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Risk Management in Practice

Lecture Title:
Risk Assessment Methodologies

Undergraduate Diploma in
Occupational Health and Safety

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Welcome and Objectives

- Learning Objectives.
- Understand the concept of risk and its relevance in OHS.
- Recognize the key components of a risk management framework.
- Appreciate the role of legislation, standards and organizational culture in managing risk.
- Begin to identify common workplace hazards and assess associated risks.

Safety Triangle

Hazard Identification Risk Program

Learning Objectives

Types of Risk Assessments

Learn to differentiate various types of risk assessments used in occupational safety and health.

Application Methodologies

Apply appropriate risk assessment methodologies tailored to specific workplace scenarios.

What is a Risk Assessment

Definition of Risk Assessment

Risk assessment systematically identifies hazards and evaluates their potential risks to safety and health.

Purpose of Risk Assessment

Its purpose is to prevent incidents, ensure legal compliance, and promote a safe working environment.

Legal and Organizational Relevance

Risk assessments are mandated by occupational health and safety laws and are vital for safety management systems.

SUBSIDIARY LEGISLATION 646.11 GENERAL PROVISIONS FOR HEALTH AND SAFETY AT WORK PLACES REGULATIONS

Summary of key requirements:

- Hazard identification & persons who may be harmed
- Risk assessments for non-eliminable risks
- Factors to consider in the RA:
  - Characteristics of the work
  - Extent of the risk - likeliness and severity
  - Principles of prevention - elimination? reducing risk? substitution?
  - Choice of control measure
  - RA must be reviewed periodically OR when circumstances change/new hazards are introduced
- Communication: results of RA to be brought to the attention of all those affected
- Additional measures when risk is not adequately controlled

Importance of Risk Assessment

Preventing Workplace Incidents

Risk assessment helps identify and mitigate hazards to prevent accidents and injuries at work.

Ensuring Legal Compliance

Conducting risk assessments ensures compliance with health and safety legislation, avoiding penalties.

Fostering Safety Culture

A strong safety culture boosts employee morale and productivity through commitment to well-being.

Types of Risk Assessment

Qualitative Risk Assessment

Qualitative assessments use experience-based judgment to categorize risks as low, medium, or high quickly.

Quantitative Risk Assessment

Quantitative assessments use numerical data for detailed probability and severity calculations of risks.

Application Contexts

Qualitative methods are simpler while quantitative methods suit complex environments requiring precision.

Qualitative and Quantitative Methods

Qualitative Methods Overview

Qualitative methods use risk matrices and checklists, offering simplicity and ease of use for workplace evaluations.

Advantages and Limitations

Qualitative methods are user-friendly but may suffer from subjectivity and lack of detail in results.

Quantitative Methods Overview

Quantitative methods include risk scoring and probabilistic assessments, providing precise numerical risk insights.

Requirements and Challenges

Quantitative methods need extensive data and expertise to execute but allow for detailed decision-making.

Type	Qualitative Risk Assessment	Quantitative Risk Assessment
Definition	Uses descriptive methods to evaluate risks based on likelihood and severity	Uses numerical data and statistical models to calculate risk probabilities and impacts
Approach	Relies on expert judgement, experience and stakeholder input	Based on historical incident data, exposure levels and failure rates
Tools	Risk matrices, hazard checklists, brainstorming sessions	Fault tree analysis, Monte Carlo simulations
Output	Risk levels like: Low, Medium or High	Numeric values like probability (%), expected loss ($) or exposure levels
Use Case	Ideal when data is limited of for initial hazard screening	Best for high-risk environments or regulatory compliance
Example	Assessing the risk of a wet floor causing slips by rating likelihood and impact without numerical data.	Calculating the probability of machinery failure leading to injury based on maintenance records and operational hours.

