



HIRARC

Hazard Identification,
Risk Assessment and
Risk Control

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HIRARC

Hazard Identification, Risk Assessment and Risk Control



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INTRODUCTION

HIRARC is an acronym that stands for "Hazard Identification, Risk Assessment, and Risk Control." It is a systematic strategy used in occupational health and safety management to detect and mitigate potential hazards and risks in the workplace or other environment. HIRARC's major goal is to make the workplace safer by minimizing the likelihood of accidents, injuries, and occupational illnesses.

HIRARC is a vital instrument for employers, managers, and safety professionals to use in order to proactively manage safety risks and protect the safety of workers and people in general. Organisations may build a safer and healthier environment by meticulously analysing potential dangers and taking preventive actions, thereby reducing the likelihood of accidents and establishing a culture of safety.



WHAT IS RISK?

The probability or likelihood of an event, activity, or condition resulting in harm, loss, or negative outcome is referred to as **RISK**. It is a natural aspect of daily life and can be found in a variety of circumstances, including riding your bike, starting up your new business, hiring a new worker or making any decision-making.

Risk is something that we all have to deal with on a daily basis. People are continually making risky judgements. The likelihood and severity of a specific hazardous event occurring are combined to form risk. -DOSH-



WHAT IS HAZARD?

Any potential source of injury, poor health impacts, or impact on something or someone. Workplaces, households, public spaces, and natural settings are all sites where hazards might be encountered. They can take numerous forms, including physical, chemical, biological, ergonomic, and psychological ones.

A source or a situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment or a combination of these.
-DOSH-



DO WE NEED HIRARC?

You can identify all the factors that may cause harm to employees and others (the hazards)



HIRARC helps organization to consider what the chances are of that harm actually be falling anyone in the circumstances of a particular case and the possible severity that could come from it (the risks)



Employers are enable to plan, introduce and monitor preventive measures to ensure that the risks are adequately controlled at all times

