Principles & Concepts and Process of 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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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 slightly to extremely 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***

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.

An 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 sourc
(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 shown in **Figure 1.** 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***.

For example: Having regard to what is reasonable, practicable, feasible, good practice and the exercise of due diligence, the ***risk*** of noise-induced hearing loss associated with the noise from a stope rock-drill ***(hazard)*** or grinding metal may be treated as follows:

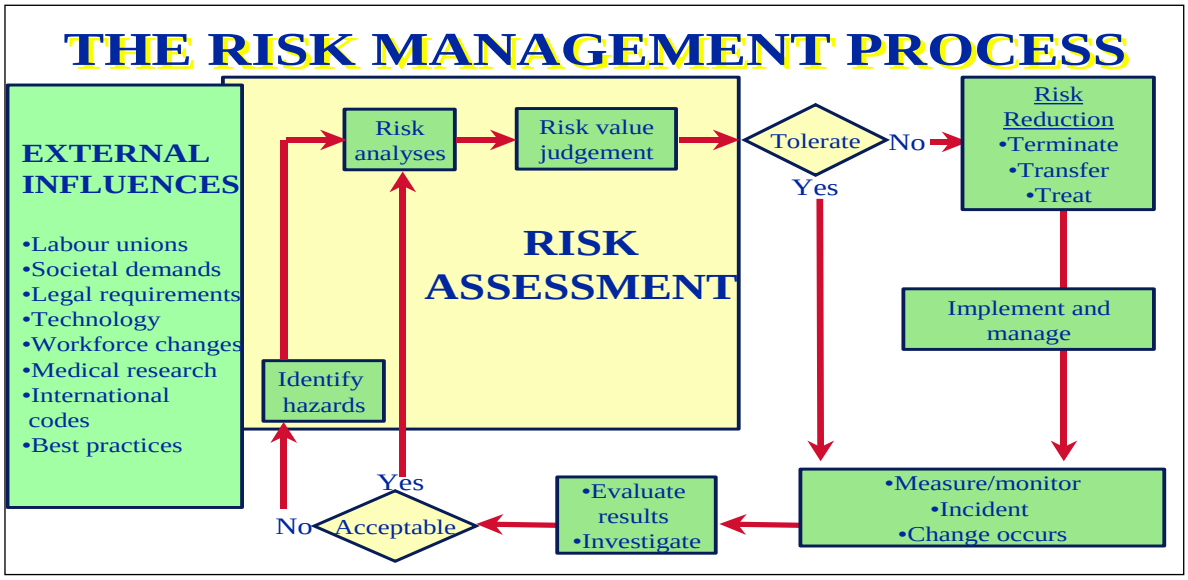
Stope Rock-Drill	Grinding Metal with Angle Grinder
Eliminate: Replace rock drills with new Technology i.e. Rock cutters, raise boring.	**Eliminate**: Replace grinding process e.g. by spark eroding if possible.
Control at source: Reduce the noise level of rock drills e.g. Fit silencers	**Control at source**: If possible grind in open area where noise will dissipate.
Minimize: Restrict access to stopes.	**Minimize**: Restrict access to grinding areas.

Remaining risk: Provide hearing protection; and	**Remaining risk:** Provide hearing protection; and
Monitor: The risk	**Monitor:** The risk

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 (not indicated in Figure 1 to highlight that this is a continuous process).

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.

