

OCCUPATIONAL SAFETY AND HEALTH (OSH) RISK MANAGEMENT : A PRACTICAL APPROACH

By:

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Occupational Safety & Health Unit, UNIMAS: Functions

- Provide OSH technical advice and guidance to university stakeholders
- Monitor university-wide OSH performances by collecting and analysing data into statistics
- Create and propose university-wide OSH policies, guidelines and codes of practices
- Conduct OSH-related research
- Organize university-wide OSH promotional activities
- Organize university-wide OSH training and workshop
- Assist PTj in major accident investigation
- Assist PTj in workplace inspection of highly technical areas or high risk areas
- Liase and cooperate with relevant OSH-related local authorities
- Manage university-wide OSH documents and records
- Manage OSH competent persons
- Manage licensing requirement of boiler, pressurised equipment and lifting equipment
- Issuing Improvement and Prohibition Notice for dangerous occurrences, major hazard potential or during investigation.
- Secretariat to UNIMAS OSH Central Committee and UNIMAS OSH Technical Committee

Why OSH?

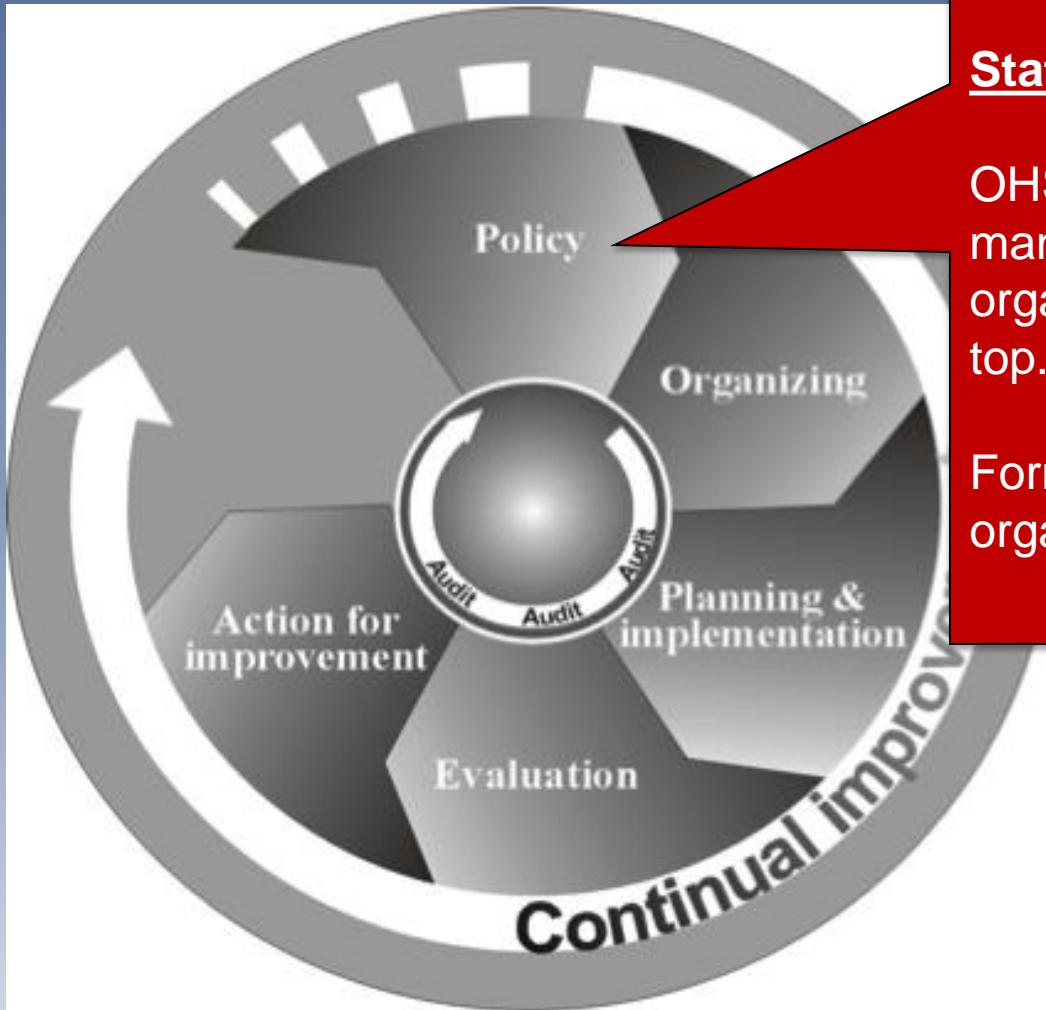
- OSH endeavors to reduce (or ideally eliminate) any form of injury, illness or damages to human capital and assets.
- Low rates of injury, illness and damage can:
 - Improve organization's reputation
 - Improve worker's morale
 - Increase productivity
 - Money stays where it should be or spent at areas needed most (instead of paying for replacement assets, temp workers etc.)
- OSH is increasingly a best practice at best companies/organization, simply a mark of civilized community.
- Meeting society expectation (family members come home in one piece, not several pieces)
- Meeting lawmakers expectation