Type	Qualitative Risk Assessment
Scenario	A warehouse has a narrow corridor where forklifts and pedestrians share space.
Hazard	Collision between forklift and pedestrian
Likelihood	Likely (based on staff feedback and past near misses)
Severity	Major (could result in serious injury)
Risk Rating	High
Control Measures	Install physical barriers Introduce one-way traffic system Provide high-visibility clothing

Type	Quantitative Risk Assessment
Scenario	A chemical plant stores flammable liquids in bulk tanks
Hazard	Fire due to tank exposure
Probability of Failure	0.002 per year (based on historical data)
Exposure level	50 workers within 100m radius
Potential impact	5 million euros in damages and potential fatalities
Control Measures	Install automatic fire suppression Increase inspection frequency Relocate non-essential staff

Side by Side comparison for same scenario qualitative vs quantitative

Scenario: A warehouse with a narrow corridor where forklifts and pedestrians share space

Aspect	Description (Qualitative)
Hazard	Collison between forklift and pedestrian
Likelihood	Likely – based on feedback and near missess
Severity	Major – could result in serious injury
Risk Rating	High - using risk matrix (likelihood and severity)
Assessment Basis	Subjective judgement, safety walk-throughs and team discussions
Control Measures	Install barriers, mark pedestrian zones, train staff
Outcome	Prioritized hazard for immediate mitigation, but no numerical justification

Aspect	Description (Quantitative)
Hazard	Collison between forklift and pedestrian
Probability of incident	0.03 per month – based on incident logs and traffic density analysis
Exposure level	20 pedestrians per shift in shared corridor
Potential impact	50KEuros per incident – medical costs , downtime and legal liability
Expected annual loss	50k * 12 * 0.03 = 18k per year
Assessment basis	Historical data, operational metrics
Control Measures	Cost – benefit analysis supports investment in automated barriers with sensors
Outcome	Financially justified control supports budget allocation

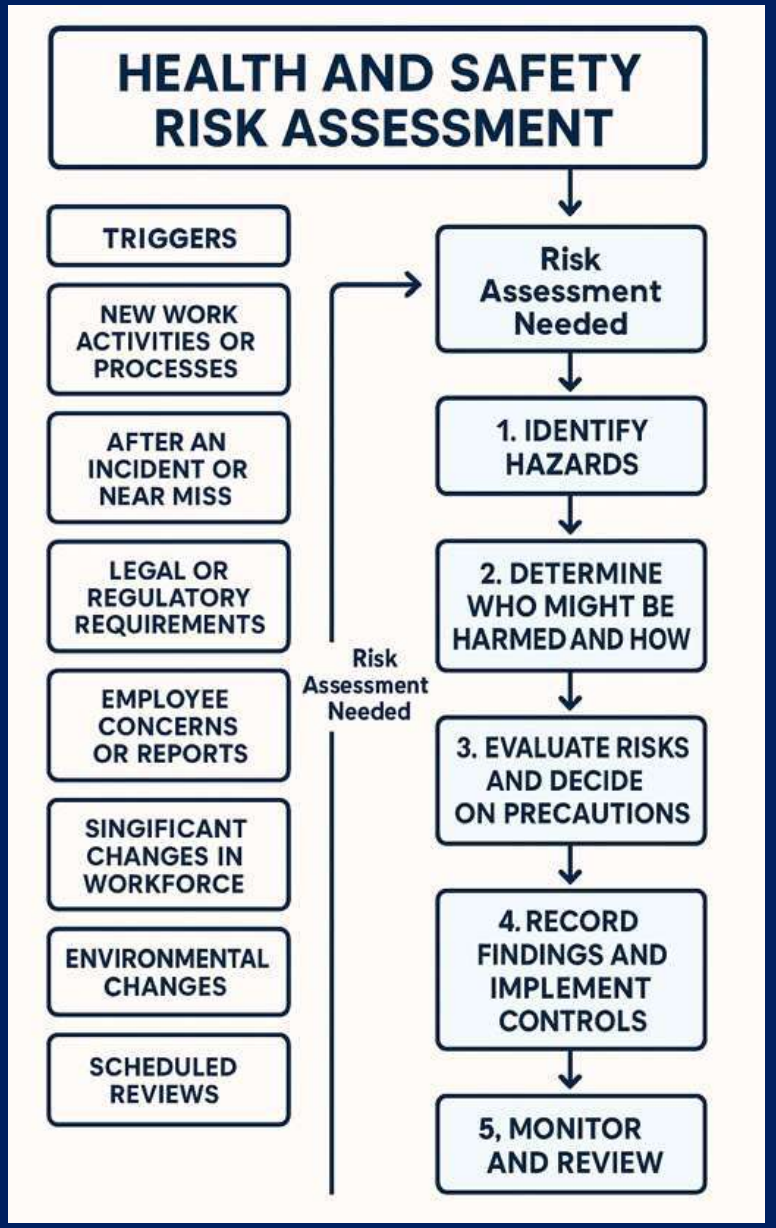
Best Approach?