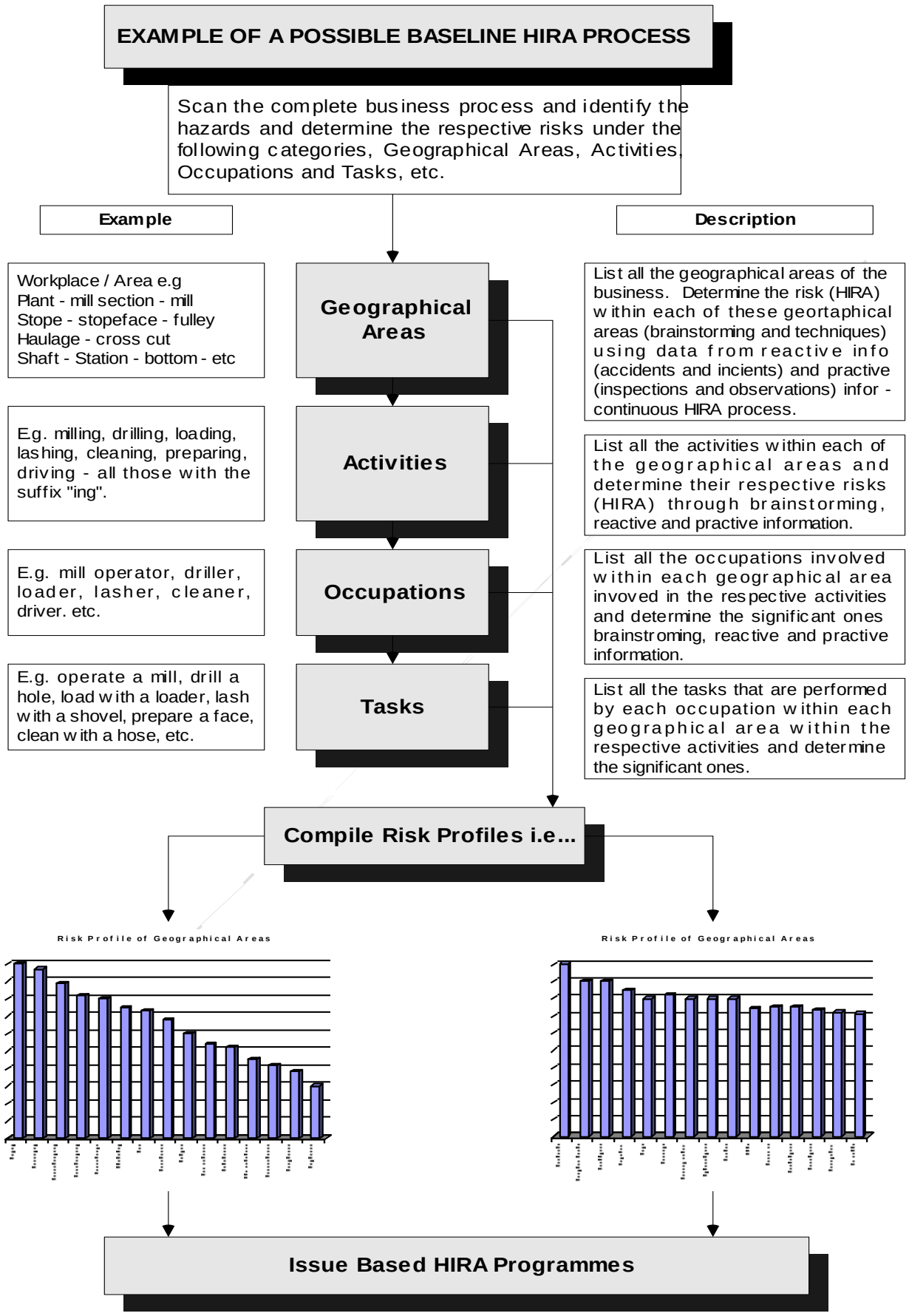
General Comments

Each Mine, or Industrial operation should decide on the set of ***risk*** profiles that are most appropriate for that mine or 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.

