

Risk Management in Practice

Lecture Title:
Monitoring and Review Risk Controls

Lecturer: Chris Camilleri

Date: 5th January 2026



**Undergraduate Diploma in
Occupational Health and Safety**

Welcome and Objectives

Summary

- Focuses on evaluating and improving risk control measures through monitoring and review

Learning Objectives

- Monitor effectiveness of risk controls
- Conduct periodic reviews and audits
- Implement continuous improvement strategies



Why is it significant within the context of Risk Management in Practice?

Monitoring and reviewing risk controls is essential because risk management is a dynamic, ongoing process, not a one-time activity.

Why monitoring and review are essential in risk management?

1. Risks and Context Change Over Time

- Business environments, regulations, technologies, and operational conditions evolve.
- New hazards may emerge, and existing risks may increase or decrease.
- Monitoring helps detect these changes early so adjustments can be made.

2. Verification of Control Effectiveness

- Controls implemented during risk treatment may degrade or fail.
- Regular review confirms whether controls are working as intended or need improvement.

3. Continuous Improvement

- Monitoring provides data and feedback that can be used to refine processes.
- Lessons learned from incidents, near misses, and audits feed into better risk management practices.



Why monitoring and review are essential in risk management?

4. Compliance and Accountability

- Many legal and regulatory frameworks require ongoing monitoring and reporting.
- Demonstrates due diligence and commitment to safety and risk reduction.

5. Early Warning and Proactive Action

- Continuous monitoring can identify trends or early signs of risk escalation.
- Enables proactive intervention before risks materialize into incidents.

6. Stakeholder Confidence

- Regular reviews and transparent reporting build trust with employees, regulators, and clients.
- Shows that risk management is not a one-time exercise but an ongoing commitment.



“What do you think is the biggest challenge in monitoring risk controls?”

The most significant challenge is **ensuring accurate, real-time visibility of control effectiveness.**

This is difficult because:

1. **Dynamic Risk Environment:** Risks evolve quickly, and controls can become outdated.
2. **Human Factors:** Non-compliance or underreporting can distort monitoring results.
3. **Data Integration:** Information often comes from multiple sources, making consolidation and analysis complex.
4. **Resource Constraints:** Continuous monitoring requires skilled personnel, technology, and budget.
5. **Lag Between Detection and Action:** Even when issues are identified, corrective actions may be delayed.



Risk Control Lifecycle diagram

1. Hazard Identification

Detect potential hazards in processes, equipment, or environment.

Examples: Workplace inspections, employee hazard reports.

2. Risk Assessment

Analyze likelihood and severity of identified hazards to prioritize actions.

Examples: Risk assessments (matrix) and quantitative risk analysis

3. Control Selection & Implementation

Choose appropriate controls following the hierarchy of controls and implement them effectively.

Examples: Installing machine guards, substituting hazardous chemicals, implementing safe work procedures.



Risk Control Lifecycle diagram

4. Monitoring & Measurement

Track performance of controls, compliance, and detect deviations through inspections and KPIs.

Examples: Safety audits, compliance checklists.

5. Review & Continuous Improvement

Evaluate effectiveness, update controls, and adapt to changes for ongoing improvement

Examples: Incident investigations, management reviews, updating risk registers.

Core Concepts: Types of Risk Controls

1. Elimination: Remove the hazard completely.

Example: Discontinue use of a dangerous chemical.

2. Substitution: Replace the hazard with something less risky.

Example: Use a less toxic cleaning agent.

3. Engineering Controls: Isolate people from the hazard.

Example: Machine guarding, ventilation systems.

4. Administrative Controls: Change the way people work.

Example: Training, safe work procedures, job rotation.

5. Personal Protective Equipment (PPE): Protect the worker with equipment.

Example: Gloves, helmets, respirators.



Core Concepts: What does effectiveness mean in practice?

1. Compliance: Are workers following the procedures?

Example: Procedures exist, but workers ignore them → control is ineffective.

2. Performance: Are controls reducing risk to an acceptable level?

Example: A guard reduces injury risk by 80% → good performance.