Reference Standards

MS 1722:2011 – Occupational Safety and Health Management Systems

OHSAS 18001:2007– Occupational Health and Safety Management Systems

Key Elements Of HSMS

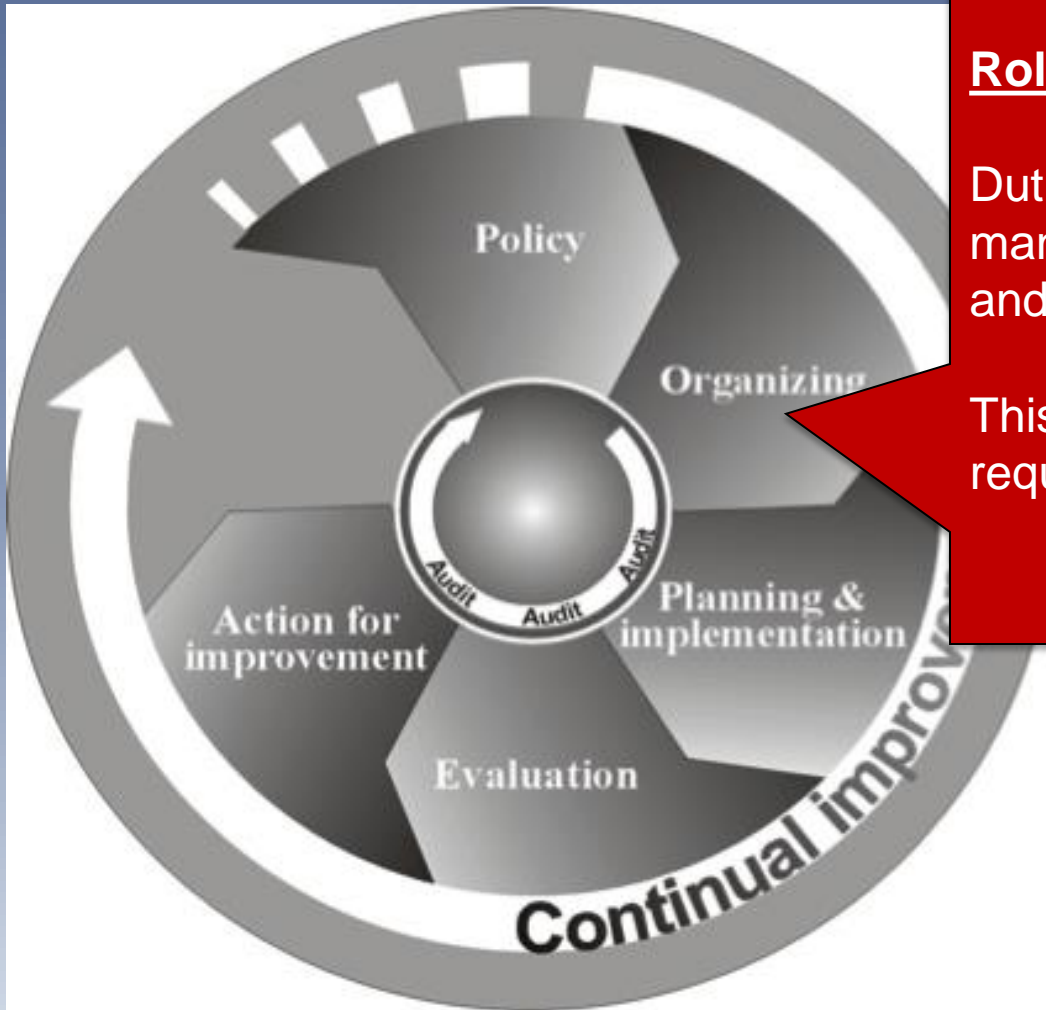


Statement of Intent

OHS as a prime commitment of management at all levels of UNIMAS organisation, but particularly at the top.

Form the basis for management organisation and implementation

Key Elements Of HSMS



Roles and responsibilities

Duties of individuals from senior management down to the operational and administrative staff.

This include duties which may be required by law

Senior Management Leadership and Commitment

- For an OSH risk management strategy to be successful in UNIMAS, it must be driven by senior management
- ***What management does, rather than what management says,*** defines the actuality of commitment or non-commitment to safety.
- What management does permeates the thousands of decisions made that:
 - create the work environment
 - set design specifications for facilities and equipment
 - establish fire protection standards, and so on.
- What senior management does is interpreted by UNIMAS staff as the role model to be followed.
- It's at the senior management level that measurable goals are established for performance expectations.

Senior Management Leadership and Commitment

- Paul O'Neil, former chairman and CEO of Alcoa, world's third largest producer of aluminum, is generally credited for breathing new life into the company's safety culture in the late 1980's