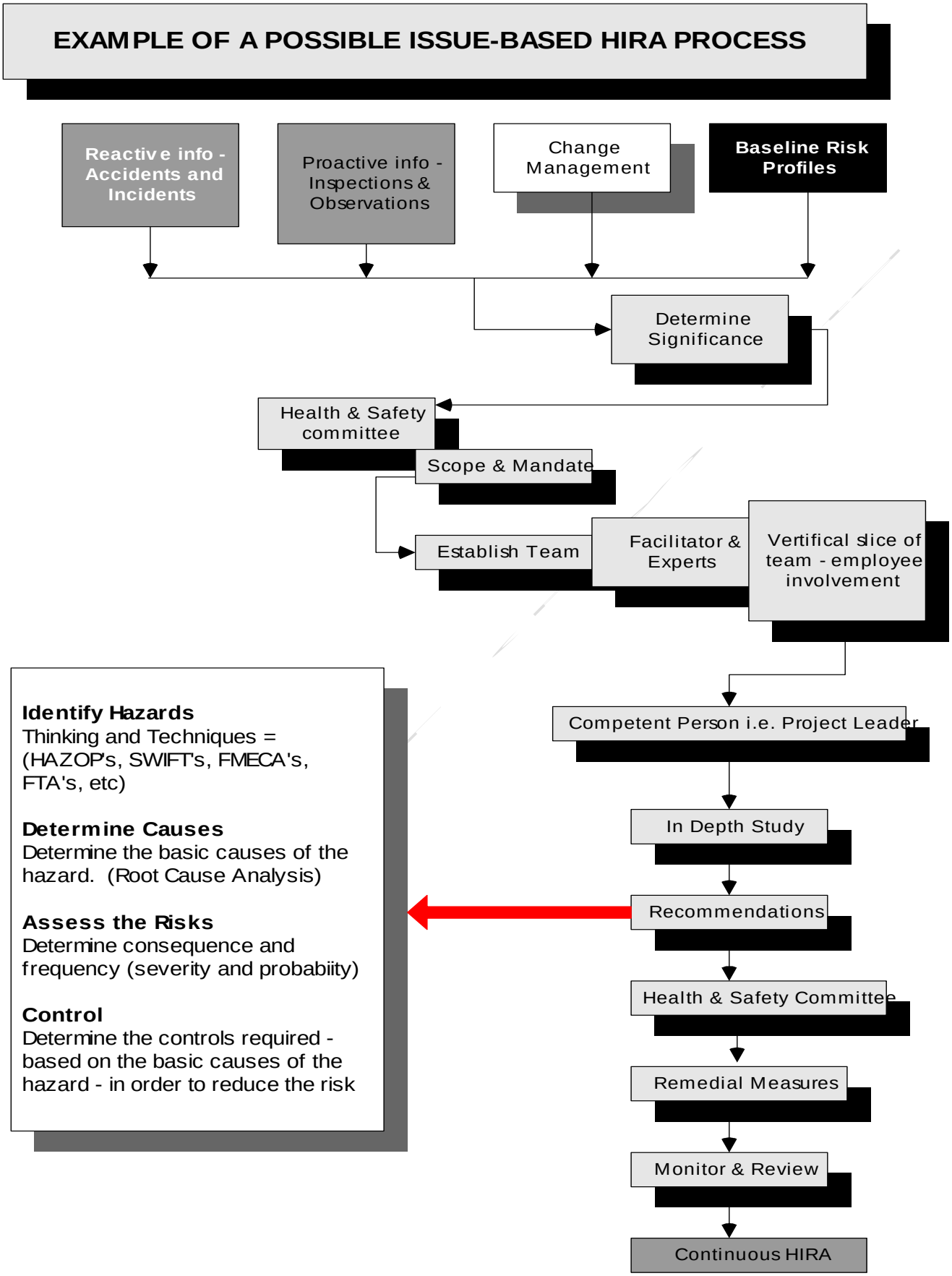
General Comments

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.

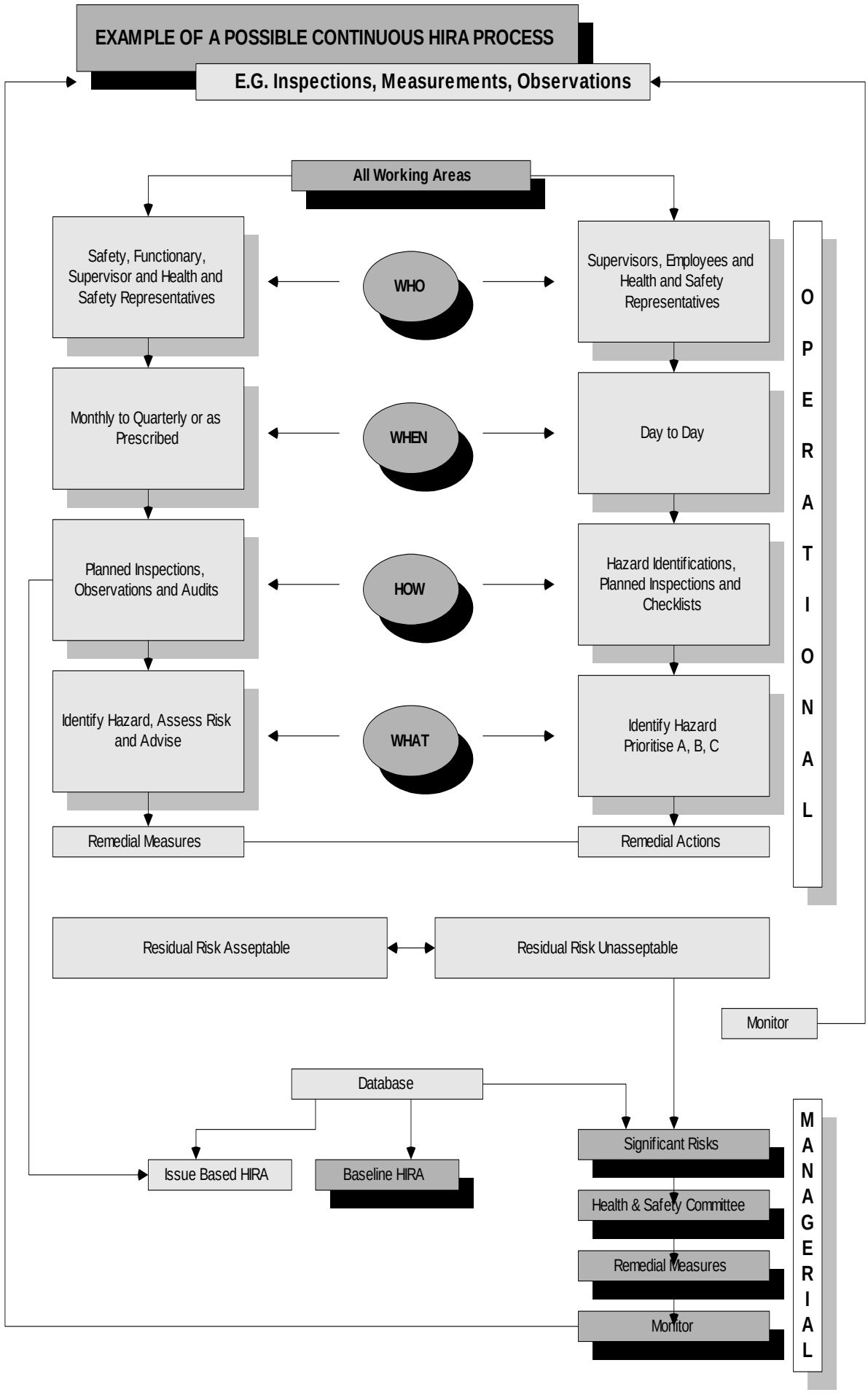
It is the duty of all first-line supervisors to ensure that effective continuous HIRA's actually take place in the workplace. An employer must ensure that all employees are competent to perform Continuous HIRA.