My opinion

Qualitative is best for Daily use.

1. **Speed and Simplicity**: You can assess risks quickly using a matrix!
2. **Accessibility**: Everyone from operators to supervisors can understand and contribute.
3. **Flexibility**: Works well across diverse hazards – from manual handling to chemical exposure
4. **Engagement**: Encourages team discussions, safety walks and proactive hazard spotting!
5. **Compliance**: Meet legal requirements for risk identification and control under most regulatory frameworks.

Five steps to Risk Assessment


HEALTH AND SAFETY RISK ASSESSMENT
TRIGGERS
NEW WORK ACTIVITIES OR PROCESSES
AFTER AN INCIDENT OR NEAR MISS
LEGAL OR REGULATORY REQUIREMENTS
EMPLOYEE CONCERNS OR REPORTS
SINGIFICANT CHANGES IN WORKFORCE
ENVIRONMENTAL CHANGES
SCHEDULED REVIEWS
Risk Assessment Needed
Risk Assessment Needed
1. IDENTIFY HAZARDS
2. DETERMINE WHO MIGHT BE HARMED AND HOW
3. EVALUATE RISKS AND DECIDE ON PRECAUTIONS
4. RECORD FINDINGS AND IMPLEMENT CONTROLS
5, MONITOR AND REVIEW

Type of Risk Assessment	Document Retention	When to Review
Maternity Risk Assessment	Personal Medical Records' File	As required
Task Based Risk Assessment	EH&S Department	Every 3 years or after changes/upgrades in the process
Facility Risk Assessment	EH&S Department	Every 3 years or after changes/upgrades in the process
Machine Risk Assessment	EH&S Department	Every 3 years or after changes/upgrades in the process

Challenges in Risk Assessment

Subjectivity in Evaluations

Subjectivity in risk evaluations can lead to inconsistent and biased assessment results across organizations.

Data Limitations

Limited or incomplete data can hinder the accuracy and reliability of risk assessments.

Organizational Culture Influence

Organizational culture shapes risk perception and can impact transparency and openness in assessments.

Addressing Challenges

Standardized procedures, training, and transparency improve the effectiveness of risk assessments.

Hazard vs Risk

HAZARD

A source or situation with the potential for harm in terms of injury or ill health.

RISK

The likelihood that a person may be harmed or suffer adverse health effects if exposed to a hazard

Risk Rating: Likelihood vs Severity

- A risk matrix helps assess risk levels by combining likelihood and severity:

- Green: Low Risk
- Yellow: Medium Risk
- Red: High Risk

Likelihood (L)

Rating	Level	Description
1	Unlikely	But could occur
2	Possible	But unusual
4	Even chance / Probable	Could happen / not surprised
8	Likely / Certain	To be expected / no doubt

Severity (S)

Rating	Level	Description
1	Low	Scratch or bruise
2	Modest	Laceration or mild ill health effect Break of a minor bone or minor illness (temporary)
3	Serious	Break of a major bone or permanent minor illness. Serious illness of a temporary nature
4	Extremely Serious	Loss of limbs or eyes. Serious illness of a permanent nature. Fatality

Risk Index (R)