When to do **HIRARC Activities?**

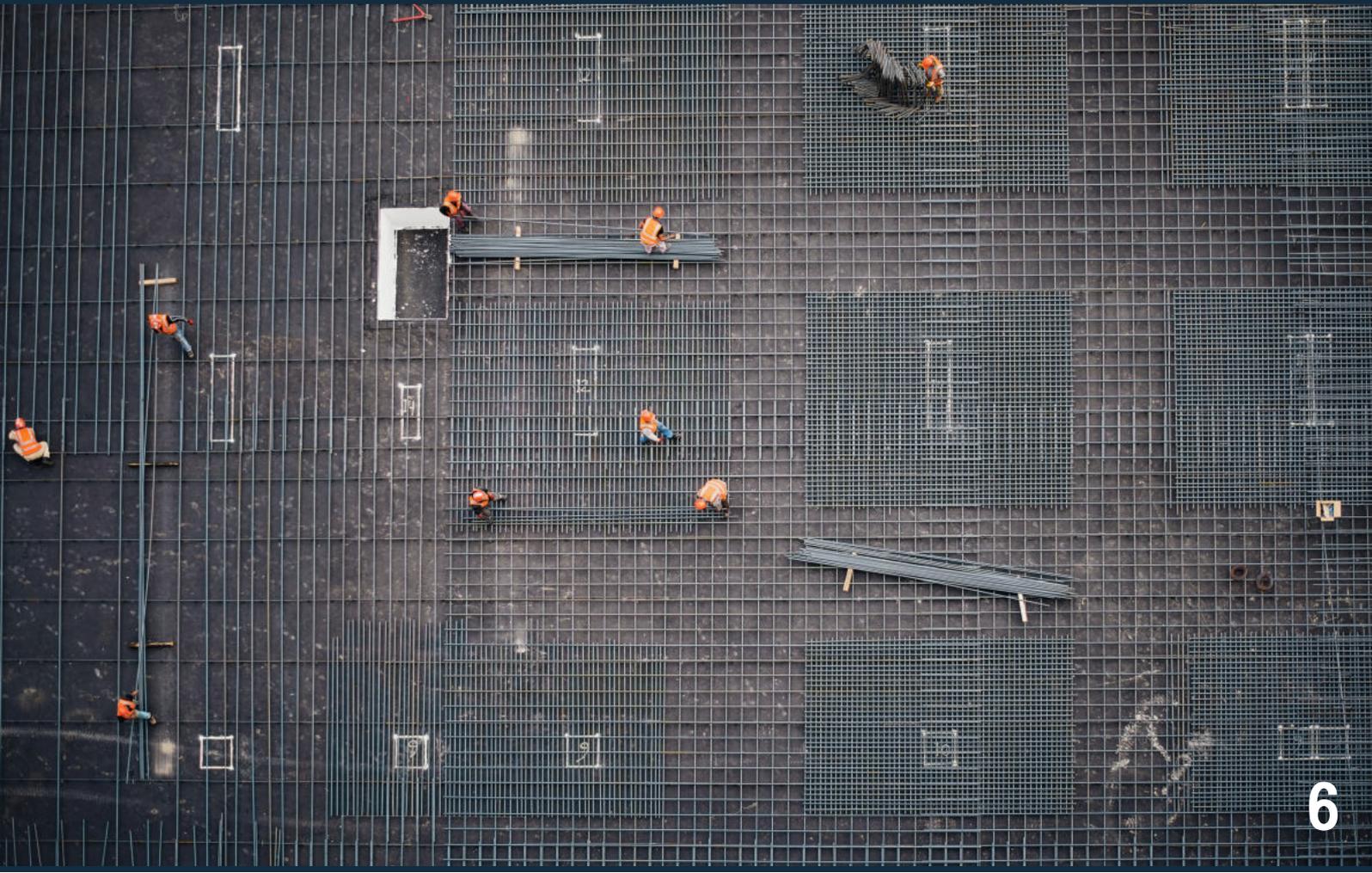
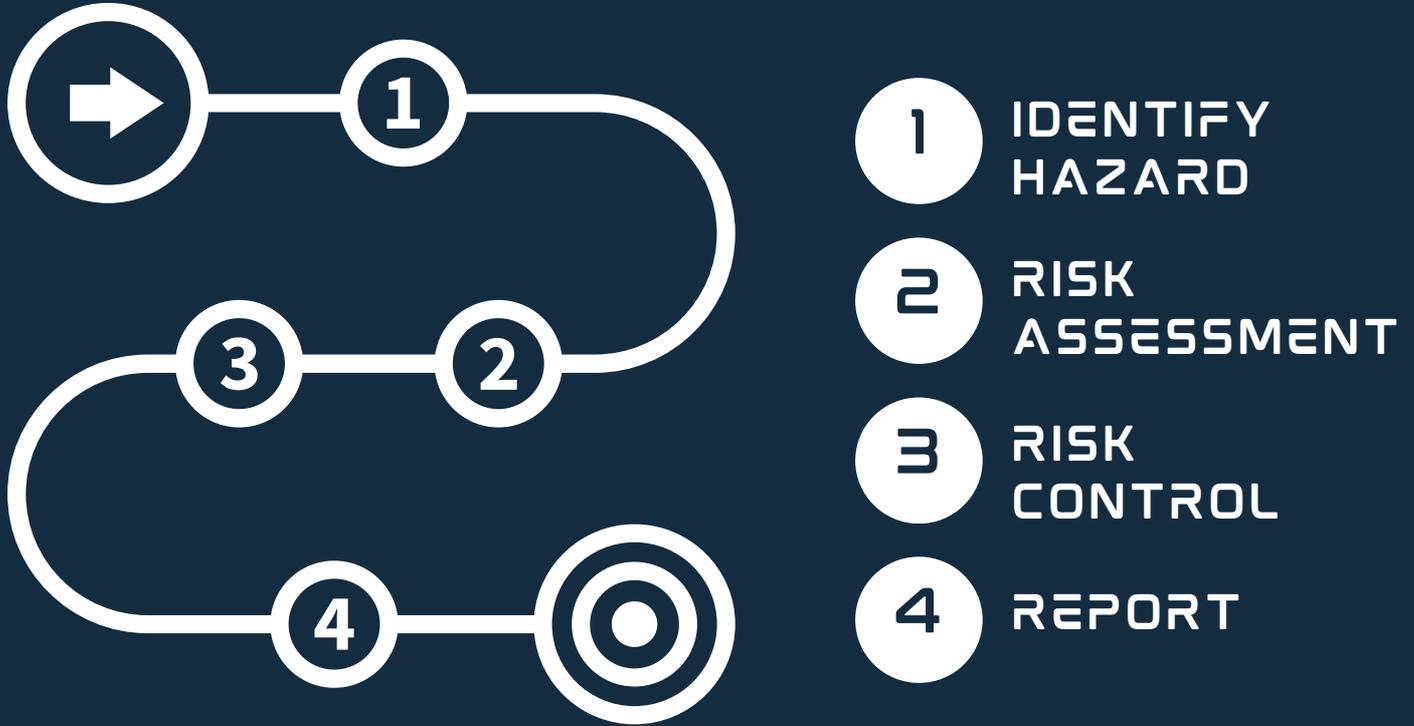
- i) When accident, incident or near miss happen
- ii) When you are uncertain about the effectiveness of the current controls.
- iii) You want to put corrective or preventive measures in place? Yes, before that.....