“Paul brought a real passion to the company's approach to health and safety. He made it his business to know exactly how many and what kinds of injuries our people (employees and contractors) were incurring. Having a CEO who knew literally everything about our health and safety performance made a fundamental change in our line leaders' view of health and safety's ranking in their daily priorities”

Excerpt from 'Driving toward "0", Best practices in corporate safety and health: How leading companies develop safety cultures', 2003

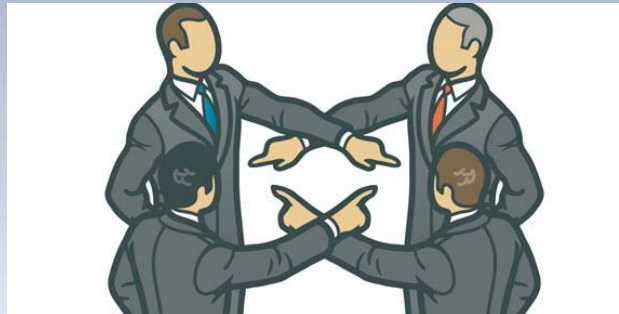
Senior Management Leadership and Commitment

Establishing accountability

- One of the principal indicators of management commitment to safety is the inclusion of safety performance in the performance review system (SKT).

‘A plant manager, speaking at a conference, said that the first items discussed in his annual performance review were his achievements in relation to previously established goals for employee injuries and illnesses, environmental occurrences, and fires.

Meeting or not meeting those goals had a bearing on his salary. He was very much informed about incidents that had occurred, and his involvement was readily apparent’



Active Involvement of each Individual in the Workplace

- Each person in UNIMAS contributes to the consideration of safety at every level of the work environment.
- Employees are often those closest to the hazard, and have the most first-hand knowledge of workplace hazards.
- Often times, safety ideas coming from the worker are easy to apply, inexpensive, and effective, and result in greater productivity.
- If employees own the safety initiative, chances are, they will commit to it long term.
- Employees must believe that they also are responsible for their safety
- Employees must be provided with the training, tools, and the necessary authority to act.