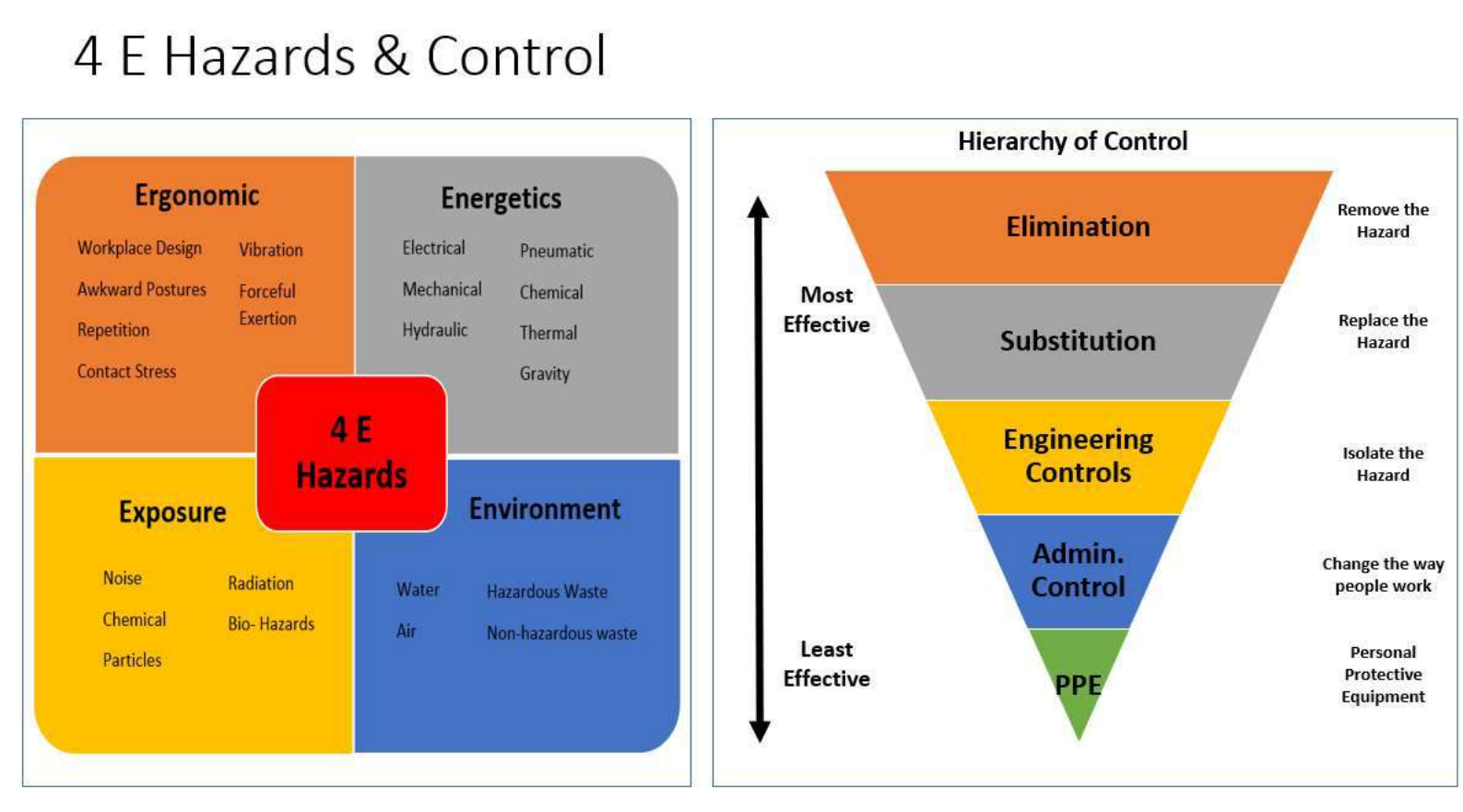
Risk	Index	CA Time Frame	Verification of Closure CA.
Low	1 - 3	6 months	Through the Safety Inspection "Gemba" walk 6 months
Medium	4 - 9	3 months	Through the Safety Inspection "Gemba" walk 6 months
High	>10	24 hours	After 24 hours

Machinery Risk Assessment

Task Based Risk Assessment

Facility Risk Assessment

4 E (Ergonomic, Energetics, Exposure, Environment)



Example of RA

4 E (Ergonomic, Energetics, Exposure, Environment)

4E Risk Assessment Form

Department:		☐ INITIAL ASSESSMENT	☐ UPDATED ASSESSMENT	(choose one)
Area:		Date:		
Supervisor:		Assessment Participants:		
Assessment Prompted by an Incident?	☐ NO ☐ YES	(choose one)		
Is the Task Being Assessed Routine?	☐ NO ☐ YES	(choose one)		
Task Description		Current Control Measures	ENGINEERING: ADMIN: PPE:	