3. Reliability: Do controls function consistently over time?

Example: Machine interlock works today, but fails next week → unreliable.



Core Concepts: What does effectiveness mean in practice?

4. Adaptability: Are controls updated when conditions change?

Example: New chemical introduced → ventilation system adjusted accordingly.

5. Evidence: Can we measure and verify their impact?

Example: Incident rates drop after implementing control → evidence of effectiveness.



Effectiveness:
Not just installing controls but
ensuring they **work in practice**
to reduce risk!



Is This Control Effective?



Scenario 1: Earplugs Without Training

Lack of Training Impact

Without training, workers may misuse earplugs, reducing protection from noise hazards significantly.

Importance of PPE Training

Proper training ensures correct and consistent use of PPE like earplugs to protect workers effectively.

Monitoring and Refresher Training

Regular monitoring and refresher training help maintain effective PPE usage and worker safety.



Scenario 2: Automated Mixing System

Automation Reduces Hazard Exposure

Automated mixing systems replace manual handling of hazardous substances, reducing worker exposure at the source.

Importance of Monitoring

Continuous monitoring ensures the automated system is maintained and operates safely under all conditions.

Operator Training for Exceptions

Operators must be trained to handle exceptions and intervene if automation fails or unexpected issues arise.



Scenario 3: Hard Hat Signs Without Enforcement

Ineffectiveness of Signage Alone

Signage without enforcement often fails as workers may ignore safety signs, increasing injury risk.

Need for Enforcement

Effective safety requires enforcement through monitoring, site inspections, and disciplinary actions.

Communication and Compliance

Both clear communication and enforcement are essential for effective administrative controls at workplaces.



Scenario 4: Guardrails with Inspections



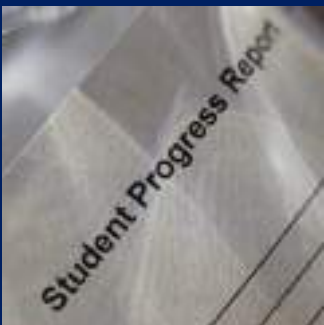
Physical Safety Barriers

Guardrails serve as physical barriers preventing falls from mezzanine edges in warehouse settings.



Regular Safety Inspections

Monthly inspections help identify and correct potential hazards, maintaining safety effectiveness.



Documentation and Review

Documented inspections and corrective actions ensure continuous safety system reliability and compliance.

Scenario 5: Safety Slogan Only

Ineffectiveness of Slogans Alone

Safety slogans alone do not change work practices or reduce workplace risks effectively.

Need for Practical Changes

Real safety improvements require practical changes in behavior and work processes, not just messages.

Monitoring Behavior Change

Effective safety monitoring measures actual behavior change rather than just the presence of slogans.



Scenario 6: Machine Guard Removed for Speed

Control Effectiveness

Removing machine guards to speed production makes engineering controls ineffective and increases safety risks.

Importance of Monitoring

Regular audits and disciplinary measures are essential to ensure safety controls are not bypassed by workers.

Behavioral Compliance

Promoting behavioral compliance is crucial to maintain engineering control effectiveness and workplace safety.



Summary of Lessons Learned

Implementation and Training

Proper implementation and employee training are critical for effective health and safety controls.

Engineering Controls Reliability

Engineering controls offer reliable protection but require continuous oversight and maintenance.

Administrative Controls and PPE

Administrative controls and PPE depend on strong support systems to ensure compliance and protection.

Monitoring and Continuous Review

Ongoing monitoring and review processes sustain the effectiveness of safety measures over time.



Monitoring Techniques



Leading Indicators

Leading indicators are proactive, predictive measures that help identify potential risks before an incident occurs.

They focus on activities, behaviors, and conditions that can prevent accidents and improve safety performance.

Key Characteristics:

1. Forward-looking: They predict future performance.
2. Preventive: Aim to reduce risk before harm happens.
3. Behavioral or process-based: Often linked to safety culture and compliance.



