

Risk Management in Practice

Lecture 6 : Control of Workplace Safety Hazards

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**Undergraduate Diploma in
Occupational Health and Safety**

Lecture Aim

Understand how when and how to control different Hazards at the work place applying the best and suitable control measures

In this lecture, learners will understand when and how to control different workplace hazards by identifying risks, assessing their likelihood and severity, and selecting the appropriate control measures. The session explains the hierarchy of controls, emphasising elimination, substitution, engineering controls, administrative procedures, and personal protective equipment. Learners will recognise physical, chemical, biological, ergonomic, and psychosocial hazards and determine suitable controls for each situation. Practical examples will demonstrate how to apply controls correctly, monitor their effectiveness, and review them regularly. This knowledge will enable participants to reduce accidents, protect health, ensure legal compliance, and promote a safer productive environment.



Lecture Objective

- Identify different types of workplace hazards and their potential impacts on health and safety
- Select appropriate control measures based on best practices and risk assessment findings
- Monitor, review, and improve control measures to ensure ongoing effectiveness



What are Workplace Hazards?

- Workplace hazards are sources or situations with the potential to cause harm to people, property, or the environment. They exist in all work settings and may arise from equipment, materials, processes, or working conditions. Hazards are not accidents themselves but conditions that increase the likelihood of injury, illness, or damage if not properly controlled. Identifying workplace hazards is a critical first step in health and safety management, as it allows employers and workers to recognize risks and take preventive action.
- These hazards can cause a wide range of negative outcomes, including physical injuries, long-term health conditions, mental stress, and damage to equipment or facilities. For example, physical hazards may lead to cuts or fractures, chemical hazards can cause burns or respiratory illness, and ergonomic hazards may result in musculoskeletal disorders. If left unmanaged, workplace hazards can also disrupt operations, reduce productivity, and lead to legal consequences, making effective hazard control essential.



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Type of Workplace Hazards?

- Mechanical
- Chemical
- Ergonomic

Physical

Biological

Psychological



Mechanical Hazards

- Unguarded moving machinery parts (gears, belts, pulleys)
- Crushing hazards from presses, rollers, or heavy equipment
- Entanglement hazards from rotating shafts or conveyors
- Shearing hazards where machine parts move past each other
- Cutting hazards from blades, saws, or sharp tools
- Pinch points between moving and stationary parts
- Impact hazards from moving or falling objects
- Ejection of materials such as flying debris or broken machine parts
- Friction and abrasion hazards caused by rough or moving surfaces
- Mechanical failure of equipment due to wear, poor maintenance, or overload



Mechanical Hazards

- Mechanical hazards can lead to a wide range of injuries, depending on the type of equipment and the level of exposure. Common injuries include **cuts and lacerations** from sharp blades or tools, **crush injuries** caused by heavy machinery, and **fractures or broken bones** resulting from impact or entrapment. **Amputations** may occur when body parts are caught in moving machinery, while puncture wounds can result from flying debris or sharp objects. In addition, mechanical hazards can cause **bruises, sprains, and strains** due to sudden movements or improper handling of equipment. **Eye injuries** may occur from ejected materials, and **burns** can result from friction or overheating machinery. Repeated exposure can also lead to long-term **musculoskeletal disorders**, highlighting the importance of effective machine guarding, maintenance, and safe work practices.



Control Measures - Mechanical Hazards

- Eliminate unsafe machinery or hazardous tasks where possible
- Substitute old or dangerous equipment with safer alternatives
- Install machine guards on moving parts
- Use interlocks and emergency stop devices
- Ensure proper equipment design and guarding of pinch points
- Implement lockout/tagout procedures during maintenance
- Provide clear safe operating procedures
- Conduct regular inspection and maintenance of machinery
- Train workers on correct machine use and hazard awareness
- Display warning signs and labels on equipment
- Enforce safe work practices and supervision
- Provide appropriate PPE (gloves, eye protection, safety footwear)



Scenario - Control Measures - Mechanical Hazards

Workplace Scenario - Example

In a manufacturing workshop, workers operate a metal cutting machine with a rotating blade, which poses a serious risk of cuts and amputations. To control this mechanical hazard, the company installs a fixed machine guard that fully covers the blade while still allowing materials to pass through safely. An emergency stop button is added within easy reach of the operator. Workers receive training on safe operating procedures and lockout/tagout requirements during maintenance. These control measures significantly reduce the risk of injury and improve overall workplace safety.