Frequency of Exposure
0 - No Exposure *(exposure never oc*
1 - Low *(occurs < 1x per month)*
2 - Medium *(occurs weekly to month*
4 - High *(occurs daily to weekly)*

Probability of Injury *(% chance)*
1 - Not likely to occur *(0-10%)*
2 - Possible, somewhat unlikely *(10-5*
6 - Possible and could occur *(50-90%*
10 - Likely to occur *(>90%)*

Severity of Impact
0 - No injury *(near miss)* | No environ. impact *(near miss)*
1 - Minor injury *(first aid)* | Minor environ. impact *(contained spill or release)*
2 - Moderate injury *(medical)* | Moderate environ. impact *(limited to site premises)*
3 - Serious injury *(lost time)* | Serious environ. impact *(beyond the site premises)*
4 - Severe injury *(disability)* | Severe environ. impact *(fines, forced shut down)*

Risk	Initial Assessment					Updated Assessment (w/ corrective actions)				
	F	P	$	Risk Rating		F	P	$	Risk Rating	
Ergonomic - *(Lighting, movement, material handling, tools)*										
Workplace design				0					0	
Repetition				0					0	
Contact Stress				0					0	
Forceful Exertion				0					0	
Awkward Position				0					0	
Vibration				0					0	
Energetic - *(Burn/cold by, Cut by, Caught In/On/Between; Pinch Points, Slips/Falls, Striking Against, Struck by or load movement of object)*										
Moving Parts				0					0	
Electrical				0					0	

HAZOP (Hazard & Operability Study)

HAZOP Overview

HAZOP is a systematic technique to identify hazards and operability issues in complex systems.

Primary Purpose

HAZOP proactively detects deviations that may cause unsafe conditions or equipment failure.

Application and Benefits

HAZOP supports risk assessment across sectors and helps foster a preventive safety culture. (mainly in complex systems where safety is critical!)

HAZOP Systematic Review

A multidisciplinary team uses guide words to identify potential deviations in processes systematically.

Deviation Example: More Chemical

The guide word 'More' identifies risks like over-adding chemicals due to faulty equipment or human error.

Safety Measures and Controls

Existing safeguards include automated dosing controls, PPE, and ventilation to prevent incidents and protect workers.

Additional Preventive Actions

Installing interlock systems and enhancing staff training improve process safety and reduce failure risks.

Step-by-Step Methodology

Define Study Scope

Identify the specific process, system, or task to be analyzed for risk assessment.

Breakdown into Nodes

Divide the process into manageable sections or nodes for detailed examination.

Apply Guide Words

Use guide words like 'No', 'More', and 'Less' to identify possible deviations from normal operation.

Evaluate and Document

Explore causes, assess safeguards, recommend controls, and document findings comprehensively.

Example Scenario and Benefits

HAZOP in Chemical Mixing

HAZOP identifies deviations like excess chemical addition caused by equipment failure or human error in labs.

Existing Safeguards

Automated dosing systems and PPE help prevent hazards during chemical processes in laboratories.

Recommended Improvements

Interlock systems and improved training enhance safety by reducing human error and equipment faults.

Benefits of HAZOP

HAZOP promotes hazard identification, team analysis, regulatory compliance, and preventive safety cult

Other Methodologies

- Bowtie Analysis

Bowtie Analysis visually maps risk scenarios along with controls to understand risk pathways effectively.

- Failure Modes and Effects Analysis

FMEA identifies potential failure points and their impacts to prioritize risk mitigation measures.

