Hazard Identification Risk Assessment (HIRA)

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QCTO: Occupational Health, Safety Quality Practitioner Qualification – NQF Level 5

ISO NET (Pty) Ltd

Learner Guide

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GLOSSARY

Hazard Identification

Definitions

Hazard: Anything (e.g. condition, situation, practice, behaviour) that has the potential to cause harm, including injury, disease, death, environmental, property and equipment damage. A hazard can be a thing or a situation.

Hazard Identification: This is the process of examining each work area and work task for the purpose of identifying all the hazards which are "inherent in the job". Work areas include but are not limited to machine workshops, laboratories, office areas, agricultural and horticultural environments, stores and transport, maintenance and grounds, reprographics, and lecture theatres and teaching spaces. Tasks can include (but may not be limited to) using screen based equipment, audio and visual equipment, industrial equipment, hazardous substances and/or teaching/dealing with people, driving a vehicle, dealing with emergency situations, construction. This process is about finding what could cause harm in work task or area.

Risk: The likelihood, or possibility, that harm (injury, illness, death, damage etc) may occur from exposure to a hazard.

Risk Assessment: Is defined as the process of assessing the risks associated with each of the hazards identified so the nature of the risk can be understood. This includes the nature of the harm that may result from the hazard, the severity of that harm and the likelihood of this occurring.

Risk Control: Taking actions to eliminate health and safety risks so far as is reasonably practicable. Where risks cannot be eliminated, then implementation of control measures is required, to minimise risks so far as is reasonably practicable. A hierarchy of controls has been developed and is described below to assist in selection of the most appropriate risk control measure/s.

Monitoring and Review: This involves ongoing monitoring of the hazards identified, risks assessed and risk control processes and reviewing them to make sure they are working effectively.

What is a hazard

There are many definitions for hazard but the most common definition when talking about workplace health and safety is "A hazard is any source of potential damage, harm or adverse health effects on something or someone."

The CSA Z1002 Standard "Occupational health and safety - Hazard identification and elimination and risk assessment and control" uses the following terms:

- Harm – physical injury or damage to health.
- Hazard – a potential source of harm to a worker.

Basically, a hazard is the potential for harm or an adverse effect (for example, to people as health effects, to organizations as property or equipment losses, or to the environment).

Please see the OSH Answers on Hazard and Risk for more information.

What is hazard identification?

Hazard identification is part of the process used to evaluate if any particular situation, item, thing, etc. may have the potential to cause harm. The term often used to describe the full process is risk assessment:

- Identify hazards and risk factors that have the potential to cause harm (hazard identification).
- Analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation).
- Determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control).

Overall, the goal of hazard identification is to find and record possible hazards that may be present in your workplace. It may help to work as a team and include both people familiar with the work area, as well as people who are not – this way you have both the experienced and fresh eye to conduct the inspection.

When should hazard identification be done

Hazard identification can be done:

- During design and implementation
  - Designing a new process or procedure
  - Purchasing and installing new machinery
- Before tasks are done
  - Checking equipment or following processes
  - Reviewing surroundings before each shift
- While tasks are being done
  - Be aware of changes, abnormal conditions, or sudden emissions
- During inspections
  - Formal, informal, supervisor, health and safety committee
- After incidents
  - Near misses or minor events
  - Injuries

To be sure that all hazards are found:

- Look at all aspects of the work and include non-routine activities such as maintenance, repair, or cleaning.
- Look at the physical work environment, equipment, materials, products, etc. that are used.
- Include how the tasks are done.
- Look at injury and incident records.
- Talk to the workers: they know their job and its hazards best.
- Include all shifts, and people who work off site either at home, on other job sites, drivers, teleworkers, with clients, etc.

- Look at the way the work is organized or done (include experience of people doing the work, systems being used, etc).
- Look at foreseeable unusual conditions (for example: possible impact on hazard control procedures that may be unavailable in an emergency situation, power outage, etc.).
- Determine whether a product, machine or equipment can be intentionally or unintentionally changed (e.g., a safety guard that could be removed).
- Review all of the phases of the lifecycle.
- Examine risks to visitors or the public.
- Consider the groups of people that may have a different level of risk such as young or inexperienced workers, persons with disabilities, or new or expectant mothers.

What types of hazards are there

A common way to classify hazards is by category:

- biological – bacteria, viruses, insects, plants, birds, animals, and humans, etc.,
- chemical – depends on the physical, chemical and toxic properties of the chemical,
- ergonomic – repetitive movements, improper set up of workstation, etc.,
- physical – radiation, magnetic fields, temperature extremes, pressure extremes (high pressure or vacuum), noise, etc.,
- psychosocial – stress, violence, etc.,
- safety – slipping/tripping hazards, inappropriate machine guarding, equipment malfunctions or breakdowns.

How do I know what is a hazard

Another way to look at health and safety in your workplace is to ask yourself the following questions. These are examples only. You may find other items or situations that can be a hazard. List any item that should be examined. During the risk assessment process, the level of harm will be assessed.

What materials or situations do I come into contact with

Possibilities could include:

- electricity
- chemicals (liquids, gases, solids, mists, vapours, etc.)
- temperature extremes of heat or cold (e.g., bakeries, foundries, meat processing)
- ionizing/non-ionizing radiation (e.g., x-rays, ultraviolet (sun) rays)
- oxygen deficiency
- water

What materials or equipment could I be struck by

- moving objects (e.g., forklifts, overhead cranes, vehicles)
- flying objects (e.g., sparks or shards from grinding)
- falling material (e.g., equipment from above)

What objects or equipment could I strike or hit my body upon, or that part of my body might be caught in, on, or between

- stationary or moving objects
- protruding objects
- sharp or jagged edges
- pinch points on machines (places where parts are very close together)
- objects that stick out (protrude)
- moving objects (conveyors, chains, belts, ropes, etc.)

What could I fall from (e.g., falls to lower levels)

- objects, structures, tanks, silos, lofts
- ladders, overhead walkways
- roofs
- trees, cliffs

What could I slip or trip on (e.g., falls on same level)

- obstructions on floor, stairs
- surface issues (wet, oily, icy)
- footwear that is in poor condition

How could I overexert myself

- lifting
- pulling
- pushing
- carrying
- repetitive motions

What other situations could I come across

- unknown/unauthorized people in area
- a potentially violent situation
- working alone
- confined space
- missing/damaged materials
- new equipment/procedure at work site
- fire/explosion
- chemical spill or release

Where can I find more information about hazards

It may be necessary to research about what might be a hazard as well as how much harm that hazard might cause. Sources of information include:

- Safety Data Sheets (SDSs).
- Manufacturer's operating instructions, manuals, etc.
- Test or monitor for exposure (occupational hygiene testing such as chemical or noise exposure).
- Results of any job safety analysis.
- Experiences of other organizations similar to yours.
- Trade or safety associations.
- Information, publications, alerts, etc. as published by reputable organizations, labour unions, or government agencies.