Chemical Hazards

- **Toxic chemicals** – Substances that can cause serious health effects or poisoning when inhaled, ingested, or absorbed through the skin
- **Corrosive chemicals** – Acids and alkalis that can burn or destroy skin, eyes, and materials
- **Flammable chemicals** – Liquids, gases, or solids that can easily ignite and cause fires or explosions
- **Explosive chemicals** – Substances that may detonate or react violently under certain conditions
- **Irritants** – Chemicals that cause inflammation or discomfort to the skin, eyes, or respiratory system
- **Sensitizers** – Chemicals that cause allergic reactions after repeated exposure
- **Carcinogens** – Substances known to cause cancer
- **Mutagens** – Chemicals that cause genetic mutations
- **Teratogens/Reproductive toxins** – Substances that harm unborn children or affect fertility
- **Asphyxiants** – Gases that displace oxygen and can cause suffocation



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Control Measures - Chemical Hazards

1. Elimination Definition: Completely remove the hazardous chemical from the workplace.

Examples: Use a non-toxic alternative instead of a hazardous solvent.

Replace a flammable cleaning agent with a safer one.

Effectiveness: Most effective because the hazard is no longer present.

2. Substitution Definition: Replace a hazardous chemical with a less hazardous one.

Examples: Using water-based paints instead of solvent-based paints.

Using ethanol instead of methanol where possible.

Note: This reduces risk but doesn't eliminate it completely.



Control Measures - Chemical Hazards

3. Engineering Controls Definition: Isolate people from the chemical hazard using equipment or design changes.

Examples: Local Exhaust Ventilation (LEV) to capture fumes at the source.

Fume hoods, glove boxes, or enclosed process systems.

Automated dispensing systems to minimize manual handling.

Effectiveness: Very effective if properly maintained.

4. **Administrative Controls Definition:** Change the way people work to reduce exposure.

Examples: Implementing safe work procedures (SOPs) for handling chemicals.

Limiting exposure time or scheduling high-risk tasks when fewer employees are present.

Training employees on chemical hazards, labeling, and emergency procedures.

Maintaining chemical inventories and Material Safety Data Sheets (MSDS).

Note: Relies on human behavior, so it's less reliable than engineering controls.



Control Measures - Chemical Hazards

5. Personal Protective Equipment (PPE) Definition: Use clothing or devices to protect workers from exposure.

Examples: Gloves resistant to specific chemicals.

Safety goggles or face shields.

Respirators or masks for inhalation hazards.

Protective clothing or aprons.

Note: Least effective because it only protects the individual, doesn't remove the hazard.

6. Additional Measures

Proper Storage and Labelling

Store incompatible chemicals separately (e.g., acids and bases). Use proper containers and secondary containment for spills.

Clearly label chemicals with hazard symbols.

Spill Response and Emergency Preparedness

Keep spill kits accessible.

Train staff in first aid and emergency evacuation.

Air monitoring for toxic fumes or dust.

Health Surveillance - Medical checks for employees exposed to hazardous chemicals.



Control Measures -COSHH Assessment Chemical Hazards

A COSHH (Control of Substances Hazardous to Health) assessment identifies and manages risks from hazardous substances used or created at work. It involves recognising substances that could harm health, such as chemicals, fumes, dusts, vapours, or biological agents. The assessment evaluates who may be exposed, how exposure occurs, and the potential health effects. Appropriate control measures are then identified, including substitution with safer alternatives, engineering controls, safe working procedures, and use of personal protective equipment (PPE). The process also considers safe storage, handling, spill response, training, and health surveillance where required. Regular review ensures controls remain effective and compliant with legal requirements, helping to protect employees, contractors, and others from health risks.



Scenario - Control Measures - Chemical Hazards

In a paint manufacturing facility, workers handle solvent-based paints containing hazardous chemicals like toluene and xylene, which are toxic and flammable. To control exposure, elimination and substitution are applied by replacing highly toxic solvents with safer, lower-volatility alternatives and, where possible, using water-based paints. Engineering controls include local exhaust ventilation over mixing tanks and enclosed machinery to capture fumes, while explosion-proof (atex) equipment reduces fire risk. Administrative measures involve standard operating procedures, shift rotation to limit exposure, chemical safety training, and accessible Material Safety Data Sheets. Personal protective equipment such as respirators, chemical-resistant gloves, goggles, and aprons provides a final layer of protection. Regular air monitoring, spill kits, and emergency drills further ensure workplace safety and regulatory compliance.