Hazard and Operability Study

- HAZOP systematically examines processes to detect deviations and hazards enhancing process

FMEA (Failure Mode and Effects Analysis)

How to Apply FMEA in Health & Safety Context

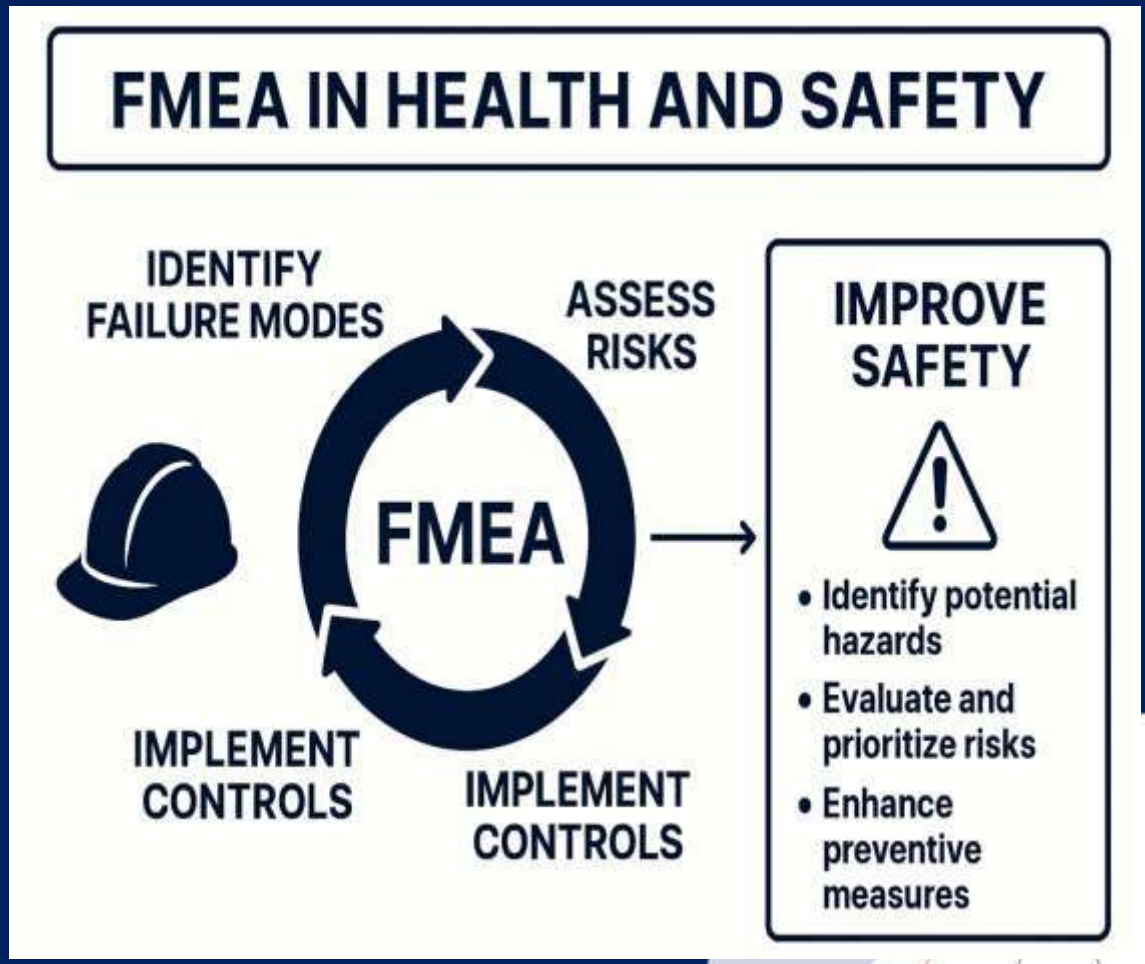
Step 1: Define the Scope
Choose a process, task, or system (e.g., chemical handling, machine operation).

Step 2: Break Down the Process
List each step or component.

Step 3: Identify Failure Modes
What could go wrong at each step?

Step 4: Assess Risks
Rate **Severity**, **Occurrence**, and **Detection** (typically on a scale of 1–10).
Calculate **RPN (Risk Priority Number) = Severity × Occurrence × Detection**

Step 5: Prioritize and Control
•Focus on high RPNs.
•Apply controls using the **Hierarchy of Controls**.



Step 6: Review and Update
•After changes, incidents, or periodically.

“Imagine you're the safety officer at a chemical plant, a hospital, and a construction site.

Would you use the same risk assessment method in all three?

Why or why not?”