And also.....



An organization that aims to improve its Occupational Safety and Health (OSH) Management System regularly.

PROCESS OF HIRARC





HAZARD IDENTIFICATION

TA L(PCCW)

TYPES OF HAZARD

The purpose of hazard identification is to highlight the critical operations of tasks tasks posing significant risks to the health and safety of employees as well as highlighting those hazards pertaining to certain equipment due to energy sources, working conditions or activities performed.



“
HEALTH
HAZARD
”

“
SAFETY
HAZARD
”

“
ENVIRONMENTAL
HAZARD
”

HEALTH HAZARD

An occupational health hazard refers to any substance or factor that can cause illness in an individual. This hazard can result in either serious and immediate (acute) effects or lead to long-term (chronic) issues. The impact of such hazards can affect the entire body or specific parts of it.



Health hazards include **chemicals** (such as battery acid and solvents), **biological** hazards (such as bacteria, viruses, dusts and molds), **physical agents** (energy sources strong enough to harm the body, such as electric currents, heat, light, vibration, noise and radiation) and work design (ergonomic) hazards.



PHYSICAL HAZARD

To figure out if something is a physical danger or not, just ask yourself if it could hurt an employee physically. This could include common items in the workplace, like things that may ignite fire or react aggressively to other people in the environment (that's include machine, extreme temperature (hot or cold), vibration, radiation and noise)

BIOLOGICAL HAZARD

Biological hazards, often known as biohazards, are substances with a potential to cause harm to living organisms, most notably humans. Included in this category are bacterium, virus, and toxin (biological source) samples, as well as medical waste.



ERGONOMIC HAZARD

Environment-based threats to musculoskeletal health are known as "ergonomic hazards." Because the injuries brought on by ergonomic hazards—strain on the body—aren't usually visible at first glance, they can be difficult to identify and prevent.

That is include poor posture, awkward repetitive movement or frequent lifting or twisting

CHEMICAL HAZARD

Chemicals are used in many different kinds of processes, from simple chemical reactions to more complicated ones. They can be found in nature, made as a single object or a mixture, or be a by-product of a manufacturing process. It could be a solid, a liquid, or a gas. When these chemicals are used at work, they often give off vapours, fumes, dust, and mists.



Chemicals can be harmful for people's health in many ways, from local effects (like skin irritation or burns from irritant or corrosive substances) to general effects (like cancers and lung diseases caused by work).

SAFETY HAZARD

A safety hazard is any force strong enough to cause injury, or damage to property. An injury caused by a safety hazard is usually obvious. For example, a worker may be badly cut. Safety hazards cause harm when workplace controls are not adequate.



Work at height

Pressure systems or steam

Lifting and other manual handling operation

Vehicles

Slipping/tripping hazards

COMMON SAFETY HAZARD

Moving parts of machinery, tools and equipment

Fire hazards (from flammable materials)

ENVIRONMENTAL HAZARD

An environmental hazard is a release to the environment that may cause harm or deleterious effects. An environmental release may not be obvious. Environmental hazards cause harm when controls and work procedures are not followed.