What if I am new to the workplace

If you are new to your workplace, to learn about the hazards of your job, you can:

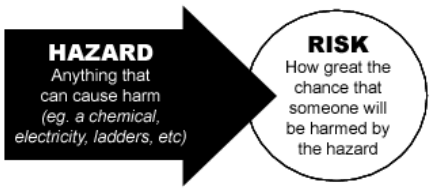
- ask your supervisor
- ask a member of the health and safety committee or your health and safety representative
- ask about standard operating procedures and precautions for your job
- check product labels and safety data sheets
- pay attention to signs and other warnings in your work
- watch for posters or instructions at the entrance of a chemical storage room to warn of hazardous products
- ask about operating instructions, safe work procedures, processes, etc.

What is the difference between a 'hazard' and a 'risk'

A **hazard** is something that can cause harm, e.g. electricity, chemicals, working up a ladder, noise, a keyboard, a bully at work, stress, etc.

A **risk** is the chance, high or low, that any hazard will actually cause somebody harm.

For example, working alone away from your office can be a hazard. The risk of personal danger may be high. Electric cabling is a hazard. If it has snagged on a sharp object, the exposed wiring places it in a 'high-risk' category.



What is a Hazard

When we refer to hazards in relation to occupational safety and health the most commonly used definition is '*A Hazard is a potential source of harm or adverse health effect on a person or persons'*.

The terms Hazard and Risk are often used interchangeably but this simple example explains the difference between the two.

If there was a spill of water in a room then that water would present a slipping hazard to persons passing through it. If access to that area was prevented by a physical barrier then the hazard would remain though the risk would be minimised.

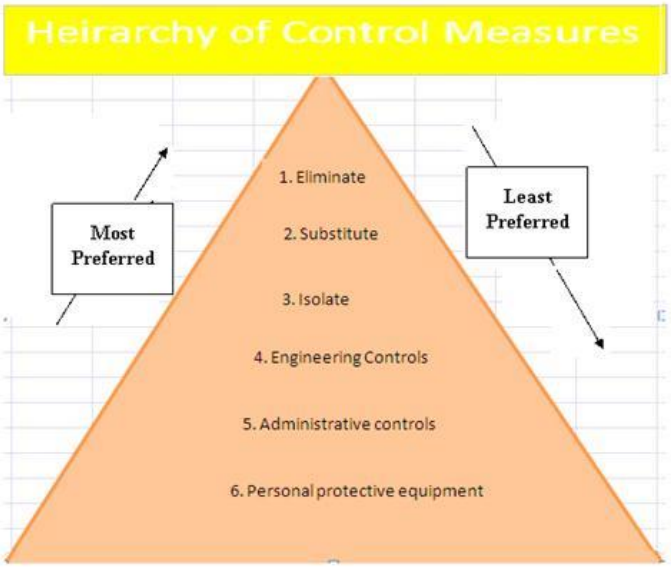
What is Risk

When we refer to risk in relation to occupational safety and health the most commonly used definition is '*risk is the likelihood that a person may be harmed or suffers adverse health effects if exposed to a hazard.'*

Categorising Risk

The level of risk is often categorised upon the potential harm or adverse health effect that the hazard may cause, the number of times persons are exposed and the number of persons exposed. For example exposure to airborne asbestos fibres will always be classified as high because a single exposure may cause potentially fatal lung disease, whereas the risk associated with using a display screen for a short period could be considered to be very low as the potential harm or adverse health effects are minimal.

What are Control Measures?



Control measures include actions that can be taken to reduce the potential of exposure to the hazard, or the control measure could be to remove the hazard or to reduce the likelihood of the risk of the exposure to that hazard being realised. A simple control measure would be the secure guarding of moving parts of machinery eliminating the potential for contact. When we look at control measures we often refer to the hierarchy of control measures.

1. Eliminate the hazard	Elimination of the hazard is not always achievable though it does totally remove the hazard and thereby eliminates the risk of exposure. An example of this would be that petrol station attendants in Ireland are no longer exposed to the risk of chronic lead poisoning following the removal of lead from petrol products sold at forecourts.
2. Substitute the hazard with a lesser risk	Substituting the hazard may not remove all of the hazards associated with the process or activity and may introduce different hazards but the overall harm or health effects will be lessened. In laboratory research, toluene is now often used as a substitute for benzene. The solvent-properties of the two are similar but toluene is less toxic and is not categorised as a carcinogen although toluene can cause severe neurological harm.
3. Isolate the hazard	Isolating the hazard is achieved by restricting access to plant and equipment or in the case of substances locking them away under strict controls. When using certain chemicals then a fume cupboard can isolate the hazard from the person, similarly placing noisy equipment in a non-accessible enclosure or room isolates the hazard from the person(s).
4. Use engineering controls	Engineering Controls involve redesigning a process to place a barrier between the person and the hazard or remove the hazard from the person, such as machinery guarding, proximity guarding, extraction systems or removing the operator to a remote location away from the hazard.
5. Use administrative controls	Administrative controls include adopting standard operating procedures or safe work practices or providing appropriate training, instruction or information to reduce the potential for harm and/or adverse health effects to person(s). Isolation and permit to work procedures are examples of administrative controls.
6. Use personal protective equipment	Personal protective equipment (PPE) include gloves, glasses, earmuffs, aprons, safety footwear, dust masks which are designed to reduce exposure to the hazard. PPE is usually seen as the last line of defence and is usually used in conjunction with one or more of the other control measures. An example of the weakness of this control measure is that it is widely recognised that single-use dust masks cannot consistently achieve and

	maintain an effective facepiece-to-face seal, and cannot be adequately fit-tested and do not offer much, if any real protection against small particulates and may lead to a false sense of security and increase risk. In such instances an extraction system with fitted respirators may be preferable where the hazard may have significant health effects from low levels of exposure such as using isocyante containing chemicals.

The risk assessment process

Risk assessment is a normal everyday activity – people often perform risk assessments without being aware of doing this, e.g. preparing to overtake a slower moving car, while driving.

Many industries have tended to develop complex risk assessment programmes, with sophisticated software and materials. This has inadvertently led to risk assessment being portrayed as a complicated science, when it ostensibly remains a common sense process.

An assessment of hazards and risks is ultimately nothing more than careful examination of activities undertaken, in order to determine what could result in harm or loss, followed by careful evaluation of whether enough precautions have been taken, or whether more can be done, to prevent the identified situation of harm or loss.

External forces motivating risk assessment

Various factors typically pressurise a company to develop a risk management system. In turn, an effective risk management system is dependent upon a risk assessment programme, which identifies what needs to be managed. These include:

- Societal demands, or consumerism, have motivated companies to implement safe systems of work. A prime example is the current pressure on the mining industry to ensure minerals are gotten without blood. To counter this, a company must demonstrate a programme of systematic identification of hazards.

- Trade competition forces companies to reduce profit margins, to remain competitive. Companies therefore must look to minimization of loss, to sustain income. In this regard, companies must evaluate potential loss situations, with consideration given to cost of risk control.

Risk assessment and risk management

Risk management is a process by which a company or person attempts to minimise risks faced, when attempting a task, project, or simply managing the business.

Risk assessment is the starting point, and foundation of a risk management programme.