Active Involvement of each Individual in the Workplace

- Examples of effective employee involvement include participation in:
 - Incident investigations
 - Procedure development
 - Safety and health audits or surveys
 - Development and implementation of safety and health training.
 - Job safety analysis.
 - Safety and health committee/team involvement.
 - Recommendations for specific actions in response to employee safety suggestions.
 - Problem-solving techniques to seek solutions to identified safety and health problems

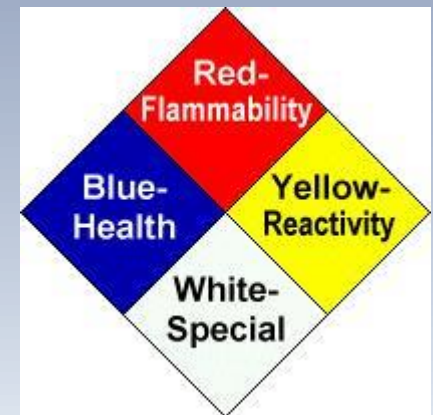


Effective Communication through Consultation

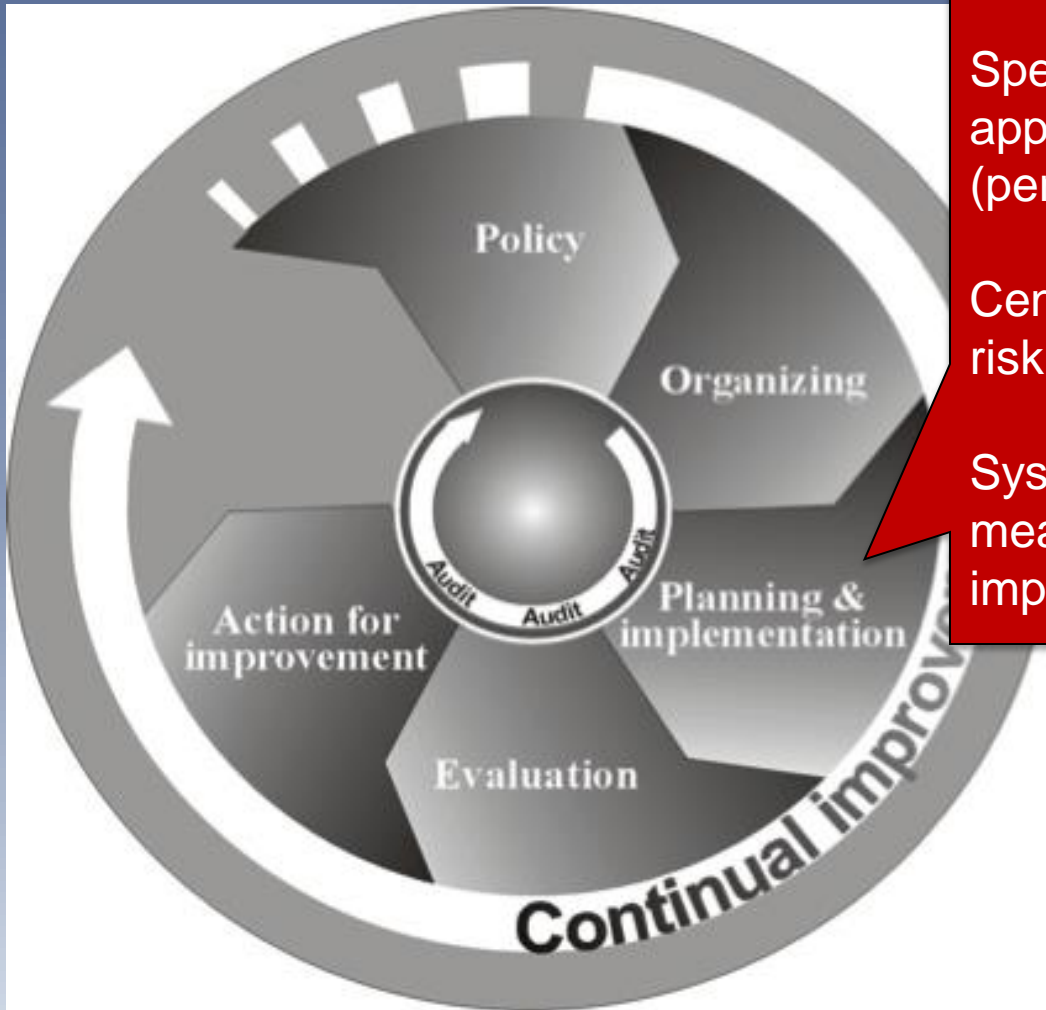
- Consultation means to appropriately invite and consider employees responses.
- Involving staff at all levels in the consultation process allows for ownership of risk identification and treatment of those risks.
- It encourages endorsement for the process and the outcome.
- Establish a framework that allows for active communication between all parties so that:
 - Different points of view can be presented
 - All views can be considered before decisions are made, and
 - There is room for negotiation about the different points of view with the aim of achieving resolution of any dispute