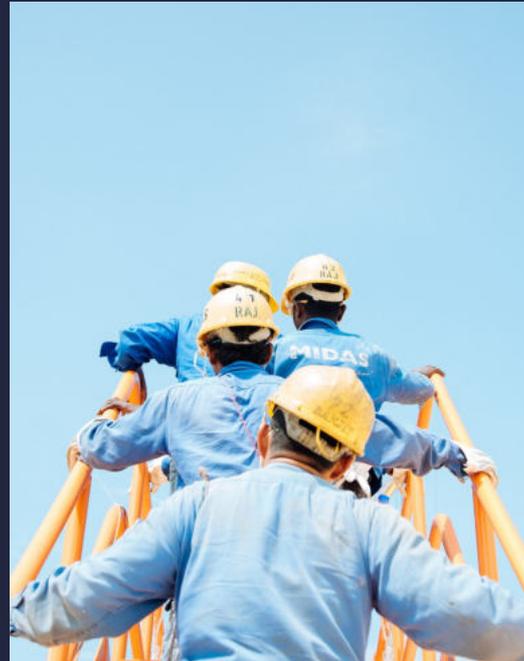
Environmental pollution can result from various sources, including industrial emissions, vehicle exhaust, chemical spills, and improper waste disposal. Pollutants can contaminate air, water, and soil, adversely affecting both human health and wildlife. Exposure to toxic chemicals or hazardous materials can have severe health effects on humans and wildlife, leading to illnesses and long-term health issues.

Technique to identify hazard

Work Place inspections

Job Hazard Analysis

Preliminary investigation



Potential Accident Factors

Failure Analysis

Accident and incident investigations

Inspection
General Condition
Evidence of Deterioration:
Evidence of Leaks:
Evidence of Pest Infestation:

EXERCISE:

FIND THE
HAZARDS



How many hazards can you find?

1 Rubbish on ground

2 Unsecured chemicals

4 Water on floor (slips/trips)

6 Person walking in front of forklift

8 Forklift stacked too high and driver can't see

7 Pallets blocking fire exit

5 Stacked material unevenly

3 Machine guarding lifted

How many hazards can you find?