1. Chemical Plant

Recommended Method: *HAZOP or Quantitative Risk Assessment (QRA)*

Why:

- High-risk environment with hazardous substances.
- Need for detailed analysis of process deviations.
- Regulatory requirements often demand quantitative data.

2. Hospital

Recommended Method: RAMS or Job Safety Analysis (JSA) or Qualitative Risk Assessment

Why:

- Human-centered tasks (e.g., patient handling, medication).
- Risks often involve ergonomics, infection control, and human error.
- Qualitative methods allow for flexible, scenario-based assessments.

3. Construction Site

Recommended Method: Task-Based Risk Assessment or JSA or RAMS

Why:

- Dynamic and changing work environment.
- Frequent use of machinery, working at heights, confined spaces.
- JSA helps break down tasks and identify hazards step-by-step.

Interpreting Risk Assessment Outcomes

Understanding Assessment Results

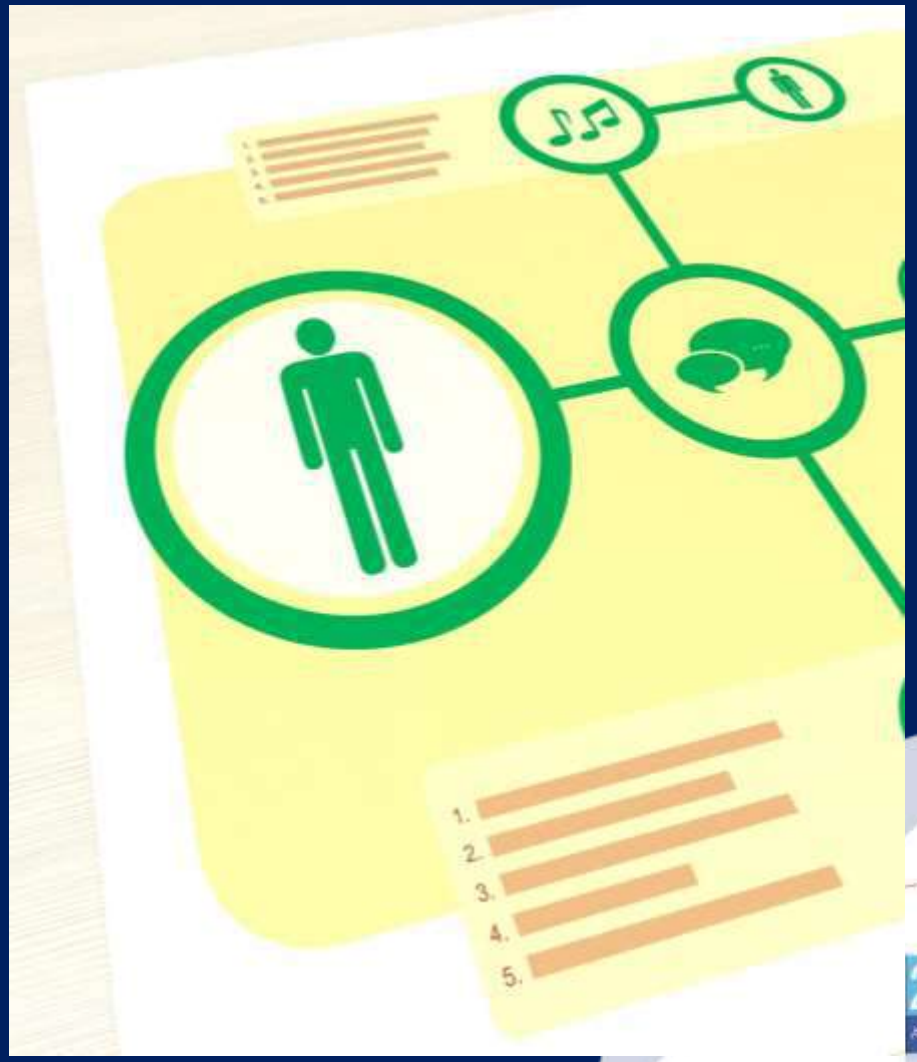
Comprehending risk assessment outcomes is essential for identifying potential hazards and their impacts effectively.

Communicating Findings

Clear communication of risk findings to stakeholders ensures informed decision-making and collaborative risk management.