Ergonomic Hazards

- Prolonged sitting or standing without adequate breaks
- Poor workstation design (incorrect desk, chair, or monitor height)
- Repetitive motions (typing, assembly line tasks)
- Awkward postures (bending, twisting, overreaching)
- Manual handling of heavy or awkward loads
- Poorly designed tools or equipment
- Excessive force required to perform tasks
- Contact stress (pressure from hard or sharp surfaces)
- Inadequate lighting causing strained postures
- High work pace or insufficient recovery time



Ergonomic Hazards – Control Measures

Ergonomic hazard control measures aim to reduce strain, fatigue, and the risk of musculoskeletal disorders. Common controls include:

- Designing workstations to suit the user (adjustable chairs, desks, and monitor height)
- Encouraging neutral postures and proper body alignment
- Reducing repetitive tasks through job rotation or task variation
- Providing mechanical aids for lifting and handling loads
- Using ergonomically designed tools and equipment (Gender Specific)
- Allowing regular breaks and micro-pauses
- Improving workplace layout to minimise reaching and twisting
- Ensuring adequate lighting to prevent awkward postures
- Training workers on correct posture and manual handling techniques
- Conducting ergonomic assessments and reviewing controls regularly



Scenario - Ergonomic Hazards – Control Measures

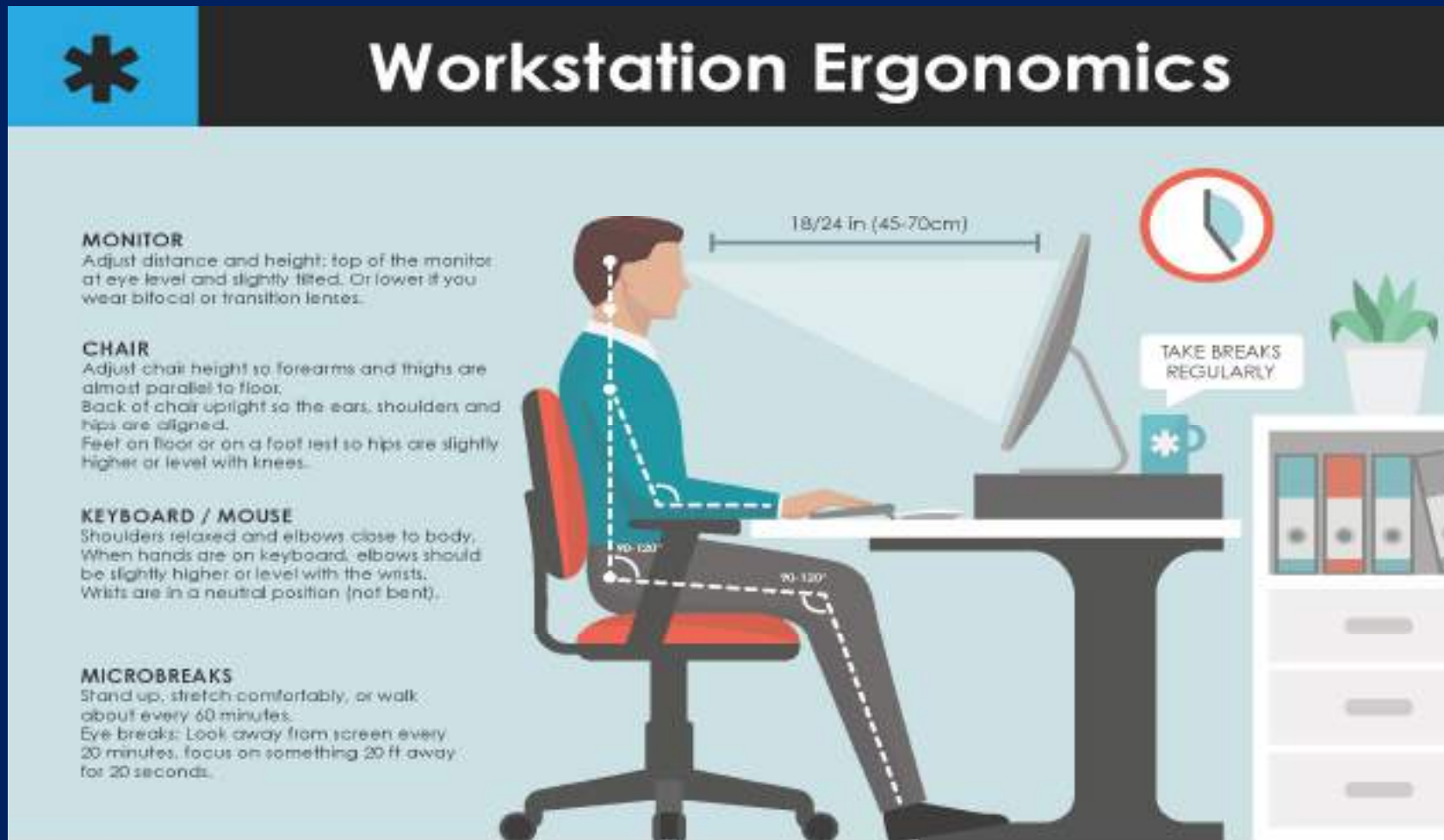
In a busy office, employees spend long hours working at computer workstations. Several ergonomic hazards are present. Staff use non-adjustable chairs, causing poor posture and lower back pain. Computer monitors are positioned too low, leading to neck strain. Keyboards and mice are placed too far away, resulting in extended reaching and wrist discomfort. Employees also sit for prolonged periods without breaks, increasing fatigue and the risk of musculoskeletal disorders.