5 Fall from heights

6 Quad bike no helmet or roll over protection

9 Smoking while filling the truck

4 Farmer standing on unstable platform

2 Unguarded auger

1 Chemical storage

3 Over-crowded sheep pen

11 Trying to mount a horse using fence

8 Farmer lifting hay bale

7 Kids playing near water

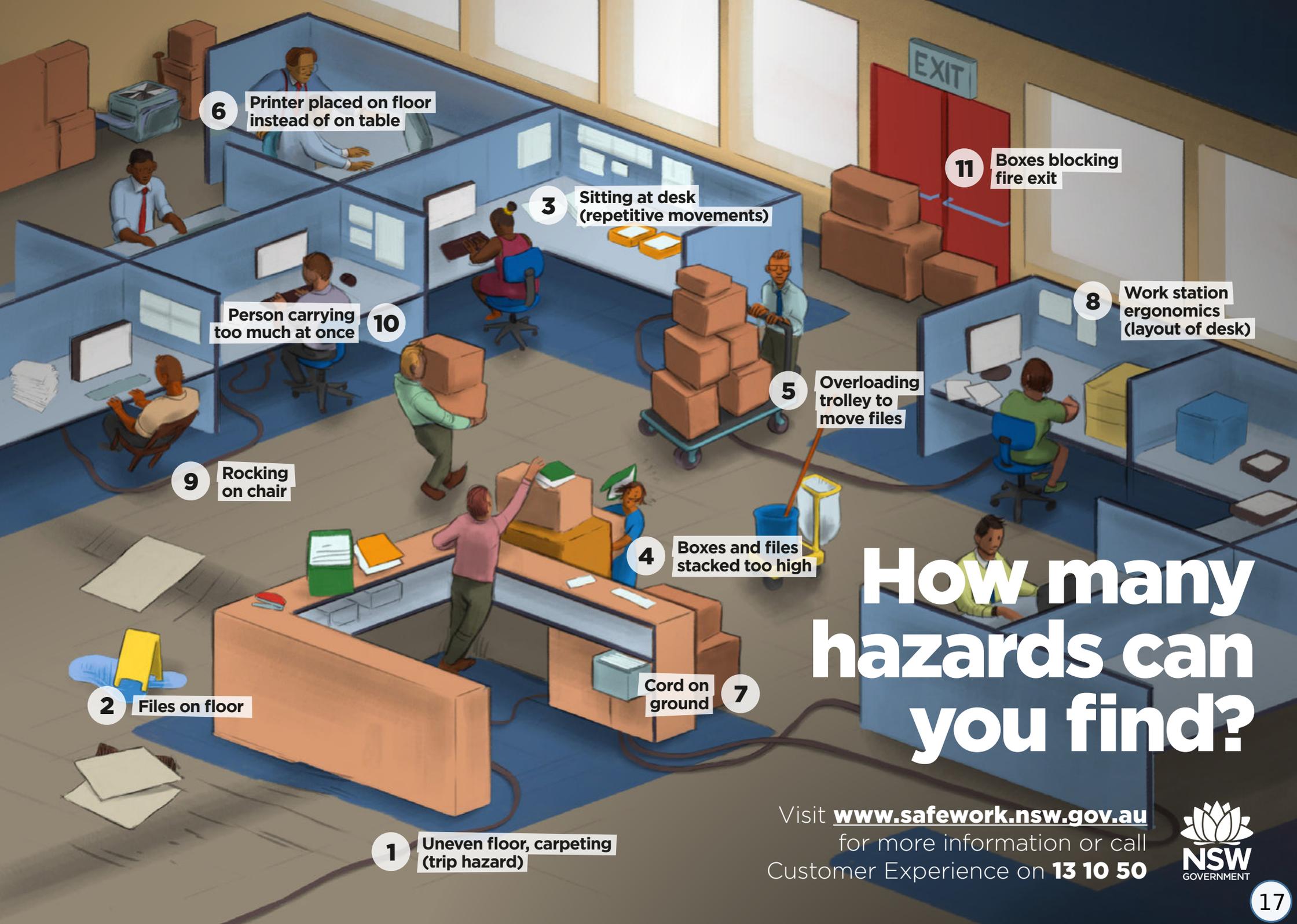
10 Cutting tree down unsafely



Visit www.safework.nsw.gov.au
for more information or call
Customer Experience on **13 10 50**

How many hazards can you find?





6 Printer placed on floor instead of on table

3 Sitting at desk (repetitive movements)

11 Boxes blocking fire exit

8 Work station ergonomics (layout of desk)

10 Person carrying too much at once

5 Overloading trolley to move files

9 Rocking on chair

4 Boxes and files stacked too high

How many hazards can you find?

2 Files on floor

7 Cord on ground

1 Uneven floor, carpeting (trip hazard)

Visit www.safework.nsw.gov.au for more information or call Customer Experience on 13 10 50



How many hazards can you find?



Visit www.safework.nsw.gov.au
for more information or call
Customer Experience on **13 10 50**

How many hazards can you find?



Working on a mezzanine floor with no fall protection **5**

Unsecured gas cylinders **6**

1 Reversing truck while person is standing behind

3 Person walking with mobile phone in front of truck

2 Forklift stacked too high and driver can't see

Loading dangerous chemicals without PPE **4**

Visit www.safework.nsw.gov.au
for more information or call
Customer Experience on **13 10 50**





RISK ASSESSMENT

Now that you already know how to identify hazard, now lets see what the level of the risk!

LET'S DO IT!



UNDERSTANDING YOUR RISK LEVEL

Risk is the determination of likelihood and severity of the credible accident/event sequences in order to determine magnitude and to priorities identified hazards. It can be done by qualitative, quantitative or semi quantitative method.



WHAT KIND OF ANALYSIS YOU GONNA USE?

In a qualitative study, words are used to describe how bad things could get and how likely it is that they will.

The goal of semi-quantitative analysis is not to suggest realistic values for risk, as is sought by quantitative analysis, but rather to generate a more comprehensive ranking scale than is typically obtained in qualitative research.

Quantitative analysis uses numbers to measure both how bad something is and how likely it is to happen. These numbers come from different places, like past accidents and scientific study.



ANALYZE AND ESTIMATE RISK

Risk can be calculated using the following formula

$$L \times S = \text{RISK}$$

L = LIKELIHOOD

S = SEVERITY

HOW DO WE ASSESS THE RISK?