It identifies what needs to be managed. Risk management could be regarded as comprising two components, namely **assessment of risk**, and **control of risk.**

If the assessment is inaccurate, the consequent identification of controls will be inaccurate, and the effective management of risk will be compromised.

Criteria for effective risk assessment

The following criteria are necessary for organisations to carry out effective risk assessment:

- Classify work activities: prepare a list of work activities covering premises, plant, people and procedures, and gather information about them.
- Identify hazards: identify all significant hazards relating to each work activity. Consider who might be harmed and how.
- Determine risk: make a subjective estimate of risk associated with each hazard assuming that planned or existing controls are in place. Assessors should also consider the effectiveness of the controls and the consequences of their failure.
- Decide if risk is tolerable: judge whether planned or existing H&S precautions (if any) are sufficient to keep the hazard under control and meet legal requirements.
- Prepare risk control action plan (if necessary): prepare a plan to deal with any issues found by the assessment to require attention. Organisations should ensure that new and existing controls remain in place and are effective.
- Review adequacy of action plan: re-assess risks on the basis of the revised controls and check that risks will be tolerable.

Stages of the risk assessment process

The risk assessment process consists of various distinct stages, namely:

- Scoping.
- Team / facilitator selection.
- Administration / preparation.
- Hazard identification.
- Risk evaluation.
- Determining acceptable risk.

- Assessment / determination of risk controls.
- Implementation of recommendations.
- Review / update of risk assessment.

Scoping

There are various factors that an organisation should consider when planning for risk assessment. This includes the need to refer to relevant regulations and guidance to ensure that specific legal requirements are met.

Scope of the separate risk assessment exercises

The first task, when establishing a risk assessment process, will be to define the **scope of the separate risk assessment exercises**. The intention should be that, through the risk assessment process, the organisation and all its activities are comprehensively reviewed and assessed.

Some care is therefore needed, in laying down the scope of the separate risk assessment exercises, to ensure that no areas or activities are missed. In general, risk assessments are scoped in three different ways:

1. **Geographically** based.
2. **Functionally** based.
3. **Hardware or equipment** based.

Some care should be taken if the approach to risk assessment is a mixture of the above three. Also, considerable care is needed when approaching the risk assessments from a "hazard" point of view because of the danger that a particular hazard will fail to be identified because the approach is based on a preconception of the areas of greatest risks.

It is normally found that the first two of the above bases are most effective in ensuring a comprehensive and complete risk assessment of an operation or activity.

The following aspects of risk assessment need to be considered carefully at the outset:

- Design of a simple risk assessment pro-forma.
- Criteria for classifying work activities and information needed about each work activity.
- Methods to identify and categorise hazards.
- Procedures for making an informed determination of risk.
- Words to describe estimated risk levels.

- Criteria for deciding whether risks are tolerable: whether planned or existing control measures are adequate.
- Time scales for implementing remedial action (where necessary).
- Preferred methods for risk control.
- Criteria for reviewing adequacy of action plan.
- The risk assessment must be scoped.

A necessary preliminary to risk assessment is to prepare a list of work activities, to group them in a rational and manageable way, and to gather necessary information about them.

It is vital to include, for example, infrequent maintenance tasks, as well as day-to-day production work. Possible ways of classifying work activities include:

- Geographical areas within/outside the organisation's premises.
- Stages in the production process, or in the provision of a service.
- Planned and reactive work.
- Defined tasks (e.g. driving).

Thereafter, a defined hazard identification method must be selected. Assessment methods generally fall into 2 categories:

- Top down method (i.e. assessing backwards from a top/final event).
- Bottom up method (i.e. breakdown of system components, and determining possible consequences of their failure).

It is better to integrate assessments for all hazards, and not carry out separate assessments. If assessments are carried out separately, using different methods, ranking risk control priorities is more difficult. Separate assessments may also lead to needless duplication.

Team / facilitator selection

Organisations should consult with everyone concerned, discuss what is planned to be done and obtain their comments and commitment. The team should be assessed on ability to conduct risk assessments, as well as on trade qualifications or experience in the activity, to be assessed.

The team should have a “vertical slice”, including:

- Employees involved in the activity.
- Front line supervisors.

- Maintenance / engineering personnel.
- Management.

Organisations should also determine risk assessment training needs for assessment personnel/teams and implement a suitable training programme. The team should be coached on the scope / method of the assessment, and information pertaining to the subject matter.

Administration / preparation

Information on the assessment subject must be gathered and analysed (the information can serve as a short cut to pinpointing hazards).
The Information might include the following:

- Tasks being carried out: their duration and frequency.
- Location where the work is carried out.
- Who normally/occasionally carries out the tasks?
- Others who may be affected by the work (e.g. visitors, contractors, the public).
- Training that personnel have received about the tasks.
- Written systems of work and/or permit-to-work procedures prepared for the tasks.
- Plant and machinery that may be used.
- Tools that may be used.
- Manufacturers' or suppliers' instructions for operation and maintenance of plant, machinery and powered hand tools.
- Size, shape, surface character and weight of materials that might be handled.
- Distances and heights that materials have to be moved by hand.
- Services used (e.g. compressed air).
- Substances used or encountered during the work.
- Physical form of substances used or encountered (fumes, gas, vapour, liquid, dust/powder, solid).

- Content and recommendations of hazard data sheets relating to substances used or encountered.

- Requirement of relevant acts, regulations and standards relevant tot he work being done, the plant and machinery used, and the substances used or encountered.

- Control measures believed to be in place.

- Reactive monitoring data: incident, accident and ill-health experience associated with the work being done, equipment and substances used gained as a result of information from within and outside the organisation.

- Findings of any existing assessments relating to the work activity.

Risk assessment pro-forma

Organisations should prepare a simple pro-forma that can be used to record the findings of an assessment, typically covering:

- work activity;

- hazard(s);

- controls in place;

- personnel at risk;

- likelihood of harm;

- severity of harm;

- risk levels;

- actions to be taken following the assessment;

- Administrative details, e.g. name of assessor, date, etc.

- Organisations should develop their overall risk assessment procedure and may need to carry out trails and continually review the system

Hazard identification

In order to conduct effective hazard identification, it is essential that the definition of "hazard" is understood, namely:

Definition:

A practice and condition with potential for harm or loss

Hazard Identification questions

- What can go wrong?
- What can cause it to go wrong?
- What controls are in place?

Hazard categories

To help with the process of identifying hazards it is useful to categorise hazards in different ways, for example by topic, e.g.:

- mechanical;
- electrical;
- radiation; and
- substances.

Hazards prompt-list

For hazard identification purposes, one could develop a prompt-list of questions such as:

During work activities could the following hazards exist?

- Slips/falls on the level.
- Falls of persons form heights.
- Falls of tools, materials, etc., from heights.
- Inadequate headroom.
- Hazards associated with manual lifting/handling of tools, materials, etc.
- Hazards from plant and machinery associated with assembly, commissioning, operation, maintenance, modification, repair and dismantling.
- Vehicle hazards, covering both site transport, and travel by road.
- Violence to staff.
- Substances that may be inhaled.
- Substances or agents that may damage the eye.