Leading Indicators

Examples:

1. Number of near-miss reports submitted.
2. Percentage of employees who completed safety training.
3. Frequency of safety audits or inspections.
4. Rate of corrective actions implemented on time

Why Important?

1. They allow organizations to act EARLY, adjust controls, and AVOID incidents.



Lagging Indicators

Lagging indicators are reactive measures that show how well your safety system has performed in the past.

They focus on outcomes rather than activities, meaning they measure incidents that have already happened.

Key Characteristics:

1. Backward-looking: They reflect historical performance.
2. Outcome-based: Measure failures or consequences.
3. Easy to quantify: Often based on recorded data



Lagging Indicators

Examples:

1. Lost Time Injury Frequency Rate (LTIFR).
2. Number of recordable injuries or illnesses.
3. Fatality rate.
4. Property damage costs.

Why Important?

1. They help identify trends and validate whether controls are working.
2. Essential for compliance reporting and benchmarking.
3. But cannot predict future risk—that's why they must be paired with leading indicators.



What happens if we only use leading indicators?

1. Predictive but not validated

Leading indicators show proactive efforts (e.g., training hours, audits) but don't confirm if those efforts actually prevent incidents.

2. False sense of security

High scores on leading indicators might look good, but without lagging data, you don't know if injuries or accidents are still occurring.

3. No outcome measurement

You miss the actual results of your safety program—such as injury rates or severity of incidents.

4. Limited accountability

Regulators and stakeholders often require lagging indicators for compliance and benchmarking.



What happens if we only use lagging indicators?

1. Reactive Approach

You measure safety performance after incidents occur, which means you respond to problems instead of preventing them.

2. Delayed Feedback

There's no early warning system. By the time you see poor results (e.g., high injury rates), harm has already happened.

3. Missed Opportunities for Prevention

Unsafe behaviors and conditions go unnoticed because they don't show up in lagging data until an incident occurs.

4. False Sense of Security

If no accidents happen for a while, you might assume everything is safe—even if risks are increasing.



Why do we need both leading and lagging indicators in monitoring risk controls?"

1. They serve different purposes

- Leading indicators are proactive. They measure activities and conditions that help prevent incidents (e.g., training hours, near-miss reports).
- Lagging indicators are reactive. They measure outcomes after an incident occurs (e.g., injury rates, lost time incidents).



Why do we need both leading and lagging indicators in monitoring risk controls?”

2. Balance between prediction and validation

- Leading indicators predict future performance and allow early intervention.
- Lagging indicators validate past performance and show whether controls worked.



Why do we need both leading and lagging indicators in monitoring risk controls?”