	SEVERITY			
LIKELIHOOD	1	2	3	4
4	4	8	12	16
3	3	6	9	12
2	2	4	6	8
1	1	2	3	4

SEVERITY

RATING	DETAILS
4	Fatalities / irrecoverable property damage and productivity
3	Non-fatal injury / Permanent disabilities
2	Temporary disabling / first aid type injury that being refer to clinic or hospital
1	Minor abrasion, bruises, cut, first aid type injury

LIKELIHOOD

RATING	DETAILS
4	Common or frequent occurrence (most likely result of the hazard)
3	Has a good chance of occurring and is not usual / within 3 months
2	Might occur sometimes in future / within 3 years
1	Has not been known to occur after many years / more than 3 years

"HOW BAD IS IT?" - SEVERITY

Severity are based upon an increasing level of severity to an individual's health, the environment, or to property

"HOW MANY TIMES HAS THIS EVENT HAPPENED IN THE PAST?"

LIKELIHOOD

This value is based on the likelihood of an event occurring. Assessing likelihood is based worker experience, analysis or measurement

STEP 1

Find the severity column that best describes the outcome of risk



STEP 2

Then follow the likelihood row to find the description that best suits the likelihood that the severity will occur

STEP 3

The risk level is given in the box where the row and column meet.



SO WHAT'S YOUR RISK LEVEL?

RISK	DESCRIPTION	ACTION
9 - 16	HIGH	<ol style="list-style-type: none">1. Require IMMEDIATE action to control the hazard as detailed in the hierarchy control.2. Action taken must be documented in the risk assessment form (include date of completion).3. Require to determine OSH risk and opportunities.
4 - 8	MEDIUM	<ol style="list-style-type: none">1. Require planned approach to control the hazard and applies temporary measure if required.2. Action taken must be documented in the risk assessment form (include date of completion).3. Determination of OSH risk and opportunities are not compulsory but encouraged.
1 - 3	LOW	<ol style="list-style-type: none">1. Risk identified as LOW may be considered as acceptable and future reduction may not be necessary. However, if the risk can be resolved quickly and efficiently, control measure should be implemented and recorded.2. Determination of OSH risk and opportunities are not compulsory but encouraged.

RISK MATRIX TABLE

A risk matrix table is a simple and visual tool used to assess and categorize risks based on their likelihood and severity. It helps individuals or organizations prioritize and manage risks effectively. The risk matrix table typically consists of a grid with different levels of likelihood and severity, and each combination represents a specific level of risk.



RISK CONTROL

What is RISK CONTROL?

01

RISK CONTROL



DEFINITION

CONTROL means discard or turning off a danger in a way that makes it safe for workers who have to go into an area or work on equipment as part of their job.

SOURCE OF HAZARD

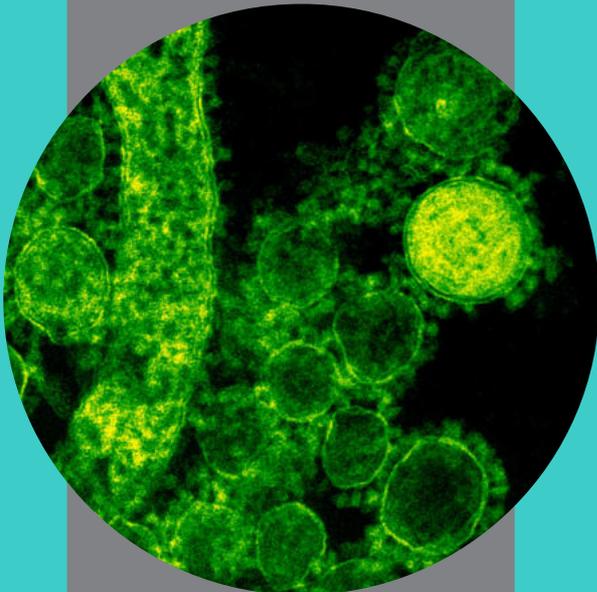


HAZARD should be avoided where it originates. The effective control is when we apply the "engineering controls" at its sources. If this does not work, hazards can frequently be controlled along the worker's path, between the source and the worker.



METHOD

The principle of control could be used to figure out how to control the risk and danger. It could be as simple as getting rid of the sources, changing the elements or substances, making physical changes to the tools or workplace, or changing the way work is done. The least effective way is to wear personal protective equipment (PPE).