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



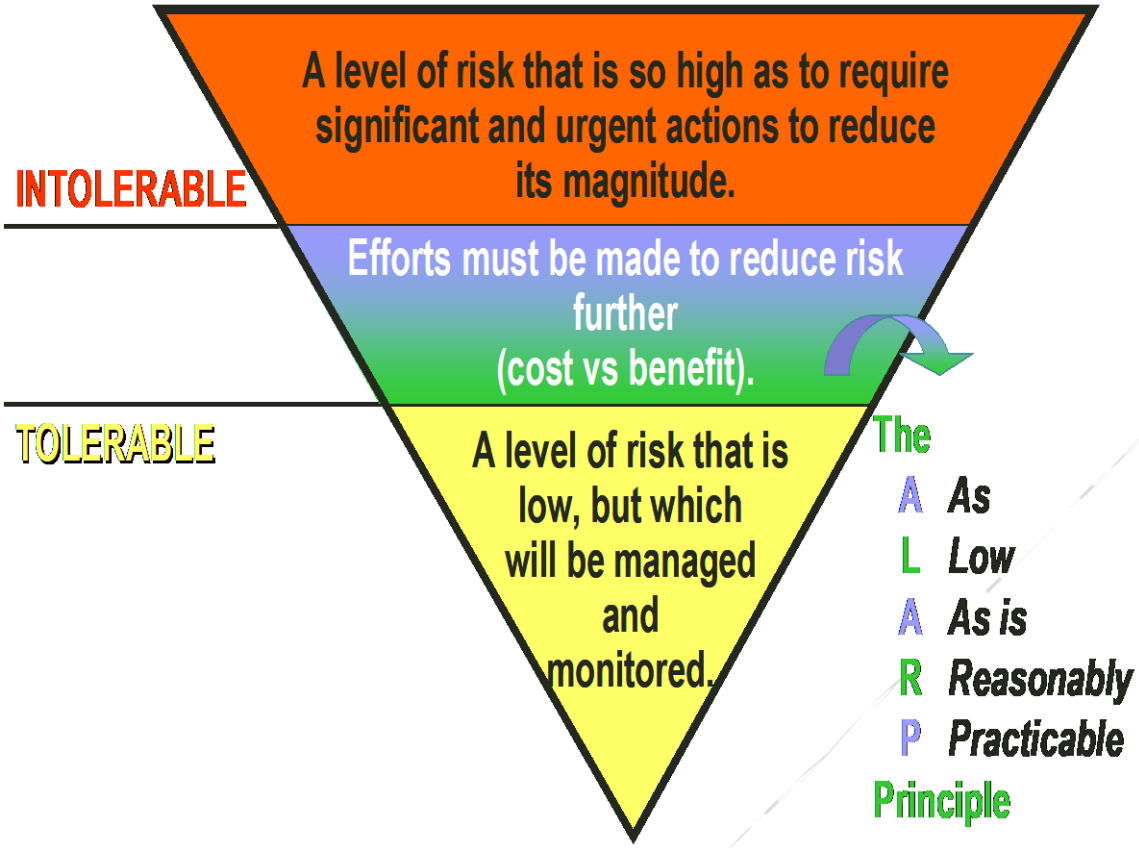
Inter-relationship between types of HIRA

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.



Likelihood	Consequence Severity				
	Low	Minor	Moderate	Major	Critical
Almost Certain	ALARP	ALARP	Intolerable	Intolerable	Intolerable
Likely	Tolerable	ALARP	ALARP	Intolerable	Intolerable
Possible	Tolerable	Tolerable	ALARP	ALARP	Intolerable
Unlikely	Tolerable	Tolerable	Tolerable	ALARP	ALARP
Rare	Tolerable	Tolerable	Tolerable	Tolerable	ALARP

Interpretation of Qualitative IRPA (Individual Risk Per Annum) Results for Total Risk

IRPA Level for Combined Site:

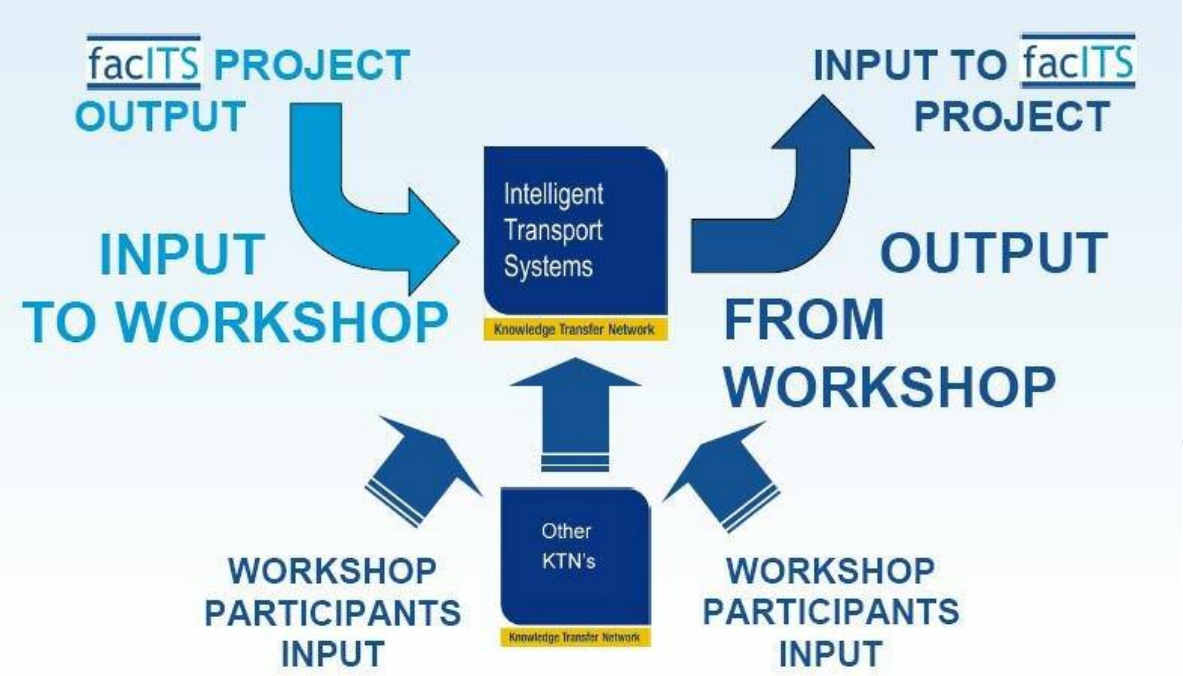
$> 1 \times 10^{-3}$ Intolerable: require significant and urgent action to reduce risk

1×10^{-4} to 1×10^{-5} ALARP: must consider measures to reduce risk

Likelihood*	Description	Frequency Description	
		Health Example only +	Safety, Environment and Community Example only+
Almost Certain	Consequence expected to occur in most circumstances	1 case per 100 person-years *	High frequency of occurrence – occurs more than once per year
Likely	Consequence will probably occur in most circumstances	1 case per 1,000 person-years	Event does occur, has a history, occurs once every 1-10 years
Possible	Consequence should occur at some time	1 case per 10^4 person-years	Occurs once every 10-100 years
Unlikely	Consequence could occur at some time	1 case per 10^5 person-years	Occurs once every 100-1 000 years
Rare	Consequence may occur under exceptional circumstances	1 case per 10^6 person-years	Occurs once every 1 000-10 000 years

Consequence Severity

Consequence Severity Descriptor	Who it affects and What it means to them	Safety Final Event	Safety Consequence Example	Privacy Final Event	Privacy Consequence Example	Financial Final Event	Financial Consequence Example	Convenience Final Event	Convenience Consequence Example
Minor (S1)	Problem to one user Nuisance to multiple users	Minor injuries for one user	Problem to one vehicle with limited outcomes	Personal information of an individual divulged, taken without consent or used in manner not consented to.	Personal information such as names, addresses, disclosed.	Minor financial loss to an individual	Individual wrongly charged by a bridge toll	Nuisance to multiple users	Road-side traffic information is inaccurate
Marginal (S2)	Emergency to one user Problem to multiple users Nuisance to a large number of people	Severe or life threatening injuries for one user Minor injuries for multiple users	eCall doesn't function correctly when required in a severe accident	Sensitive information of an individual disclosed. Personal information of multiple users divulged, taken without consent or used in manner not consented to.	Sensitive information may be previous and current locations visited, telephone numbers called, credit card details	Major financial loss to an individual Minor financial loss to multiple users		Nuisance to a large number of people.	Map database is wrong Traffic information is inaccurate
Serious (S3)	Emergency to multiple users Problem to a large number of people Nuisance to wider society	Severe or life threatening injuries for multiple users Minor injuries for a large number of people	Incorrect warning by blind spot warning system causes multiple-car accident	Sensitive information of multiple people disclosed. Personal information of a large number of people divulged, taken without consent or used in manner not consented to.	Records of registration plates, names and addresses for every user of a bridge toll disclosed.	Major financial loss to multiple users Minor financial loss to a large number of people / organisational level	Bridge toll charges the wrong amount to all users	Nuisance to wider society	Nationwide traffic statistics are not accurate



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.

Role and prevention and control strategies

The concepts of risk assessment and risk management are fundamental to prevention and control of risks to safety and health in the workplace. The key aspects of risk assessment include making sure all relevant risks are taken into account, checking the efficiency of the safety measures adopted, documenting the outcomes of the assessment and reviewing the assessment regularly to keep it updated.

Workers have a right to reduction in ill health and accidents given that these things can be prevented or reduced if risk assessment and risk management are done.

In 2003, the International Labour Organization (ILO) published a global strategy on OSH.[1] The strategy states that one of the fundamental pillars of a global OSH strategy includes the building and maintenance of a national **preventative** safety and health culture and the introduction of a systems approach to OSH management.

The ILO strategy includes the background for the need for a preventative culture including that the magnitude of the global impact of occupational accidents and diseases, as well as major industrial disasters, in terms of human suffering and related economic costs, have been a long standing source of concern at workplace, national and international levels.

Significant efforts have been made at all levels to come to terms with this problem, but nevertheless the ILO estimated in 2003 that over 2 million workers die each year from work related accidents and diseases and that globally, this figure is on the increase.