Provision of Appropriate Information, Education and Training

- Employers should consult with their employees about the necessary information and training they require to undertake their work safely.
- Safety is a subject in induction training for new employees.
- Refresher training in safety so that employee are aware of any changes in the safe work procedure.
- Safety information is embedded everywhere (in procedures, in brochures, in posters, in minutes of meeting, signages etc)
- Employees can access hazard information at any time (i.e. Material Safety Data Sheet or Job Safety Analysis)



Key Elements Of HSMS



Specification of standards to be applied in all aspects of work (performance standard)

Central to this idea is the concept of risk assessment.

Systems of work and control measures identified, planned and implemented.

Hazard Identification, Risk Assessment and Risk Control at Workplace Level



Step 1
Identify the hazards



Step 2
Decide who might be harmed and how



Step 3
Evaluate the risks and decide on precautions



Step 4
Record your findings and implement them



Step 5
Review your assessment and update if necessary

Some Definition

- A hazard is anything that may cause harm.
- Risk is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
- A risk assessment is a careful examination of what, in your work, could cause harm to people, so that you can weigh up whether you have taken enough precautions or should do more to prevent harm.
- Workers and others have a right to be protected from harm caused by a failure to take reasonable control measures.



Objective Of Risk Assessment

- To provide employees with sufficient knowledge, awareness and understanding of the risks from hazards, to which they are exposed to.
- To provide a basis for identifying, evaluating, defining and justifying the selection (or rejection) of control measures for eliminating or reducing risk.
- To lay the foundations for demonstrating that the risks have been reduced to a level that is as low as reasonably practicable (ALARP).
- To provide the specific information required by the regulations.

Identify The Hazard

Can be seen/easy to anticipate

- Protruding nail on the floor
- Moving object/vehicle
- Rotating parts of a machine
- Fire or Smoke
- Falling objects
- Sharp objects

Unseen/Difficult to anticipate

- Pressure
- Radiation
- Gas/Vapor
- Electricity
- Heat
- Chemical hazard
- Pathogens
- Stress
- Noise & Vibration
- Stored energy



How Do We Identify The Hazards?

- There are many ways:
 - By observing (usually through inspection process)
 - By analyzing (planning a job/watching a worker doing the work)
 - Job Safety Analysis (simple)
 - HAZOP, FTA (more complex)
 - Check the regulations, guidelines, technical standards & codes of practice
 - Check manufacturer or supplier information
 - Refer past incident data



Some Significant Hazards at UNIMAS

- Fire (especially at east campus)
- Use of chemicals
- Use of pressurized equipment (boiler)
- Use of lifting equipment
- Working at heights
- Biological hazard (exposure to pathogens)
- Steam, heat (auto clave, working outdoor)
- Violence (during travel, out of campus work, dealing with students or public)
- Use of substances (drugs, alcohol etc)
- All kinds of hazards related to construction
- Mechanical hazard (pinch, cut, entangled in machines)
- Manual handling



Identifying Population At Risk

- Who are the group of people exposed to hazards?
 - Mainly workers are exposed, but there may be others such as:
 - Visitors (parents, families of students or employees)
 - Students
 - Contractors in close vicinity
 - Maintenance staff
 - Cleaners
 - Members of the public
 - Are there vulnerable people?
 - Young workers
 - New and expectant mother
 - Aged employees
 - Lone worker
 - Physically-challenged individual
 - Hyper-sensitive individual