- Substances that may cause harm by coming into contact with, or being absorbed through, the skin.
- Substances that may cause harm by being ingested (i.e., entering the body via the mouth).
- Harmful energies (e.g., electricity, radiation, noise, vibration).
- Work-related upper limb disorders resulting from frequently repeated tasks (ergonomics).
- Inadequate thermal environment, e.g. too hot.
- Lighting levels.
- Slippery, uneven ground/surfaces.
- Inadequate guard rails or hand rails on stairs.
- Contractors' activities.

The above list is not exhaustive. Organisations should develop their own hazard 'prompt-list' taking into account the character of their work activities and locations where work is carried out.

Hazard Identification consideration

The hazard identification process must consider the following:

- All aspects of the work/machinery etc. under normal circumstances.
- Possible non-routine operation/work situations, or
- Effect of interruptions / changes to the work/operation.
- All persons who may be affected by the activities (highlighting persons who are particularly affected).
- Existing control measures.

Hazards that clearly possess negligible potential for harm should not be documented or given further consideration.

Risk evaluation

As with understanding “hazard”, it is essential that the definition of “risk” is understood, namely,

The chance of harm or loss (i.e. the hazard) occurring.

The risk from the hazard should be determined by estimating the potential severity of harm and the likelihood that harm will occur.

Determining severity of harm

Information obtained about work activities is a vital input to risk assessment. When seeking to establish potential severity of harm, the following should also be considered:

- Part(s) of the body likely to be affected.
- Nature of the harm, ranging from Insignificant to Catastrophic harmful:

1) Insignificant, e.g.:

   - Not likely to cause injury – Safety
   - Minor localised Spills - Environmental

2) Minor, e.g.:

   - First Aid Cases – Safety;
   - On-site release immediately contained – Environmental

3) Moderate, e.g:

   - Medical treatment or restricted incident - Safety

   Lacerations; burns; concussion; serious sprains; minor fractures, deafness; dermatitis; asthma; work related upper limb disorders; ill-health leading to permanent minor disability.

   - Off-site release with detrimental short term effects. Off-site release immediately - Environmental

4) Major, e.g:

   - Lost time injury – Safety
   - Off-site release with detrimental short term effects – Environmental

5) Catastrophic, e.g:

   - Fatality or permanent disability - Safety

   Amputations; major fractures; poisonings; multiple injuries; fatal injuries. Occupational cancer; other severely life shortening diseases; acute fatal diseases.

   - On or off-site release with detrimental long term effects - Environmental

Determining likelihood of harm

When seeking to establish likelihood of harm the adequacy of control measures already implemented and complied with needs to be considered.

Here legal requirements and codes of practice are good guides covering controls of specific hazards.

The following issues should then typically be considered:

- Number of personnel exposed.
- Frequency and duration of exposure to the hazard.
- Failure of services e.g. electricity and water.
- Failure of plant and machinery components and safety devices.
- Exposure to the elements.
- Protection afforded by personal protective equipment and usage rate of personal protective equipment.
- Unsafe acts (unintended errors or intentional violations of procedures) by persons, for example, who:

    1) May not know what the hazards are.
    2) May not have the knowledge, physical capacity, or skills to do the work.
    3) underestimate risks to which they are exposed; and
    4) Underestimate the practicality and utility of safe working methods.

It is important to take into account the consequences of unplanned events.

These subjective risk estimations should normally take into account all the people exposed to a hazard. Thus any given hazard is more serious if it affects a greater number of people.

But some of the larger risks may be associated with an occasional task carried out just by one person, for example maintenance of inaccessible parts of lifting equipment.

Determining acceptable risk

A basic **qualitative** method is a reasonable starting point, although some organisations may wish to develop more sophisticated **quantitative** approaches.

It is generally not necessary to make precise numerical calculations of risk. Complex methods for quantified risk assessment are normally only required where the consequences of failure could be catastrophic.

Risk assessment in major hazard industries is related to the approach required in other workplaces, but in most organisations much simpler subjective methods are appropriate.

The assessment of risks to health associated with exposure to toxic substances and harmful energies may require, for example, measurements of airborne dust concentrations or noise exposure.

Qualitative method

The qualitative method involves replacing statistics with words, e.g. instead of referring to 8 fatalities, an incident is described as “catastrophic”.

This method is more suitable for persons who may be more comfortable expressing themselves by words, than numbers. It is particularly suitable for basic risk assessments. An example is shown below:

	Slightly harmful	**Harmful**	**Extremely harmful**
Highly unlikely	***Trivial Risk***	***Tolerable Risk***	***Moderate Risk***
Unlikely	***Tolerable Risk***	***Moderate Risk***	***Substantial Risk***
Likely	***Moderate Risk***	***Substantial Risk***	***Intolerable Risk***

Qualitative method

The numerical values are based on indicators of consequence and probability. Below is an example of a qualitative risk matrix:

Numbers may be used to describe risks, instead of the terms 'moderate risk', 'substantial risk', etc. NB: Using numbers does not confer any greater accuracy to these estimates.

The different numerical descriptions form part of a matrix of set values, or classes, e.g.:

- Class 01 – Insignificant
- Class 02 – Minor
- Class 03 – Moderate
- Class 04 – Major
- Class 05 - Catastrophic

Semi quantitative method

The semi quantitative approach uses scales of values in order to mathematically calculate the risk factor. This scale would usually include values based on:

- Measurement of ***consequence*** (i.e. extent of potential harm/loss).

- Measurement of ***frequency*** or exposure (how often and how long persons may be affected within a defined time period).

- Measurement of ***probability*** (chance estimate of the harm/loss occurring during the exposure situation).

The semi quantitative approach involves multiplying values assigned for *consequence, frequency* and *probability*, to get a single risk factor value.

During a risk assessment, the same values should also be used to calculate risk reduction values for existent control measures.

Determining acceptability level / value

CURRENT RISK RATING	REQUIRED ACTIONS	APPROVALS
LOW	HIRA reviewed by team leader	Team leader and facilitator
MEDIUM	Hazard controls to be reassessed by Supervisor to reduce risk rating	Supervisor
SIGNIFICANT	Hazard controls to be reassessed by Supervisor to reduce risk rating. Involvement by Manager	Manager
HIGH	Hazard controls to be reassessed by manager to reduce risk rating.	CEO

Assessment / determination of controls

The outcome of a risk assessment should be an inventory of actions, in priority order, to devise, maintain or improve controls.

Control effort and urgency should be proportional to the identified risk.

Sequence of controls

The determination of controls should be based on a defined sequence of options, namely:

- First determine if elimination of the hazard / risk is possible. This is the ideal option, but is usually impossible or impractical
- Secondly, one must then consider controlling the hazard / risk at source.
- Thirdly, one must consider minimising the impact of the hazard / risk upon the working environment.

Only as a last resort should one consider the need for personal protective equipment.