Control Measures:

- Provide adjustable chairs with lumbar support
- Position monitors at eye level and at a suitable distance
- Place keyboards and mice within easy reach and at elbow height
- Encourage regular breaks and stretching exercises
- Conduct workstation assessments and provide ergonomic training



Scenario - Ergonomic Hazards – Control Measures



Physical Hazards

- Excessive noise
- Vibration from tools or machinery
- Extreme temperatures (heat or cold)
- Poor lighting or glare
- Radiation (ionising and non-ionising)
- Slips, trips, and falls
- Electrical hazards
- Working at heights
- Confined spaces
- Poor ventilation or air quality
- Pressure hazards (compressed gases, steam systems)



Physical Hazards

Physical hazards at the workplace can lead to a wide range of **injuries, illnesses, and long-term health effects**, including:

- Slips, trips, and falls causing sprains, fractures, or head injuries
- Hearing loss due to prolonged exposure to high noise levels
- Hand–arm vibration syndrome (HAVS) from vibrating tools
- Heat stress, dehydration, or heat stroke from high temperatures
- Hypothermia or frostbite in cold environments
- Electric shock, burns, or electrocution
- Eye strain or vision damage from poor lighting or radiation
- Respiratory issues from poor air quality
- Fatigue and reduced concentration, increasing accident risk
- Long-term musculoskeletal disorders
- In severe cases, permanent disability or fatal injuries



Control Measures - Physical Hazards

- Eliminating hazards where possible (e.g. removing unsafe equipment or processes)
- Substituting with safer equipment or processes
- Engineering controls such as machine guarding, noise enclosures, and ventilation systems
- Regular inspection and maintenance of tools, machinery, and electrical systems
- Improving workplace lighting and visibility
- Implementing safe systems of work and clear procedures
- Providing warning signs and barriers in hazardous areas
- Limiting exposure time through job rotation and rest breaks
- Providing appropriate personal protective equipment (PPE)
- Training employees on hazard awareness and safe work practices
- Supervising work activities to ensure compliance
- Conducting regular risk assessments and reviewing controls



Scenario - Control Measures - Physical Hazards

On a large construction site during summer, workers are exposed to high temperatures while performing physically demanding tasks such as concrete pouring, steel fixing, and roofing. Prolonged exposure to direct sunlight, hot surfaces, and heavy protective clothing increases the risk of heat stress, dehydration, heat exhaustion, and heat stroke. Workers may experience fatigue, dizziness, reduced concentration, and muscle cramps, increasing the likelihood of accidents and injuries.