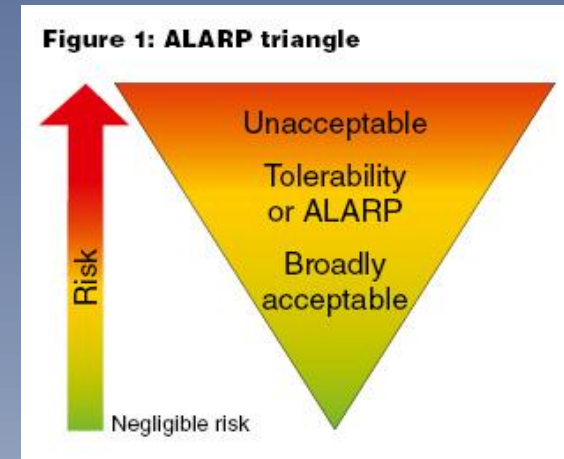


Identifying Population At Risk

- Different group of people may be exposed by different means.
- This is true especially for chemical and biological hazards which require slightly more complex risk assessment due to the diversity of factors involved.
 - There may be contract workers lifting heavy construction materials during a renovation of college building, but there are also students going through the area at different point of time.
 - Both these group of people have different risk level, but they are at risk nonetheless.
 - During risk assessment, the manner in which different group of people is exposed to hazards must be described.

The ALARP Principle (As Low As Reasonably Practicable)

- The ALARP requires “every employer to ensure, so far as is reasonably practicable, the health, safety and welfare of all his employees”.
- This remains the basis of the approach for risk management in Malaysia, and in many other parts of the world.
- Employers are required to adopt safety measures unless the cost (in terms of money, time or trouble) is grossly disproportionate to the risk reduction.
- Once all such measures have been adopted, the risks are said to be ALARP.



Criteria For A 'Suitable And Sufficient' Risk Assessment

- **Sufficient** means that the risk assessment are adequate to show that risks are ALARP, and do not require further elaboration.
- **Suitable** means that the risk assessment technique chosen should be appropriate to the assessment being made.