3. Comprehensive view of safety performance

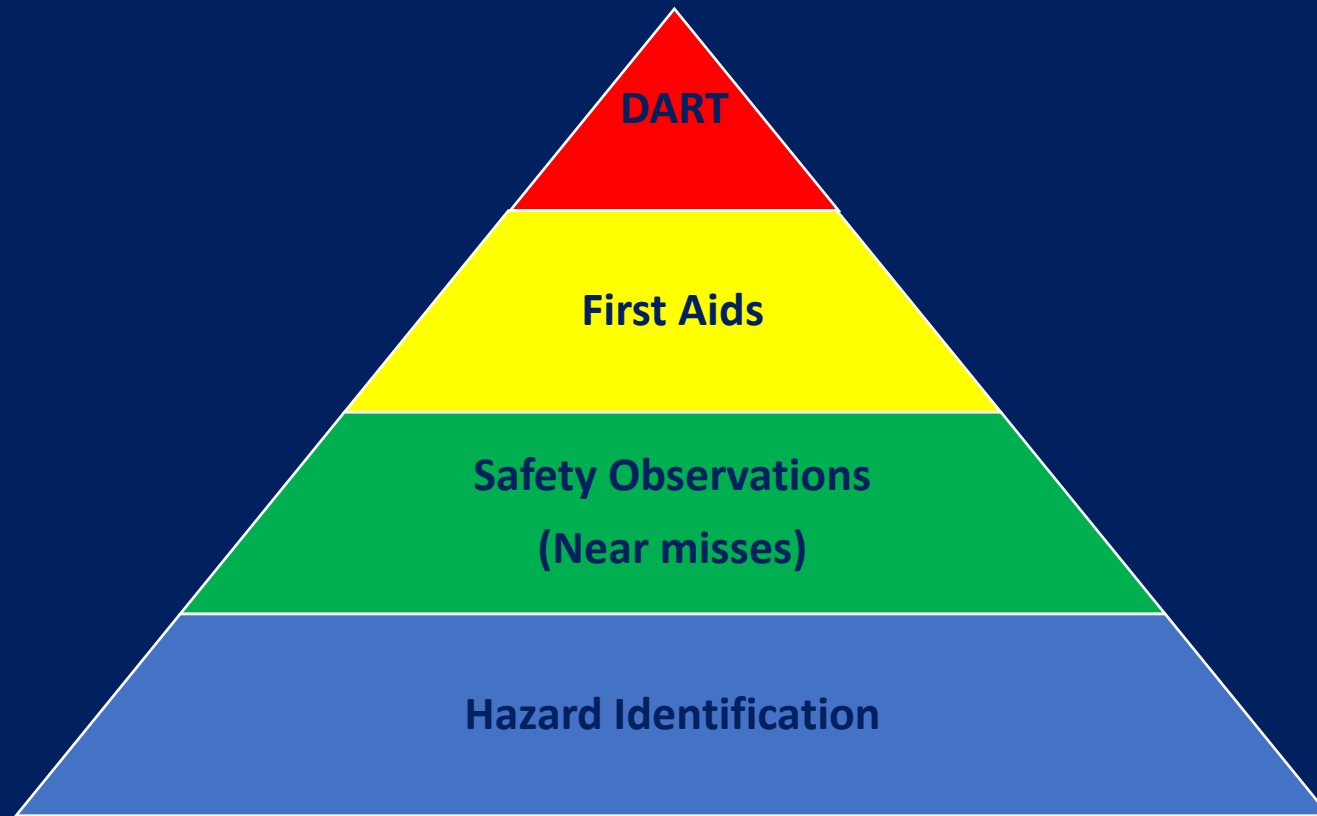
- Relying only on lagging indicators means you act after harm occurs.
- Relying only on leading indicators means you might miss actual outcomes.
- Together, they provide a full picture for continuous improvement.



KPI examples for EHS performance



Safety Triangle



Type	Indicator	Description
Leading	Safety Training Completion Rate	Percentage of employees who completed required safety training.
Leading	Near-Miss Reports	Number of near-miss incidents reported (shows proactive hazard identification).
Leading	Safety Audits Conducted	Frequency and quality of internal safety audits or inspections.
Leading	Corrective Actions Closed on Time	Percentage of corrective actions completed within the set timeframe.
Leading	Employee Safety Observations	Number of safety observations or behavioral checks performed.
Lagging	Lost Time Injury Frequency Rate (LTIFR)	Number of lost-time injuries per million hours worked.
Lagging	Total Recordable Incident Rate (TRIR)	Rate of recordable injuries and illnesses per 200,000 hours worked.
Lagging	Fatalities	Number of work-related fatalities.

KPIs link to continuous improvement

KPIs drives action that enhance safety performance over time



1. Define the Continuous Improvement Cycle

Use the **Plan – DO – Check – Act (PDCA)** model

- A. **Plan:** Identify areas for improvement based on KPI trends
- B. **Do:** Implement corrective or preventive actions
- C. **Check:** Monitor KPI changes after interventions
- D. **Act:** Standardize successful practices and set new targets



2. Map KPIs to Improvement Actions

Create a table showing KPI → Insight → Action → Outcome:

KPI	Insight	Action	Outcome
Near-Miss Reports (Leading)	Low reporting indicates poor engagement	Launch awareness campaign & simplify reporting	Increase in near-miss reports → proactive hazard control
Safety Training Completion	Low completion rate	Schedule mandatory sessions & track progress	Improved competency → fewer incidents
Corrective Actions Closed on Time	Delays in closure	Assign accountability & automate reminders	Faster resolution → reduced recurrence
LTIFR (Lagging)	High rate signals inadequate controls	Review risk assessments & strengthen controls	Reduction in LTIFR over time

3. **Show Trend Analysis**

Use graphs to show KPI trends improving after interventions.
Example: Near-miss reports ↑ → incidents ↓ → LTIFR ↓.