Control Measures:

- Plan work schedules to avoid peak heat periods
- Provide shaded rest areas close to work zones
- Ensure easy access to cool drinking water and electrolyte drinks
- Enforce regular rest breaks and job rotation
- Use lighter, breathable PPE where possible
- Train workers to recognise symptoms of heat-related illness
- Monitor weather conditions and stop work during extreme heat
- Appoint supervisors to observe workers for signs of heat stress



Biological Hazards

- Bacteria (e.g. Salmonella, E. coli) – Can cause food poisoning, diarrhoea, vomiting, fever, dehydration, and in severe cases organ failure.
- Viruses (e.g. influenza, COVID-19, hepatitis) – May lead to respiratory infections, fever, fatigue, long-term illness, liver damage (hepatitis), or death in severe cases.
- Fungi and moulds – Can cause allergic reactions, asthma, respiratory infections, skin irritation, and long-term lung damage.
- Blood and other body fluids – Risk of blood-borne diseases such as HIV, hepatitis B and C through cuts, needle injuries, or contact with broken skin.
- Animal bites, scratches, or droppings – Can transmit infections such as rabies, tetanus, leptospirosis, and other zoonotic diseases.
- Insects and parasites (e.g. mosquitoes, ticks) – May spread diseases like malaria, dengue fever, Lyme disease, and cause allergic reactions.
- Sewage and wastewater – Exposure can lead to gastrointestinal illness, skin infections, hepatitis, and respiratory diseases.
- Contaminated food or water – Can result in foodborne illnesses, stomach cramps, diarrhoea, dehydration, and serious infections.



Control Measures - Biological Hazards

- 1. Elimination Definition: Completely removing the hazard from the workplace or environment.
 - Examples: Using pre-sterilized medical instruments instead of reusable ones.
 - Replacing live pathogens with non-pathogenic strains in research settings.
 - Effectiveness: Highest because the hazard is completely removed.
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- 2. Substitution Definition: Replacing a hazardous biological agent with a less hazardous one.
 - Examples: Using a non-pathogenic bacteria for experiments instead of a dangerous strain.
 - Employing inactivated viruses for vaccine production or training purposes.



Control Measures - Biological Hazards

- 3. Engineering Controls Definition: Physical changes to facilities or equipment to reduce exposure.
 - Examples: Biosafety cabinets (Class I, II, III) to contain aerosols.
 - Autoclaves for sterilizing equipment and waste.
 - Negative-pressure isolation rooms for infectious patients.
 - Hand-free sinks, ventilation systems, and air filtration (HEPA filters).Effectiveness: Very high, reduces risk without relying on human behaviour.
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- 4. Administrative Controls Definition: Policies, procedures, and work practices designed to minimize risk.
 - Examples: Standard Operating Procedures (SOPs) for handling infectious agents.
 - Training and education on infection control.
 - Limiting access to labs or areas where biological hazards exist.
 - Scheduling work to reduce exposure (e.g., rotating staff in high-risk areas).
 - Reporting and monitoring infections and incidents.



Control Measures - Biological Hazards

5. Personal Protective Equipment (PPE) Definition: Equipment worn by individuals to protect against exposure.

Examples:

Gloves, lab coats, gowns.

Face masks, respirators, face shields. Eye protection like goggles.

Shoe covers or booties in high-risk areas.

Effectiveness: Last line of defense; must be used properly and consistently.



6. Hygiene and Sanitation Measures

Regular handwashing with soap or using alcohol-based sanitizers.

Proper disinfection of surfaces and equipment (e.g., using bleach or ethanol).

Safe waste disposal (biohazard bins, sharps containers, autoclaving).

Vaccinations where available (e.g., hepatitis B for lab workers, influenza).

Scenario - Control Measures - Biological Hazards

A nurse in a hospital's infectious disease ward is exposed to biological hazards while caring for patients with contagious illnesses. She handles blood, bodily fluids, used needles, and contaminated equipment, putting her at risk of bloodborne and airborne pathogens such as HIV, Hepatitis B/C, and TB.

Control Measures:

- Hand Hygiene: Wash hands before and after patient contact.
- PPE: Wear gloves, gowns, masks, eye protection, and N95 respirators.
- Safe Needle Practices: Use sharps containers, avoid recapping needles.
- Vaccinations: Ensure staff are immunized against Hepatitis B, influenza, etc.
- Isolation Protocols: Use negative pressure rooms for infectious patients.
- Surface Disinfection: Regularly clean equipment and patient areas.
- Training: Educate staff on infection control and standard precautions.
- Incident Reporting: Promptly report exposures or needlestick injuries.