Factors in determining controls

Controls should be chosen taking into account the following:

- where possible adapt work to the individual, e.g. to take account of individual mental and physical capabilities;
- take advantage of technical progress to improve controls;
- ensure compatibility of the selected control measure with the overall work system
- utilise measures that protect everyone, or at least give priority to measures which will protect the most people;
- a blend of technical and procedural controls is usually necessary;
- evaluate the need to introduce planned maintenance of, for example, machinery safeguards;
- Evaluate pro-active measurement indicators necessary to monitor compliance with the controls.

Considerations must also be given to the development of emergency and evacuation plans, and provision of emergency equipment relevant to the organisation's hazards.

Example of a basic control action plan.

RISK LEVEL	ACTION AND TIMESCALE
Trivial	No action is required and no documentary records need to be kept.
Tolerable	The risk has been reduced to the lowest level that is reasonably practicable. No additional controls are required. Consideration may be given to a more cost-effective solution or improvement that imposes no additional cost burden. Monitoring is required to ensure that the controls are maintained.
Moderate	Efforts should be made to reduce the risk, but the costs of prevention should b e carefully measured and limited. Risk reduction measures should be implemented within a defined time period. Where the moderate risk is associated with extremely harmful consequences, further assessment may be necessary to establish more precisely the likelihood of harm as a basis for determining the need for improved control measures.
Substantial	Work should not be started until the risk has been reduced. Considerable resources may have to be allocated to reduce the risk. Where the risk involves work in progress, urgent action should be taken.
Intolerable	Work should not be started or continued until the risk has been reduced. If it is not possible to reduce risk even with unlimited resources, work has to remain prohibited.

Implementation of recommendations

Risk assessment recommendations should be implemented and monitored through action plans, depending on the complexity of the recommendation.

Review / update of risk assessment

A risk assessment process must be continuous, and not a “once off” exercise. Routine reviews should be carried out on completed risk assessments, mainly to check the adequacy of control measures.

These reviews should focus on the following:

- Current applicability of completed risk assessments, and
- Risk reduction value of measures implemented (due to the recommendation by the risk assessments).

In particular, reviews of risk assessments should be conducted in the following situations:

- During unusual / changed circumstances, e.g. when an incident has occurred, or

When major change, e.g. to plant or work processes, has occurred, to the extent that hazards and risks are significantly affected.

Relationship between HIRA and Risk Management

It is important to note that ***risk*** management and HIRA are not synonymous, but that the latter forms part of a bigger, more comprehensive management approach. The outcomes of the HIRA process are inputs for the ***risk*** treatment process, which forms part of the broader ***risk*** management process

General observations

- HIRA is an ongoing process, and should not be regarded as a once-off exercise.
- HIRA should be undertaken systematically to identify and record significant ***risks***.
- It is important that complete records are kept for future reference, including a clear description of the methodology, system, terminology, etc. used, and what actions may be required for improvement in the future.

Manufacturers and suppliers also have duties relating to HIRA, General Safety Regulation 2 and Major Hazardous Installation Regulations 5 etc.

Risk treatment strategy

A primary objective of ***risk*** management is to assist an organisation to address existing and foreseeable significant OH&S ***risks***.

(a) eliminate the risk;

(b) control the risk at source

(c) minimize the risk by means that include the design of safe work systems; and

(d) *in so far as the risk remains, provide for the use of personal protective equipment, having regard to what is reasonable, practicable and feasible, good practice and the exercise of due diligence.*

This sequence can be followed in the risk assessment process.

For example, the focus should be placed on ways and means to control the effect of identified *OH&S hazards* only when it becomes clear that it is practically impossible to *eliminate* the specific *hazards*.

The assessment process can, therefore, be summarized as being the employment of preventative and protective measures, in the sequence outlined, until a stage is reached where the ***risk*** that remains is less than or equal to the ***tolerable risk***.

It should be noted that tolerable risk is defined as being ***risk*** that is acceptable in a given context based on the current values of society. It follows that, over time, protective measures that may have led to the acceptance of the remaining ***risk*** may need to be reviewed to satisfy new levels of ***tolerable risk***.

THE RISK MANAGEMENT PROCESS

A ***process of managing risk*** needs to be in place, a process that would constantly review and update information on risk and review and improve control measures as appropriate.

Identification of hazards

In order to manage risk, the first step is to identify hazards.

Risk analysis

Once the hazards have been identified, the level of risk and the threat that it poses to the organisation has to be analysed and determined. At this stage the adequacy of present safeguards must also be considered.

Value judgement of the risk

With the extent of the risk known, a decision has to be taken whether with the existing safeguards, the risk is acceptable or whether something needs to be done about it. Should the level of risk be found to be acceptable, it could be **tolerated** but measuring and monitoring is required to detect any change in the level of risk.

Risk reduction

This is part of the risk management process where the strategy for dealing with specific risks is formed. Any of the techniques of risk control or risk financing may be selected here; as a general guideline, however, it is wise to combine at least one control measure with at least one financing technique for each risk faced.

Terminate

This is strictly a risk control technique and this approach is a synonym for risk avoidance. It should be thought of as including both the refusal to expose the organisation to a risk in the first place and the complete elimination of a risk that is already present in the operation. This is the only risk management technique designed, to be used without any others.

Transfer

Perhaps the most common risk transfer is to finance losses through insurance, but many types of contractual transfers are also common. Risk control plays an important part here too, since transfers are not fool proof and almost always leave some chance that the "transferee" may suffer a loss.

Treat

Also related to risk control, "treating" the risk includes the techniques known as risk control, or loss prevention, and reduction. Note that when these techniques are applied, the risk still exists, the tools are designed to stop or reduce losses only. For example, wearing a hard hat does not eliminate the risk of being struck by falling objects, it only prevents or reduces injuries. Risk treatment is a vital area of activity for reasons that will be examined later.

Implementing and monitoring the system

With work identified and standards set, the required control measures are implemented.

Measurement / audit

It is often found that control measures are implemented and never reviewed – unless something drastic - e.g. a major incident - occurs. Therefore, in order to ensure that the control measures are indeed as effective as was intended, they need to be monitored and measured. This measurement can be in the form of regular measurement by sampling, or by comprehensive measurements - such as auditing - on a periodic basis.

Evaluation of the measurement results

Following the measurement or audit, the results need to be analysed in order to understand what the measurement revealed.

The measurement evaluation may reveal that:

- Firstly, everything is on target and therefore one would want to commend somebody for good performance.
- Secondly, it may reveal a deviation from the set standards, in which case one has to apply constructive correction.
- Thirdly, the measurement may reveal that the control measures are ineffective or that the standards or work to be done are inadequate to control the hazard adequately or possibly even that not all hazards have been identified, in which case the process starts again at hazard identification.

TYPES OF RISK ASSESSMENT

There are three types of Risk Assessment:

- Baseline;
- Issue-based; and
- Continuous.

The three types are inter-related and form an integral part of a management system. A brief description of each of the three types of Risk Assessment is given below.

Baseline Risk Assessment

Purpose

The purpose of a baseline Risk Assessment is to determine the current status of *OH&S risk* associated with your business.

Output

The output of a baseline Risk Assessment is a set of ***risk*** profiles, which are used to prioritize both action programs and issue-based ***risk*** assessments.