It is difficult to get a more current overall statistical picture of ill health, injury and death caused by work as statistics are collected by individual countries or groups of countries and in different ways. In 2011, the reported number of fatalities due to work place accidents in the EU-27 was about 3,700 and some 2.7 Million workers suffered injuries which caused three or more absence days.

Principles of prevention and control

Principles deriving from the legislative Framework

Prevention means the act or practice of stopping something bad from happening. In the sense of OSH it means the avoidance of the risk or hazard at work. In contrast to prevention, control is the term to describe mitigation activities where the risk cannot be prevented.

The principles of prevention and control strategies are enshrined in several pieces of Health and Safety (H&S) legislation. The OSH Framework Directive is of fundamental importance; it is basic H&S law which lays down general principles concerning prevention and protection of workers against occupational accidents and disease and establishes the framework for safety and health management at the workplace.

The Framework Directive contains general principles concerning:

- prevention of risks,
- protection of safety and health, assessments of risks,
- elimination of risks and accidents,
- the informing, consultation, balanced participation in accordance with national laws and / or practices
- and training of workers and their representatives,
- general guidelines for the implementation of the said principles.
- obligations of employers, employees and other groups.

General principles of prevention:

- avoiding risks;
- evaluating the risks which cannot be avoided;
- combating the risks at source;
- adapting the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work rate and to reducing their effect on health;
- adapting to technical progress;
- replacing the dangerous by the non-dangerous or the less dangerous;
  developing a coherent overall prevention policy which covers technology, organization of

work, working conditions, social relationships and the influence of factors related to the working environment;
- giving collective protective measures priority over individual protective measures;
- giving appropriate instructions to the workers.

Risk assessment

Risk assessment is the cornerstone to prevent occupational accidents and ill health. It is the start of the health and safety management approach. If it is not done well or not at all the appropriate preventative measures are unlikely to be identified or put in place.

Risk assessment can be defined as "the process of evaluating the risk to health and safety of workers while at work arising from the circumstances of the occurrence of a hazard at the workplace".

The process can be described as a continuous improvement cycle which can be implemented in the management processes in the company. The fundamental steps in risk assessment are:

- Step 1: identifying hazards and those at risk
- Step 2: evaluating and prioritising risks
- Step 3: Deciding on preventive action
- Step 4: Taking action
- Step 5: Monitoring and reviewing

The employer must be in possession of an assessment of the risk. This applies to all kind of risks. The assessment shall be kept up-to-date, particularly if there have been significant changes or if the results of health surveillance show it to be necessary.

The employer must take the necessary preventive measures and the risks must be eliminated or reduced to a minimum following the hierarchy of prevention measures. The specific protection, prevention and monitoring measures listed below must be applied if the assessment carried out by the employer reveals a risk to the safety and health of workers.

The employer must ensure that the risk:

- is eliminated, or if not applicable,
- reduced to a minimum, preferably by substitution (e.g. replacing a hazardous task or chemical agent with a task or chemical agent which is not or at least less hazardous.

The employer must regularly control the efficiency of measures and the presence of hazards which may present a risk to workers' health, e.g. in relation to the occupational exposure limit values and must immediately take steps to remedy the situation if exceeded.

Risk assessment requires a fundamental understanding of the terms hazard and risk. It also requires the person undertaking the risk assessment to be competent. Competence is particularly derived from appropriate training and experience.

A hazard is something (e.g. an object, a property of a substance, a phenomenon or an activity) that can cause adverse effects. For example:

- Water on a staircase is a hazard, because you could slip on it, fall and hurt yourself.
- Loud noise is a hazard because it can cause hearing loss.

A **risk** is the likelihood that a hazard will actually cause its adverse effects, together with a measure of the effect. It is a two-part concept and you have to have both parts to make sense of it.

Likelihoods can be expressed as probabilities (e.g. 'one in a thousand'), frequencies (e.g. '1000 cases per year') or in a qualitative way (e.g. 'negligible', 'significant', etc.). The effect can be described in many different ways. For example:

- The annual risk of a worker in Great Britain experiencing a fatal accident (effect) at work (hazard) is less than one in 100,000 (likelihood);
- About 1500 workers each year (likelihood) in Great Britain suffer a non-fatal major injury (effect) from contact with moving machinery (hazard); or
- The lifetime risk of an employee developing asthma (effect) from exposure to substance X (hazard) is significant (likelihood).

Risk management

Once the risk has been assessed a decision needs to be made on what new measures (if any) need to be introduced in order to reduce the residual risk, taking into account what is regarded as good practice as a guideline. The key point is that wherever preventative measures are to be taken they should improve the level of protection afforded to workers with regard to safety and health.

Where possible it is particularly important that decisions of this type should be made at the design or purchasing stages of new processes, plants, products and procedures. Across in many other countries, demographic change means that employers are increasingly needing to accommodate older workers.

This is an important factor to take into account, not only in risk assessment but also in managing those risks. A particular focus lies with those workers having some form of disability (possibly just due to age-related degenerative change) and the legal duties of employers extends to making suitable adjustments for such workers to enable them to remain in work.