Psychosocial Hazards

- **Workplace Stress** – Can cause anxiety, burnout, depression, reduced productivity.
- **Bullying or Harassment** – Leads to low morale, mental health issues, absenteeism.
- **Work Overload / Long Hours** – Causes fatigue, sleep problems, cardiovascular issues.
- **Job Insecurity** – Results in stress, anxiety, depression, decreased job satisfaction.
- **Poor Management / Leadership** – Leads to low motivation, conflict, poor team cohesion.
- **Lack of Social Support** – Causes isolation, depression, reduced mental well-being.
- **Unclear Job Roles / Responsibilities** – Leads to confusion, stress, errors, low performance.
- **Violence or Threats** – Can result in PTSD, anxiety, fear, disengagement.
- **Shift Work / Irregular Hours** – Causes sleep disruption, fatigue, mood disorders.
- **Work-Life Imbalance** – Leads to stress, family conflict, burnout, poor mental health.



Psychosocial Hazards – Control Measures

- **Workload Management** – Ensure fair distribution of tasks and reasonable working hours.
- **Clear Job Roles** – Define responsibilities and expectations to reduce confusion and stress.
- **Supportive Leadership** – Train managers in communication, conflict resolution, and positive supervision.
- **Employee Support Programs** – Provide counseling, mental health services, or employee assistance programs (EAPs).
- **Anti-Bullying Policies** – Implement and enforce zero-tolerance policies for harassment and workplace bullying.
- **Flexible Work Arrangements** – Offer remote work, flexible hours, or shift adjustments to support work-life balance.
- **Team Building & Social Support** – Encourage collaboration, mentoring, and peer support networks.
- **Stress Management Training** – Offer workshops on coping strategies, resilience, and mindfulness.
- **Regular Feedback & Communication** – Maintain open channels for concerns, suggestions, and recognition.
- **Monitoring & Review** – Conduct regular workplace surveys and risk assessments to identify and address psychosocial hazards early



Scenario - Psychosocial Hazards – Control Measures

Sarah works as a project manager in a busy marketing firm. She frequently works **long hours**, juggles **multiple tight deadlines**, and feels **constant pressure** from management to deliver more. She rarely takes breaks and often skips lunch to catch up on work. Over time, Sarah experiences **emotional exhaustion, decreased motivation, irritability, and reduced productivity**, classic signs of **burnout**, a psychosocial hazard. Her stress also affects her relationships with colleagues and her overall well-being.

Control Measures

1. **Workload Management** – Assign tasks fairly and avoid excessive overtime.
2. **Flexible Work Arrangements** – Allow remote work or flexible hours when possible.
3. **Regular Breaks** – Encourage taking short breaks and proper lunch hours.
4. **Clear Job Roles** – Define responsibilities to reduce role confusion and stress.
5. **Supportive Management** – Provide mentorship, feedback, and recognition.
6. **Employee Assistance Programs (EAPs)** – Offer counselling and stress management support.
7. **Stress Management Training** – Teach coping strategies, mindfulness, and resilience.
8. **Team Support & Social Interaction** – Promote collaboration and peer support.
9. **Monitoring & Early Intervention** – Identify signs of burnout early through surveys or check-ins.
10. **Encourage Work-Life Balance** – Promote hobbies, exercise, and time off



Decision Making- Control Measures

Effective decision-making in occupational health and safety (OHS) requires identifying hazards, assessing risks, and selecting the most suitable control measures. The hierarchy of controls—elimination, substitution, engineering, administrative, and PPE—guides prioritisation.

Choosing the most effective control means balancing risk reduction with practicality, ensuring the solution is feasible, cost-effective, and sustainable.

In practice, decision-makers must evaluate workplace constraints and implement layered controls for maximum safety. Combining engineering solutions, safe work procedures, and training often provides a balanced approach



Evaluating Control Effectiveness

Regular Inspections – Conduct scheduled workplace inspections to ensure controls are implemented correctly.

Incident & Near-Miss Reporting – Track accidents, near misses, or unsafe events to see if controls prevent hazards.

Employee Feedback – Gather input from workers on usability and effectiveness of controls.

Safety Audits – Perform formal audits to verify compliance with OHS policies and standards.

Performance Metrics – Use measurable indicators like reduced injury rates or fewer hazard exposures.

Maintenance Checks – Ensure engineering controls and equipment are functioning and well-maintained.

Training & Refresher Programs – Monitor staff understanding and adherence to safe work practices.

Continuous Improvement – Review and update control measures based on monitoring results and changing conditions.





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