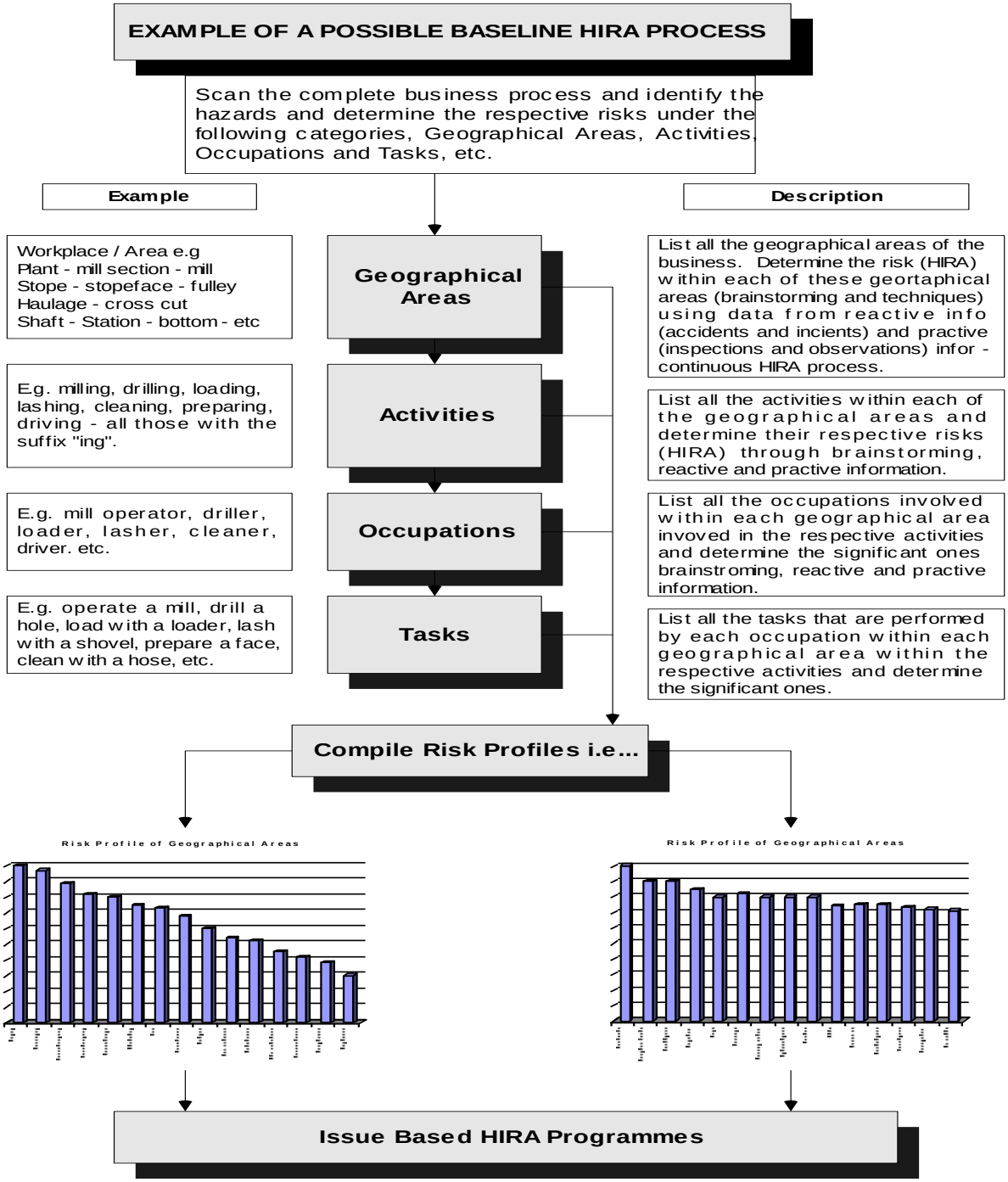
General Comments

Each Operation should decide on the set of ***risk*** profiles that are most appropriate for that operation (e.g. ***risk*** profiles for all the geographical areas and, within each geographical area, for activities, occupations and tasks. In selecting a set of ***risk*** profiles, care should be taken to ensure that all significant ***risks*** are identified. It is possible to overlook a significant ***risk*** if the ***risk*** profiles are not selected correctly.

The ***risks*** should be listed in order of significance. An example of a risk profile, and a schematic depiction of a possible process to arrive at various ***risk*** profiles are shown in **Figure 2**.

The baseline Risk Assessment should be reviewed on a needs-driven basis, to support business planning and budgeting, or when circumstances could significantly change a ***risk*** profile.

Figure 2 - Example of a Possible Baseline HIRA Process



Issue-based Risk Assessment

Purpose

The purpose of an issue-based Risk Assessment is to conduct a detailed assessment study.

Output

The output of an issue-based Risk Assessment is clear recommendations to management for:

- input into continuous Risk Assessment;
- action plans for the treatment of significant ***risk***; and
- input into training programmes, standards, procedures, codes of practice and management system.