4. **Link to Strategic Goals**

Align KPIs with organizational objectives (e.g., “Zero Harm” or ISO 45001 compliance).

Show how continuous improvement supports risk reduction and culture change

5. Visualize the feedback loop

KPIs feed into analysis → actions → improved KPIs → new targets → repeat.

In the context of PDCA and KPIs:

Feedback loop = A circular process where:

1. **Plan:** Set objectives and KPIs.
2. **Do:** Implement actions.
3. **Check:** Measure results against KPIs.
4. **Act:** Adjust based on findings → feed back into the next planning phase.





Real-Time Monitoring Tools

What if you could detect hazards
before they happen?

Introduction to Real-Time Monitoring Tools

1. Hazard Detection and Response

Real-time monitoring tools enable immediate detection of workplace hazards and prompt incident response to minimize risks.

2. Technology Integration

IoT sensors, dashboards, and wearables support a proactive safety culture by providing continuous environmental and health data.

3. Predictive Analytics and Compliance

- Integrating real-time data enables predictive analytics, regulatory compliance, reduced downtime, and enhanced productivity.

4. Industry Applications and Benefits

- High-risk industries benefit from real-time monitoring by preventing accidents and promoting safer work environments.



Technologies for Real-Time Monitoring



IoT Sensors for Environmental Hazards

1. Real-time Environmental Monitoring

IoT sensors continuously monitor temperature, humidity, gas, noise, and vibration to detect hazards early.

2. Early Warning and Alert Systems

Sensors provide immediate alerts when unsafe conditions arise, enabling prompt corrective actions.

3. Connectivity and Data Integration

IoT devices connect wirelessly to central systems for seamless data integration and monitoring.

4. Industrial Scalability and Safety

IoT sensors are scalable and widely used in industries like oil, gas, manufacturing, and construction to improve safety.



Dashboards for Centralized Data Visualization

Centralized Data Integration

Dashboards consolidate data from IoT sensors, wearables, and multiple sources into one interface for easy monitoring.

Real-Time Alerts and Analytics

Dashboards provide real-time alerts and predictive analytics to enable proactive risk management and quick decision-making.

Multi-Device Accessibility

Dashboards are accessible on desktops, tablets, and smartphones, ensuring critical information is available anytime, anywhere.

Enhanced Situational Awareness

Dashboards improve workplace safety by providing comprehensive views and supporting communication among safety teams.



Wearables for Worker Health and Exposure

Real-Time Health Monitoring

Wearable devices monitor vital signs like heart rate and body temperature to prevent health risks.

Exposure to Environmental Hazards

Sensors track exposure to heat, noise, and chemicals ensuring worker safety in hazardous environments.

Emergency Response Integration

Wearables transmit location data during emergencies to enable rapid assistance and improve safety response.

Worker Engagement and Safety Culture

Feedback from wearables encourages safer behaviors and helps build a proactive safety culture.



Smart Safety: Examples of Real-Time Monitoring in High-Risk Industries



1. Oil & Gas

- o IoT sensors for gas leaks, pressure, and temperature.
- o Wearables for worker location and exposure tracking.
- o Dashboards for remote site monitoring.

2. Mining

- o Sensors for air quality, dust, and vibration.
- o Wearables for fatigue and heat stress.
- o Real-time alerts for underground hazards.

3. Construction

- o Wearables for fall detection and posture monitoring.
- o IoT sensors for noise, dust, and structural integrity.
- o Drones for site inspections.

4. Chemical & Pharmaceutical

- o IoT sensors for toxic gas detection and temperature control.
- o Real-time monitoring of chemical storage conditions.
- o Automated alerts for spills or leaks.