Safety and health management systems

Commonly, risk assessment and all kind of prevention and control measures are embedded in the management process landscape or in management systems. OSH management systems derive from the Total Quality Management approach, specifically those with Quality Management Systems.

The method is based on the 'Deming cycle', which consists of an iterative process of four steps, known as 'Plan, Do, Check and Act (PDCA)'. The involvement of top management in all steps of the process is essential for an effective management system. Risk assessment is the most important in the 'Plan' stage.

The preventive and corrective measures should be carried out under participation of employees ('Do'). Performance measures and corrective and preventive action are the essence of 'Check'. 'Act' centres around the management review, taking into account OSH performance measures.

The most common standard for safety and health management systems is OHSAS 18001. In 2001, the International Labour Organisation (ILO) also published OSH MS Guidelines. Recently, the approaches were broadened by including health aspects.

For example the World Health Organisation (WHO) published a model for 'healthy workplaces' with has many of the characteristics of an OSH MS.

The British Standards Institute (BSI) has developed a publicly available standard for the management of psychosocial risks, which can be considered a supplement to the OHSAS 18001 standard.

Hierarchy of prevention and control measures

Main article: Hierarchy of prevention and control measures

Risks should be avoided/eliminated and (if not possible) reduced by taking preventative measures, in order of priority. The order of priority is also known as the hierarchy of control. There different hierarchies of prevention and control measures which have been developed by different institutions. Common are five steps in the hierarchy of control OHSAS 18001 management system.

The five steps are:

Step 1 Elimination: Elimination of hazards refers to the total removal of the hazards and hence effectively making all the identified possible accidents and ill health impossible. The term 'elimination' means that a risk is reduced to zero without a shifting it elsewhere.

Elimination is the ideal objective of any risk management. This is a permanent solution and should be attempted in the first instance. If the hazard is removed, all the other management controls, such as workplace monitoring and surveillance, training, safety auditing, and record keeping will no longer be required.

Step 2 Substitution: Substitution means replacing the hazard by one that presents a lower risk. The elimination is immediately combined with a shift to another but much lower risk. Often or usually thought of in the context of chemicals, the concept of 'replacing the dangerous by the non-dangerous or the less dangerous' can be applied much more widely; and features as one of the central tenets of the sequence of preventative measures.

With chemicals, substitution with a safer form of the same chemical, rather than replacing the chemical may offer a viable, safer option (e.g. pellets rather than powder).

Step 3 Engineering Controls: Engineering controls are physical means that limit the hazard. These include structural changes to the work environment or work processes, erecting a barrier to interrupt the transmission path between the worker and the hazard.

Local exhaust ventilation (LEV) to control risks from dust or fume is a common example' as is separation of the hazard from operators by methods such as enclosing or guarding dangerous items of machinery/equipment. Priority should be given to measures which protect collectively over individual measures.

Step 4 Administrative Controls: Also known as organisational measures administrative controls reduce or eliminate exposure to a hazard by adherence to procedures or instructions. Documentation should emphasise all the steps to be taken and the controls to be used in carrying out the activity safely.

Particularly in respect of younger workers, social media is of growing importance as an avenue for disseminating safety messages and other information relating to occupational safety and health.

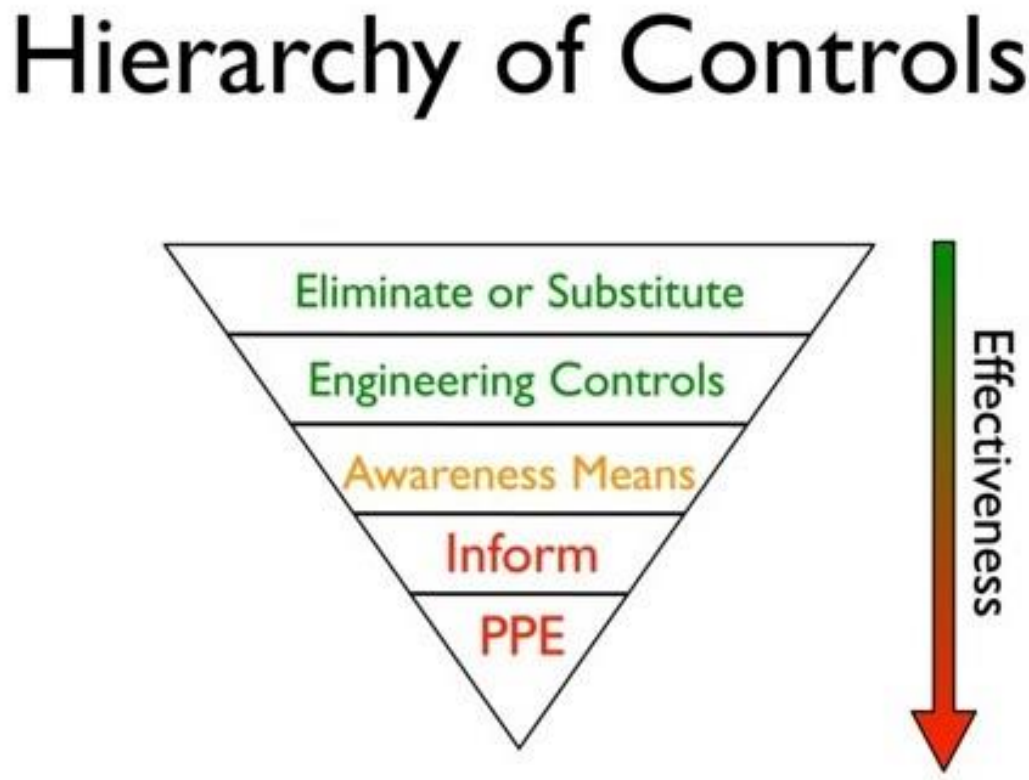
Improving the resilience of workers through measures such as workplace health promotion can also be a useful aspect of a holistic approach to prevention and control.