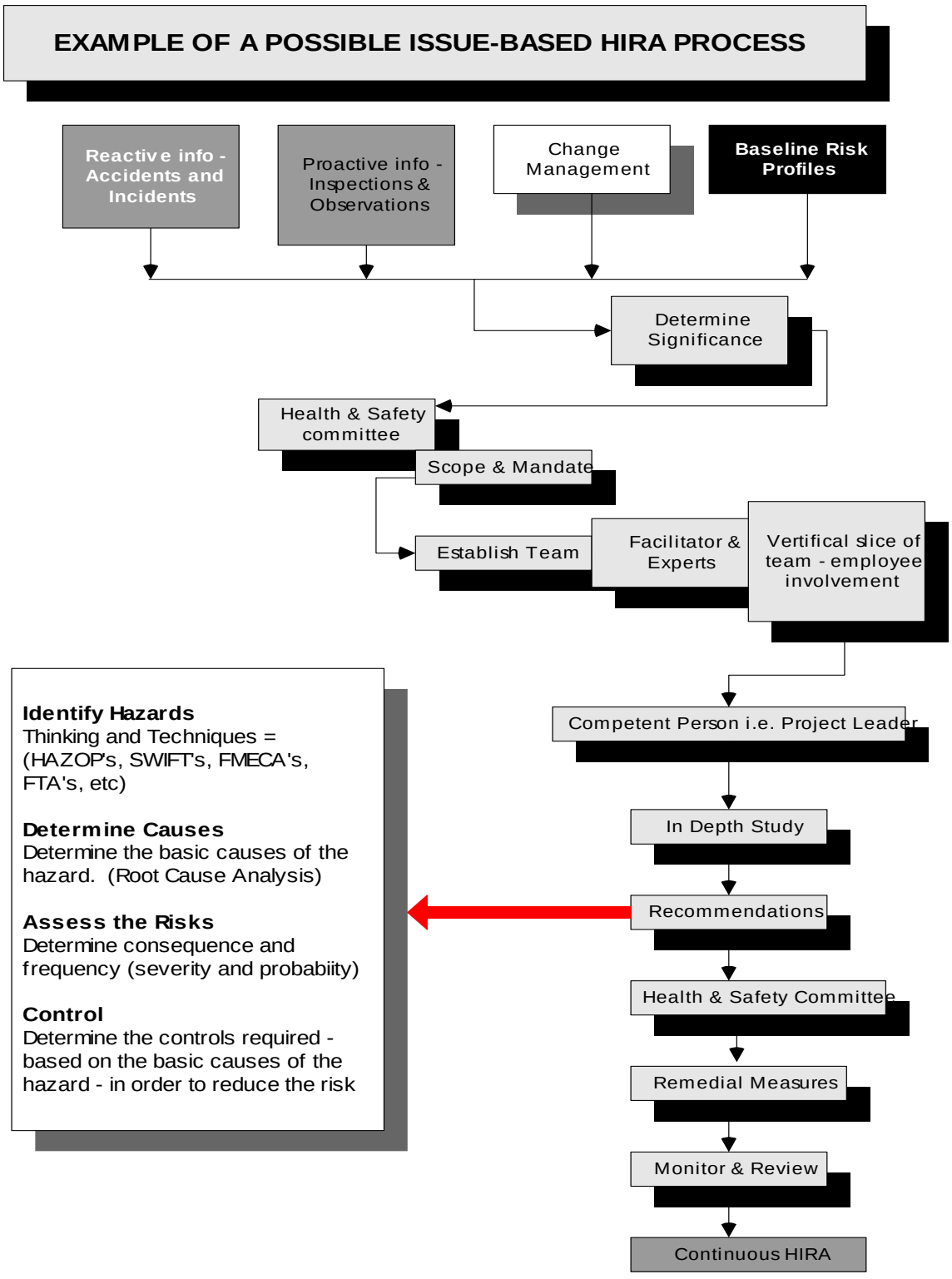
General Comments

The issue-based Risk Assessment program may need to be modified because of, for example, the following occurrences:

- accidents, incidents or 'dangerous occurrences';
- new, and/or changes to, designs, layouts, equipment, or processes, etc.;
- findings that come to the fore during continuous Risk Assessment;
- requests from employees, regulators or members of affected stakeholder parties;
- a change in the baseline ***risk*** profile; and
- new knowledge and information becoming available on the level of ***risk*** to employees.

Figure 3 is a schematic of a possible process to conduct an issue-based Risk Assessment. There are various techniques (such as HAZOP, SWIFT, FMECA, Fault Tree analysis, etc.) that can be used.

Figure 3 - Example of a Possible Issue-Based HIRA Process



Continuous Risk Assessment

Purpose

The purpose of continuous Risk Assessment is to identify promptly OH&S ***hazards*** for the purpose of immediately treating significant ***risks***.

The responsibility for addressing the ***hazard***, and ensuring that it is addressed to the point of conclusion, lies with the person who first identified that ***hazard***. Most accidents occur because somebody has not taken immediate action when something appeared to be wrong.

Output

Outputs of continuous Risk Assessment are:

- risks are treated immediately, in order of significance;
- information to feed back to issue-based Risk Assessment; and
- information to feed back to baseline Risk Assessment.

General Comments

Figure 4 is a schematic depiction of a possible process to conduct a continuous Risk Assessment. Continuous Risk Assessment should take place continually as an integral part of day-to-day operations management. It might not use the more sophisticated Risk Assessment techniques used in baseline and issue-based Risk Assessment but, in terms of ensuring the reduction of OH&S ***risks*** in the workplace, this form of Risk Assessment is possibly the most powerful and important.

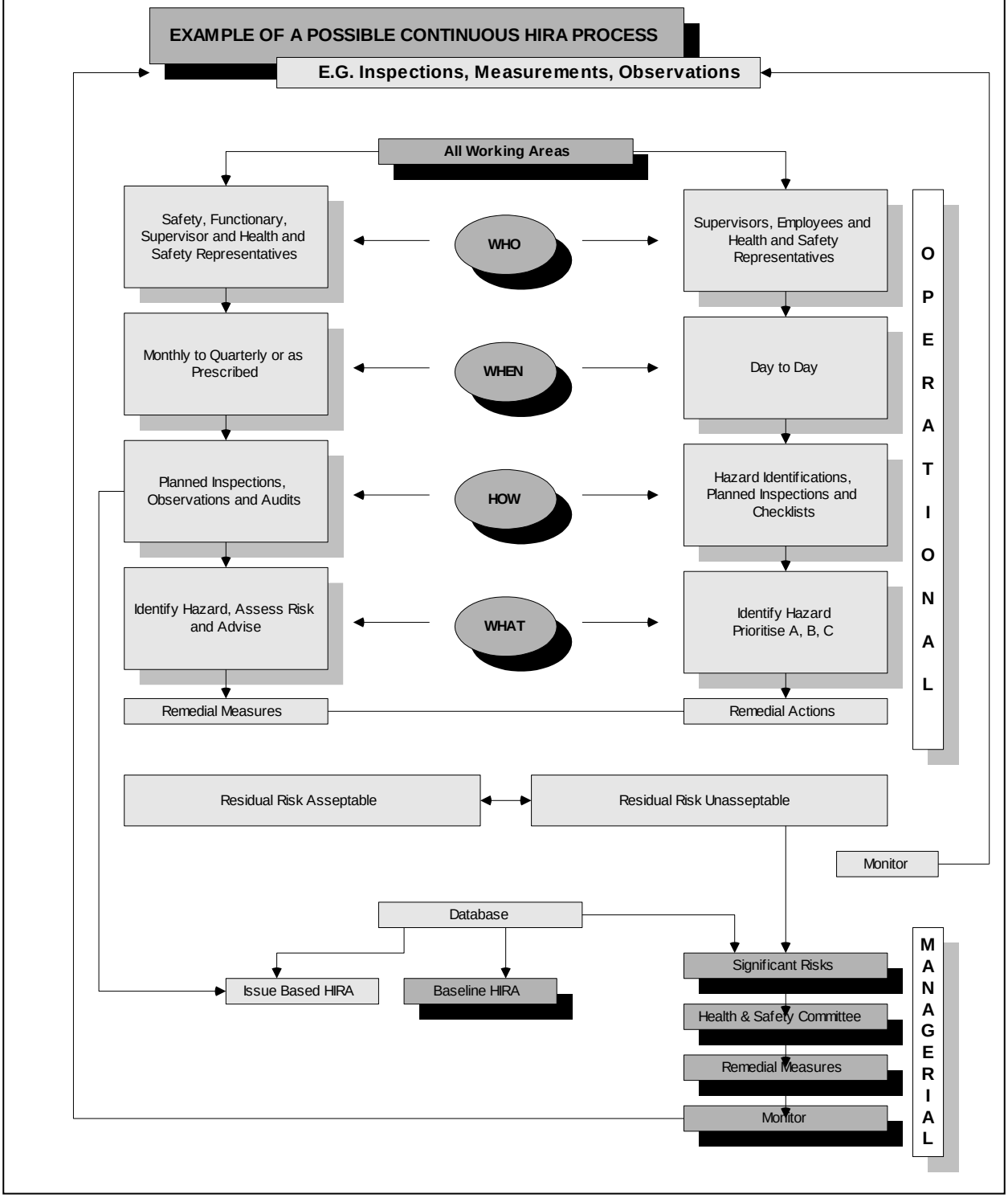
It is the duty of all first-line supervisors to ensure that effective continuous HIRA's actually take place in the workplace. An employer must ensure that all employees are competent to perform Continuous HIRA.