Forms of Risk Assessment

Qualitative

Semi-
Quantitative

Quantitative

Qualitative Approach

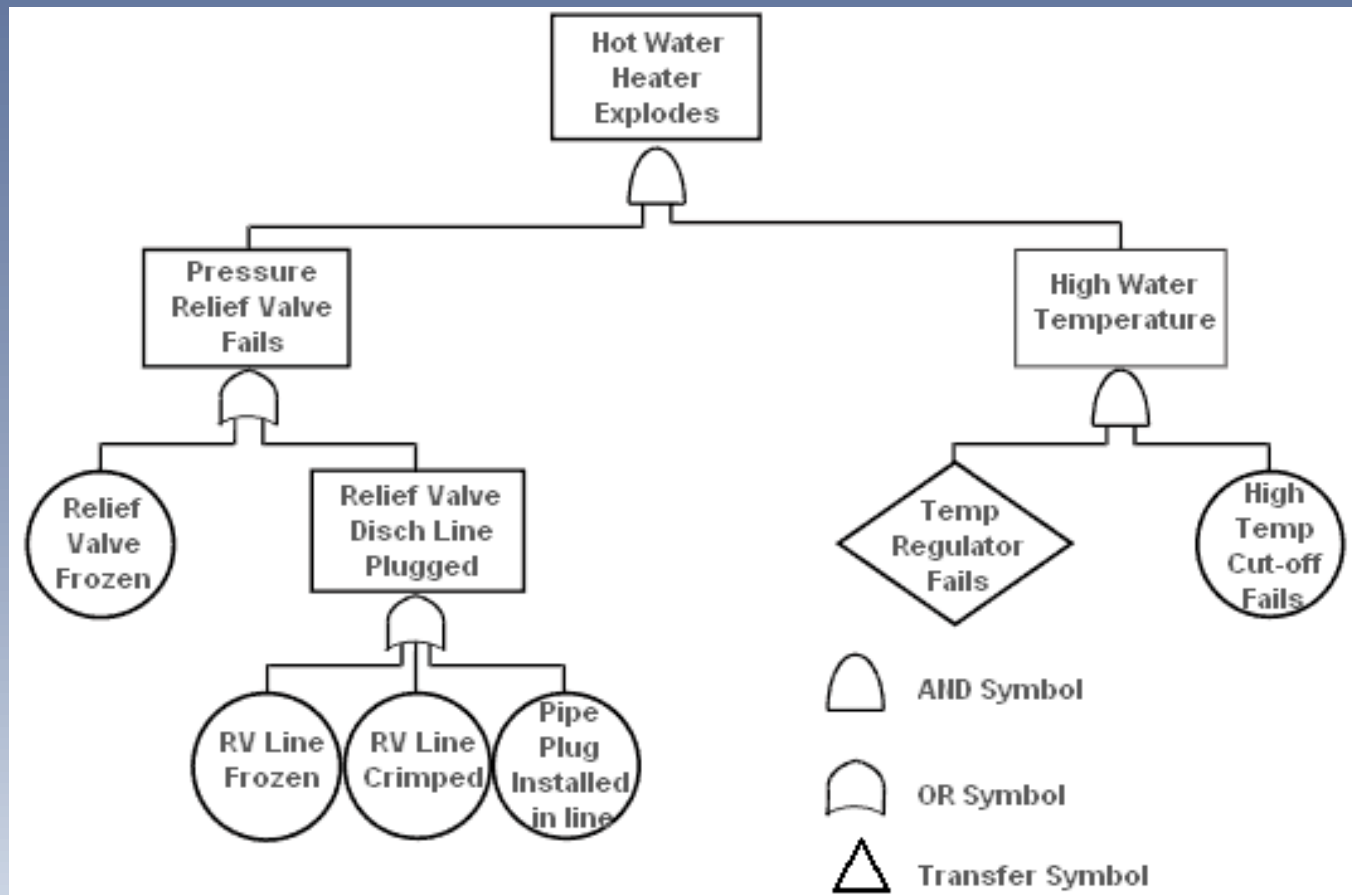
		Severity of Harm			
		Minor	Moderate	Major	Extreme
Likelihood	Very Unlikely	Low	Low	Medium Risk	Medium Risk
	Unlikely	Low	Medium Risk	Medium Risk	Medium Risk
	Likely	Medium Risk	Medium Risk	Medium Risk	High Risk
	Very Likely	Medium Risk	Medium Risk	High Risk	High Risk

Semi-Quantitative Approach

		Severity of Harm			
		Minor 1	Moderate 2	Major 3	Extreme 4
Likelihood	Very Unlikely 1	1	2	3	4
	Unlikely 2	2	4	6	8
	Likely 3	3	6	9	12
	Very Likely 4	4	8	12	16

Quantitative Approach

Fault Tree Analysis



QRA - HAZOP

Project: Tutorial.hazx - Hazop+ 2008

File Edit Tools Window Help

Hazop Study Delete Autofit Columns Autofit Rows Record Up Record Down Spelling Help

Allow editing of all sessions Cell edit: On entry On key press or mouse click Font size: - +

Session: Preliminary Session Node: <All Nodes> Deviation: [dropdown]

Nodes	Deviations	Likelihood	Severity	Cost Ranking	Causes	Consequences
Process fluid line	Reverse process fluid flow	Remote	High	Medium	1 Failure of pressure fluid inlet valve	1 Production loss
Cooling water line	No cooling water flow	Remote	Moderate	Low	1 Failure of cooling water valve to open	1 Temperature increase 2 Crack
Cooling water line	Less flow of cooling water	Remote	Moderate	Low	1 Pipe blockage	1 Temperature increase 2 Crack
Cooling water line	Less flow of cooling water	Occasional	Moderate	Low	2 Pipe leakage	1 Temperature increase 2 Crack
Cooling water line	More flow of cooling water	Occasional	Minor	Low	1 Failure of cooling water valve to close	1 Temperature decrease
Heat Exchanger tube	More pressure on tube side	Occasional	Critical	Unacceptable	1 Failure of pressure fluid inlet valve	1 Bursting
Heat Exchanger tube	Contamination of process fluid	Remote	High	Medium	1 Leakage of tube and cooling water goes in	1 Contamination
Heat Exchanger tube	Corrosion of tube	Probable	Moderate	Medium	1 Hardness of cooling water	1 Temperature increase 2 Crack