Step 5 Personal Protective Equipment (PPE): PPE should be used only as a last resort, after all other control measures have been considered, or as a short term contingency during emergency / maintenance / repair or as an additional protective measure.

The success of this control is dependent on the protective equipment being chosen correctly, as well as fitted correctly, worn at all times and maintained properly.

The reason that the use of PPE is at the bottom of the hierarchy of controls and is effectively a last resort is because of the higher likelihood (compared to controls higher up the hierarchy) of failing to danger because they place so much reliance for their success on the individual - be that in terms of them actually using the PPE or how well they use it or it actually fits them.

Figure 1: Hierarchy of Controls



Source: machinery safety

When applying the hierarchy of prevention and control measures one should have in mind the legal requirements. In the context of prevention and control measures, the legal framework prioritises avoidance and elimination of the risks at source clearly over reduction.

"Reduce the hazards and the risk" also has a double implication, which is unfortunately not really apparent at first glance in the above mentioned OHSAS 18001 hierarchical system: If it is not possible to avoid the risks or eliminate the hazards, then the next step has to be to reduce/minimise the hazards AND to separate the remaining hazards from the workers.

Equally important, risk must not be transferred to another area; for example by providing exhaust ventilation of toxic substances in such a way that the discharge poses a risk to another workroom or to the public off-site.

Also note that as you go down the list of options, the controls become less reliable, more costly and require more work to ensure they are maintained. In most situations, the actual method for controlling the risk is a combination of options in the hierarchy.

Training of workers should be associated with all steps and is fundamental to prevention and control. Where a potential emergency scenario is identified as part of the risk assessment then appropriate drills and exercises are likely to be part of the training and familiarisation of workers to deal with any such situation arising.

Assessment of effectiveness of prevention and control strategies

Audit

European directives or national legislation establish that the employers have a duty to ensure the safety and health of workers in every aspect related to the work. The employers have responsibilities not only to take the necessary measures, but also to assure an improvement in the level of protection afforded to workers.

Guidelines issued by national OSH authorities in OSH at workplace describe the elements of an OSH management system model, subjected to periodic audits that could conduct to success in implementation of legislation.

An audit is defined as a systematic, independent and documented process for obtaining evidence and evaluating it objectively against standards to determine to what extend the defined audit criteria are fulfilled.

Systematic OSH management and periodic audit help to fulfil OSH legislation and to improve OSH performance in the company. It is essential that inspection or audit or other management systems are properly applied and maintained in order that risks are managed effectively.

This will include audit, training, communication, and having a risk register as well as an accident or even a near miss log.

Practical examples of assessment of effectiveness of prevention and control strategies

Examples of assessment of effectiveness of control measures include the measurement of worker exposure to hazardous substances followed by appropriate comparison with relevant exposure standards.

Where engineering controls such as local exhaust ventilation (LEV) are being used to manage the risk of worker exposure to hazardous substances the performance of the LEV can be assessed by quantitative measures such as measurement of velocity of airflow at the face of booths and in pipework and also use of qualitative measures e.g. the use of smoke or other ‘tell tales’ to demonstrate whether contaminants are being captured effectively.

When controlling the effectiveness, one should also check that risks are not only shifted from one work station, area or activity to another or replaced by another risk.

The degree of risk reduction is not always quantifiable. However, when measuring OSH performance in an organisation, both leading and lagging indicators can be used. For example, a quantitative calculation of the impact of the risk reduction measure could be feasible in cases that apply to a large number of workplaces and where there is an easily quantifiable risk such as the number of accidents.

Other examples for lagging indicators are production days lost through sickness absence, number incidents or near misses in a certain time span, or complaints of workers about work that is carried out in unsafe or unhealthy conditions.

Leading indicators can be percentage of OSH projects and activities that are finalised on time, percentage of management meetings wherein OSH is addressed, or percentage of managers and workers that received OSH training.

Work away from an employers premises presents particular challenges in preventing and controlling risks.

Conclusions

Principles of prevention and control underpin management of risks to health and safety at the workplace. These are well established principles and widely applicable.

The focus of action and consideration should be given to prevention of risk in the first place, particularly in terms of elimination at the source or substitution e.g. of a less hazardous substance, rather than immediately considering risk management/control measures.

Psychosocial issues and general health issues should also be considered along with the safety risks and risks to health caused by physical, chemical, and biological agents.

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