The following could form *part* of Continuous HIRA:

- inspections and observations;
- occupational hygiene measurements;
- planned maintenance systems;
- pre-work assessments;
- OH&S audits; and
- planned task observations.

In continuous HIRA, the emphasis is on day-to-day ***hazard*** awareness through HIRA, and immediate ***risk*** treatment. In developing ***hazard*** awareness, memory joggers, such as inspection checklists, pre-use checklists, and critical part and paths checklists can be used.

Figure 4 - Example of a Possible Continuous HIRA Process



Inter-relationship between types of HIRA

The inter-relationship between the three different types of HIRA is described below.

1. During the Baseline HIRA where geographical areas, activities and tasks are broken down and analyzed, significant issues requiring immediate attention are closely monitored through the Continuous HIRA process.

2. The data from the Continuous HIRA process is used during the Baseline HIRA process.

3. Outcomes from Continuous HIRA might require more in-depth analysis through the Issue-based HIRA.

4. The outcome of an Issue-based HIRA needs to be monitored through the Continuous HIRA process to ensure recommendations are complied with and are effective. Checklists are normally produced as part of an Issue-based HIRA to be used in the Continuous HIRA as part of the monitoring process.

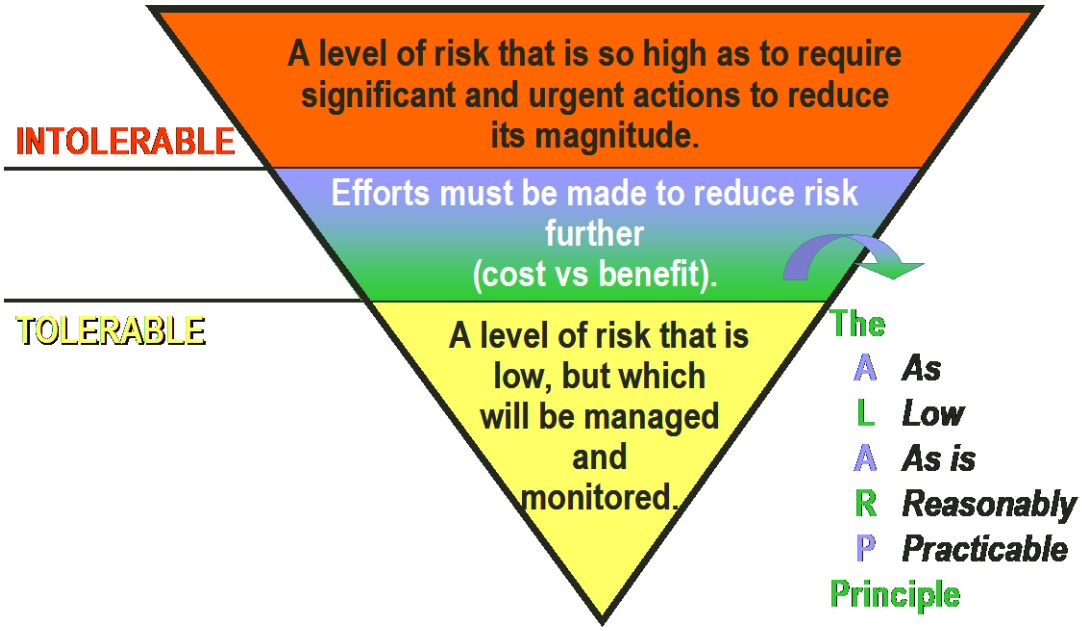
5. Baseline ***Risk*** Profiles can be used to prioritise Issue-based HIRA, and the broken down components of the Baseline HIRA can be used in the scoping process of the Issue-based HIRA.

6. As part of the Continuous and Issue-based HIRA processes, the integrity and effectiveness of the Management Systems is continually evaluated and up-dated to keep ***risks*** as low as is reasonably possible.

7. The results from the complete ***Risk*** Management Process manifest themselves in the Baseline ***Risk*** Profiles at the end of a given cycle. This can be used for comparison purposes against the Baseline ***Risk*** Profiles of previous cycles.

The following principles are important:

- Keep the process simple, realistic and practical;
- Select the most appropriate and fit-for-purpose ***risk*** estimation technique based on the significance of the ***risk***;
- Ensure and demonstrate total transparency;
- Focus on the significant OH&S ***risks*** first;
- Follow the ***risk*** management strategy prescribed by the Mine Health and Safety Act;
- Ensure participation of as many employees as is practically possible;
- Never underestimate the contribution of even the lowest level of employee; and
- Be systematic in your approach while recording the steps taken and motivation for recommendations and decisions.



GLOSSARY

The following terms have been used in this guide and it is recommended that all those conducting risk assessments follow them.

CONSEQUENCES	the degree of harm, the potential severity of the injuries or ill health and/or the number of people potentially affected.
EVENT	an incident or situation, which occurs in a particular place during a particular interval of time.
EXPOSURE	how often and for how long employees are exposed to a hazard.
FREQUENCY	chance per unit time (usually per year), also see likelihood and probability.
HARM	injury or loss.
HAZARD	a condition or practice with the potential to cause harm.
HEALTH	refers to occupational health, and includes occupational hygiene and medicine.
ILO	International Labour Organisation
LIKELIHOOD	chance per unit time (usually per year), used as a qualitative description of probability.
MHSA	Mine Health and Safety Act No. 29 of 1996.

OHSA	Occupational Health and Safety Act No. 85 of 1993 as amended 72 of 1997.
PROBABILITY	chance that a person or persons will be harmed during the exposure period.
REASONABLY PRACTICABLE	means practicable having regard to: (a) the severity and scope of the hazard or risk concerned; (b) the state of knowledge reasonably available concerning that hazard or risk and of any means of removing or mitigating that hazard or risk; (c) the availability and suitability of means to remove or mitigate that hazard or risk; and (d) the cost of removing or mitigating that hazard or risk in relation to the benefits derived there from.
RISK	the likelihood that the harm from a particular hazard will occur ('the chance of harm or loss').
RISK ACCEPTANCE	an informed decision to accept the consequences and the likelihood of a particular risk.
RISK ANALYSIS	systematic use of available information to determine how often specified events may occur and the magnitude of their consequences.
RISK ASSESSMENT	the overall process of risk analysis and risk evaluation.
RISK CONTROL	that part of risk management, which involves the implementation of policies, standards, procedures and physical changes to eliminate or minimise adverse risks.
RISK IDENTIFICATION	the process of determining what can happen, why and how.
TOLERABLE RISK	risk, which is accepted in a given context based on the current values of society.

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