Review & Audit Process



Periodic Reviews: Frequency and Scope

Frequency:

1. Monthly: Operational checks (e.g., PPE compliance, housekeeping).
2. Quarterly: Department-level safety performance review.
3. Annually: Full system review aligned with ISO 45001 or corporate standards.

Scope:

1. Policies and procedures compliance.
2. KPI trends (leading and lagging indicators).
3. Effectiveness of corrective actions.
4. Risk assessments and control measures.



Internal vs. External Audits

Internal Audits:

- a) Conducted by trained internal staff.
- b) Focus on continuous improvement and compliance with internal standards.
- c) More frequent (quarterly or semi-annual).

External Audits:

- a) Performed by third-party or certification bodies.
- b) Validate compliance with legal requirements and international standards.
- c) Typically annual or bi-annual.



Documentation and Reporting

Audit Reports:

Findings, non-conformities, and recommendations.
Action plans with deadlines and responsible persons.

Review Records:

Meeting minutes, KPI dashboards, and trend analysis.

Communication:

Share results with stakeholders and management.
Use reports to update risk registers and safety plans



You are the auditor. What questions will you ask?

1. Can you show me your latest risk assessment?
2. How often is it updated?
3. What process do you follow to identify hazards in your area?
4. How do you ensure that corrective actions from previous audits are closed on time?
5. What KPIs do you monitor for safety performance?



Continuous Improvement Strategies



Root Cause Analysis for Failures

Purpose: Identify underlying causes, not just symptoms.

Methods:

1. 5 Whys: Ask “Why?” repeatedly until the root cause is found.
2. Fishbone Diagram (Ishikawa): Categorize causes (People, Process, Equipment, Environment).
3. Fault Tree Analysis: Visualize failure pathways.



Corrective and Preventive Actions (CAPA)

Corrective Action: Fix the immediate issue and prevent recurrence.

Preventive Action: Anticipate and eliminate potential issues before they occur.

Example:

Corrective: Replace faulty PPE.

Preventive: Implement PPE inspection schedule.



Integration with ISO 45001

Clause 10: Improvement

Requires organizations to react to nonconformities and continually improve the OH&S management system.

Link to PDCA: Continuous improvement is embedded in ISO 45001 through the PDCA cycle.



How would you improve a failing control?"

Undergraduate Diploma in
Occupational Health & Safety

Example: "Machine guarding is repeatedly bypassed."

Step 1: What is the root cause?

Step 2: What corrective and preventive actions would you take?

Step 3: How would you monitor effectiveness?

Debrief: Link back to PDCA and ISO 45001

Plan: Identify the issue and set objectives (e.g., zero bypass incidents).

Do: Implement corrective and preventive actions.

Check: Monitor compliance and KPI trends.

Act: Standardize successful changes and update procedures.

ISO 45001 Clause 10: Continuous improvement and corrective action requirements



1. What is the purpose of monitoring risk controls?
2. What is the difference between monitoring and reviewing?
3. Name two types of monitoring methods.
4. Why is real-time monitoring important?



5. Give an example of an IoT sensor in OHS.
6. What role do dashboards play in monitoring?
7. How do wearables improve worker safety?.
8. What is a key benefit of predictive analytics in monitoring?

9. Why should controls be reviewed after an incident?
10. What is the hierarchy of monitoring activities?
11. How often should risk controls be reviewed?
12. What is active monitoring?



13. What is reactive monitoring?
14. Name one limitation of technology-based monitoring.
15. Why involve workers in monitoring?
16. What is the role of KPIs in monitoring?



17. Give an example of a KPI for OHS monitoring.
18. What should trigger an immediate review of controls?
19. How can data visualization improve monitoring?
20. Why is continuous improvement important in OHS?



Next: Lecture 12: Safety Culture and Organizational Behavior

Examines the role of organizational culture and behaviour in shaping risk management outcomes.

Learning objectives:

- Define safety culture and its components
- Assess organizational behaviour impacts on safety
- Promote positive safety culture initiatives