Three steps in determining RISK CONTROL



SELECTING OF SUITABLE RISK CONTROL

02

EVALUATE and select short and long term controls.



Noise Hazard is identified

IMPLEMENTING short term measures to protect worker until permanent control can put in place.

Require workers to use **Hearing Protection.**



IMPLEMENTING long term controls when reasonably practicable.



Require **removing or isolating the noise source.**

03 HIERARCHY OF CONTROL

**What is
HIERARCHY OF
CONTROLS?**



To create a plan for improving health and safety at work, eliminating of dangers, and reducing or controlling health and safety risks at work.

A technique to determine and rank safety measures that protect workers from risks.



Elimination, substitution, engineering controls, administrative controls, and personal protective equipment are listed from most successful to least effective.



03 HIERARCHY OF CONTROL

Why it is important, what does it mean ?



REMOVE the source of the danger completely

Elimination 1

2 Substitution

REPLACE the hazardous work practice or machine with an alternative



PHYSICAL CHANGES redesign machine by adding safeguards or barrier

Engineering Controls 3

4 Administrative Controls

Developed other work practices to protect workers from danger.
Example:
Install proper signage, job rotation



PROTECT the worker with Personal Protective Equipment. Provide gloves, earplugs, goggles

PPE 5



ELIMINATION

**What is ELIMINATION
of hazards ?**

» **The best way to protect workers could mean to get rid of a dangerous job, tool, method, machine, or substance.**

When the risk is too high or a safer choice is available, this precautionary measure should be used.



» For example, washing your equipment using water and soap instead of using strong chemical based cleaner.

**BEST WAY TO
AVOID A
HAZARD**



SUBSTITUTION

What is an example of SUBSTITUTION CONTROL?

➤ **SUBSTITUTION** controls comprise replacing the hazard with something less hazardous.

It should REDUCE THE RISK when using the alternative replacement.



➤ Substitution controls can involve using items or materials that contain less of the harmful ingredient.

A toxic chemical, for example, can be replaced with a less dangerous one



AN EFFECTIVE CONTROL, MUST NOT PRODUCE ANOTHER HAZARDS





ENGINEERING CONTROL

What is the best example of the ENGINEER CONTROL?

First, it was control by design and not rely on people. It is mostly physical items in nature. >>

>> Examples: Barriers, fixed guards, ventilation systems, control room.

Engineering control can also refer to any sensing system or upgrade elements that reduce heavy loads or convert manual handling into an automatic system. >>

MULTIPLE CONTROLS CAN BE USED TOGETHER WITH ENGINEERING CONTROLS





ADMINISTRATIVE CONTROLS

What is ADMINISTRATIVE CONTROLS ?

➤ **Administrative controls are adjustments to how work is done that restrict how long, how often, and how severely people are exposed to hazardous substances or situations.**

➤ Administrative controls include standard safety measures may have to be followed by workers. Monitoring and training that been taught to workers on how to do their jobs safely at the start, continuous training given, work processes that have been reviewed and revised on a regular basis with personnel are the example of administrative control.

➤ Furthermore from that, the administration control approach includes the distribution of safety infographics, awareness program and the implementation of safety signage.





PERSONAL PROTECTIVE CONTROL (PPE)

Why is PPE an equipment?

» **“PPE” is equipment worn to minimize exposure to a variety of hazards.**

Clothing or tools that employees wear to protect themselves from harmful materials. »

» To keep the person safe, it must always be worn in the correct way.

Personal protective equipment can include things like gloves, safety glasses, shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests, and full body suits. »

