)	Low (3)	Medium (4)	Medium (5)

# Risk Level Legend

## 📊 Color-Coded Action Levels:

### ● RED (Extreme, Very High - 15-25):

- Immediate corrective action required
- Activity should stop until risk is controlled

### ● ORANGE (High - 10-12):

- Short-term corrective action required
- Management attention needed

### ● YELLOW (Medium - 4-9):

- Requires attention and monitoring
- Schedule improvements

### ● GREEN (Low, Negligible - 1-3):

- Acceptable risk
- Routine monitoring sufficient

# Group Activity - Risk Assessment Practice

## Scenario: "Chemical Storage Area Assessment"

### ► Identified Hazards:

1. Flammable liquids stored near electrical panels
2. Poor ventilation in storage room
3. No spill containment system
4. Inadequate labeling of chemicals

### ► Task:

- Assess each hazard using the Risk Matrix
- Determine risk level for each
- Prioritize actions based on risk levels



# Step 3 - Determine Control Measures

## ➤ Hierarchy of Controls (**SIRP Principle**):

### 1. S - SUBSTITUTION (Most Effective)

➤ Replace hazardous materials/processes with safer alternatives

➤ **Example:** Use water-based paints instead of solvent-based

### 2. I - ISOLATION

➤ Separate people from hazards

➤ **Example:** Machine guarding, soundproof enclosures

### 3. R - REDESIGN/REORGANIZE

➤ Change work processes and procedures

➤ **Example:** Job rotation, safety procedures, training

### 4. P - PPE (Least Effective)

➤ Personal Protective Equipment - Last line of defense

➤ **Example:** Safety glasses, gloves, respirators

# Control Measures Activity

## Practical Application:

For each hazard from our previous activity, propose control measures using the SIRP hierarchy:

- ▶ Flammable liquids near electrical panels
- ▶ Poor ventilation
- ▶ No spill containment
- ▶ Inadequate labeling

**Consider:** Effectiveness, cost, implementation time



# Risk Analysis Documentation

## Essential Elements:

- ▶ Hazard Description - Clear and specific
- ▶ Risk Assessment - Severity, Probability, Risk Level
- ▶ Control Measures - Proposed actions
- ▶ Responsible Person - Who will implement
- ▶ Timeline - Implementation deadline
- ▶ Review Date - When to reassess

# Real-World Case Study

## Scenario: "Office Building Safety Assessment"

### Background:

- ▶ 10-story office building
- ▶ 500 employees
- ▶ Mixed use: offices, server room, cafeteria

### Task: Conduct risk analysis for:

- ▶ Fire safety
- ▶ Electrical safety
- ▶ Ergonomic hazards
- ▶ Emergency evacuation



# Case Study Group Work

## Group Assignment (45 minutes):

- **Group 1:** Fire Safety Risks
- **Group 2:** Electrical Safety Risks
- **Group 3:** Ergonomic Hazards
- **Group 4:** Emergency Evacuation

## Each Group Presents:

- Top 3 hazards identified
- Risk assessment using matrix
- Proposed control measures
- Implementation priority



# Key Success Factors



## Effective Risk Analysis Requires:

- **Management Commitment - Resources and support**
- **Employee Involvement - Frontline knowledge**
- **Competence - Trained assessors**
- **Documentation - Clear records**
- **Continuous Review - Regular updates**
- **Action Orientation - Implementation focus**



# Session 3 Summary

- ▶ Key Takeaways:
- ▶ 3-Step Process: **Identify** → **Assess** → **Control**
- ▶ Risk Matrix: **Severity** × **Probability** = **Risk Level**
- ▶ **SIRP** Hierarchy: Most to least effective controls
- ▶ Practical Application: From theory to workplace implementation

**Assess Risks Today — Ensure Safety Tomorrow**

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***Thank you all for your attention***