Linking to Control Measures

Connecting assessment results to appropriate control actions helps mitigate risks and enhance safety effectively.



Summary of Key Points

Types and Methods of Risk Assessment

Various types and methods of risk assessments help identify hazards and evaluate their impact in workplaces.

Application in Workplaces

Risk assessments are applied in diverse workplace scenarios to prevent incidents and ensure safety.

Importance of Interpretation

Interpreting risk assessment outcomes effectively is crucial for compliance and fostering a safety culture.

Frameworks and Case Studies

Key frameworks and case studies demonstrate practical implementation of risk assessment strategies.

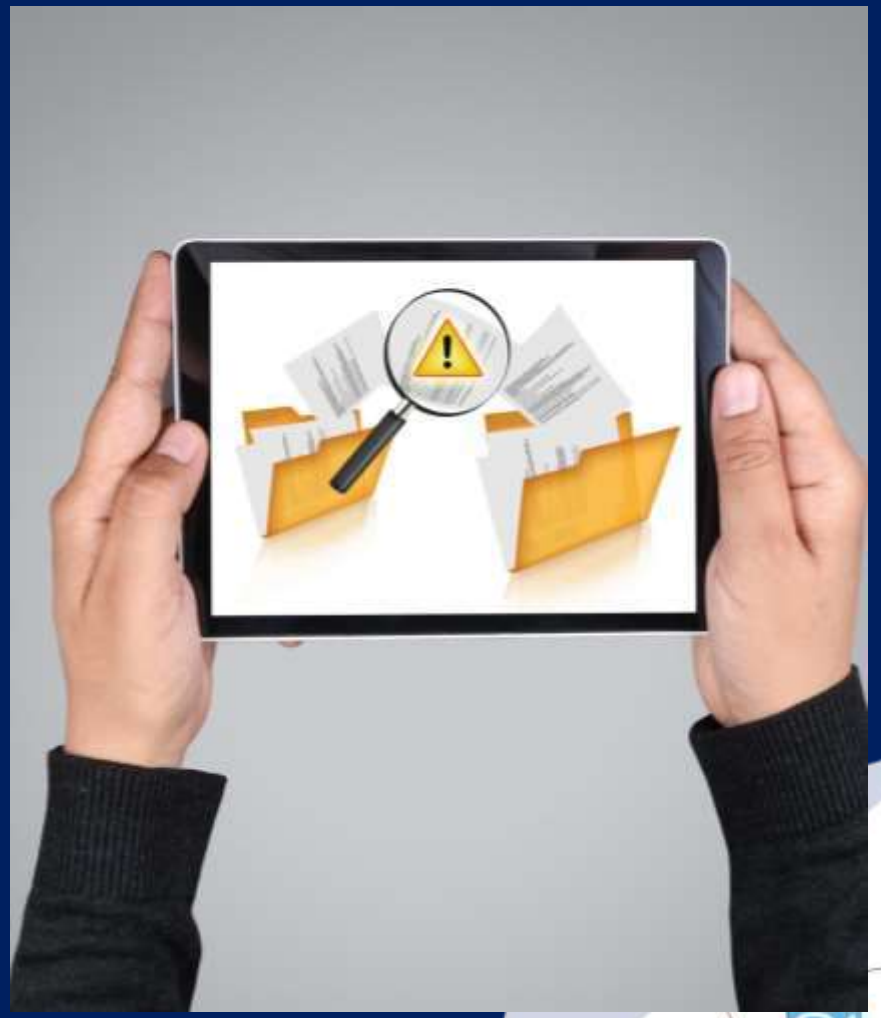
Suggested Reading

HSE Risk Assessment

The HSE Five Steps to Risk Assessment guide explains systematic approaches to identifying and managing workplace risks effectively.

ILO OSH Guidelines

ILO Guidelines on Occupational Safety and Health Management Systems support the creation of structured and effective safety strategies.



Next: Lecture 3: Hazard Identification Techniques

Systematic approaches to identifying hazards in the workplace using tools like checklists, inspections, and job safety analysis.

Learning Objectives:

- Identify various types of workplace hazards.
- Use structured techniques for hazard identification.
- Document and communicate identified hazards effectively.