**THE LAST LINE
OF DEFENCE**





EXERCISE QUESTION



1
How do you determine the severity of incident?



2
How do you keep risks from happening at work?

3
List 3 examples of each Hierarchy Control method.

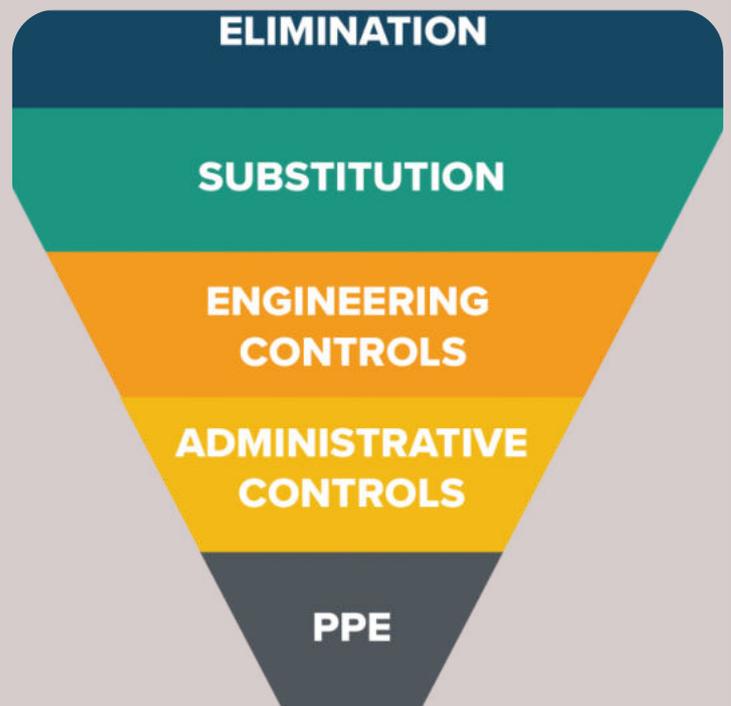


4
What are the engineering control can be done at manufacturing area?



5
List 5 Personal Protective Equipment that can be used at construction site.

6
When do you need the hierarchy of Risk Control ?



DISCUSSION QUESTION



As a newly appointed Safety and Health officer in a factory, you have seen that many strong chemicals are used in a manufacturing process. Discuss the steps to ensure the exposure limit level to workers are minimize.



Explain the purpose of implementing HIRARCC at a workplace. What can HIRARC achieve compared to a non-HIRARC workplace?

During a safety inspection, you found a large number of complaints concerning workers injuries, specifically to fingers due to a new process involving staplers during packaging. As a consultant, conduct a Job Hazard Analysis for this complaint.



4
What action should be taken if you involved in an accident at the workplace?



One workers accidently injured her finger during drilling process. Discuss what are preventive measures should be taken to avoid the incident from happening again.

6
Discuss what action should be taken in case of chemical spillage incident at your workplace.



REFERENCES

Department of Occupational Safety and Health (DOSH) (2008). *Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC)*. JKKP.

Mohd Khairul Domadi, Koo Kean Eng (2020). *Occupational Safety and Health (2nd edn.)*. Oxford Fajar Sdn. Bhd.

Khor Seow Loon, Mohd Sallehuddin Bin Yazid dan Salina Binti Sumali (2014). *Occupational Safety & Health, DUW1012 - Politeknik Malaysia*. Ministry of Education, Jabatan Kejuruteraan Mekanikal.

Chemical hazards | IOSH. (n.d.). IOSH. <https://iosh.com/health-and-safety-professionals/improve-your-knowledge/occupational-health-toolkit/chemical-hazards/>

Editorial Foreword. (2016b). In Elsevier eBooks (pp. xix–xxii). <https://doi.org/10.1016/b978-0-12-394847-2.06001-0>

Edmonds, J. F. (2016). Review of common human vulnerabilities and contributions to past accidents. In Elsevier eBooks (pp. 25–38). <https://doi.org/10.1016/b978-0-12-803806-2.00003-0>

Undang-Undang, L. P. (2019). Occupational Safety and Health Act 1994 (ACT 514), Regulations & Orders: (As at 15TH April 2019).

Malaysia, & Bhd, M. S. (1993). *Factories and Machinery Act, 1967: Factories and Machinery Regulations: All Amendments Up to May, 1993: Act 139*.

Workplace Hazards Series: Physical Hazards. (2023). SafetyLine Lone Worker | Leaders in Work Alone Safety Monitoring. <https://safetylineloneworker.com/blog/workplace-hazards-physical-hazards>

REFERENCES

Biological hazards | IOSH. (n.d.). IOSH. <https://iosh.com/health-and-safety-professionals/improve-your-knowledge/occupational-health-toolkit/biological-hazards/>

For interactive diagram:

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