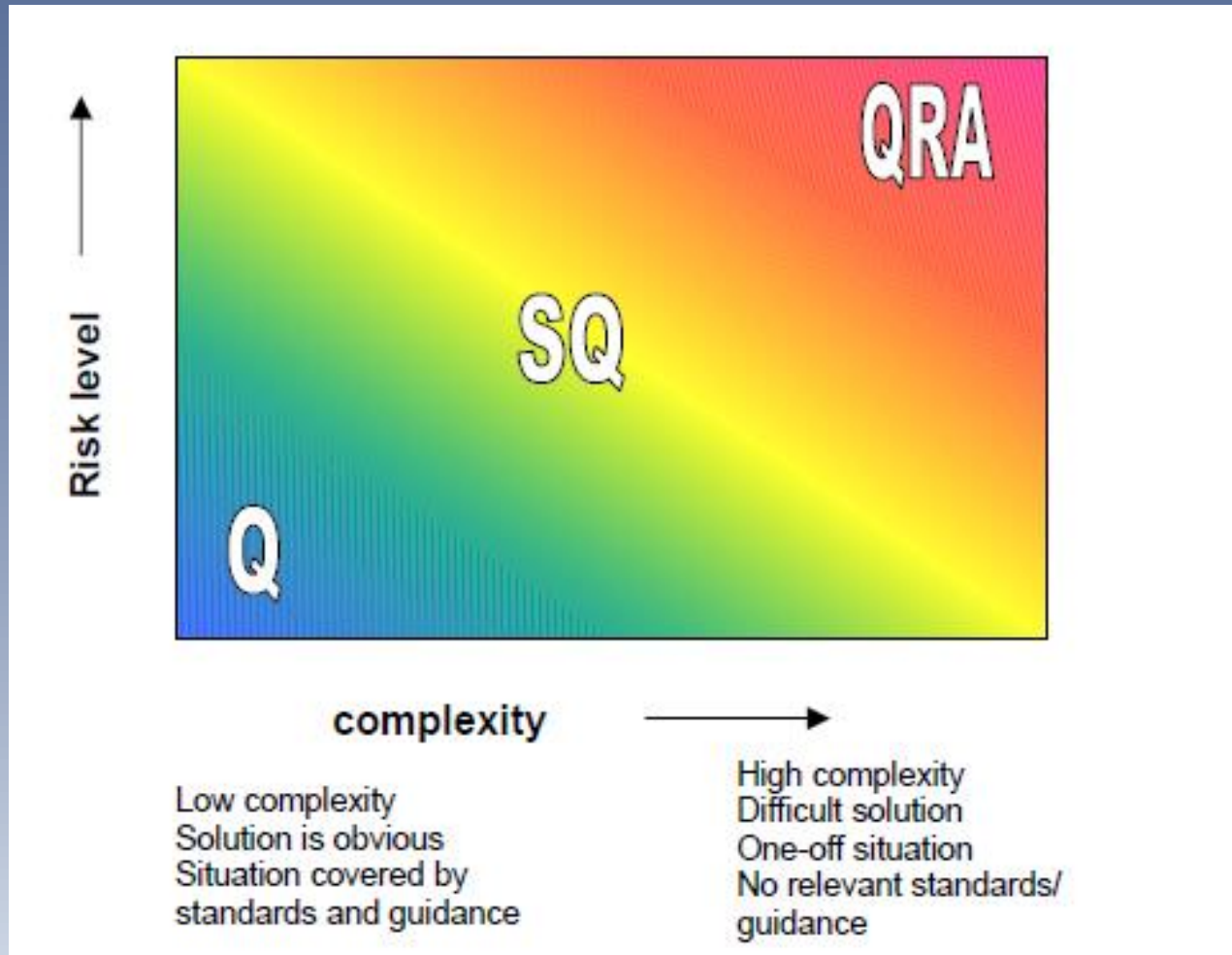
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Failure Mode, Effects & Criticality Analysis

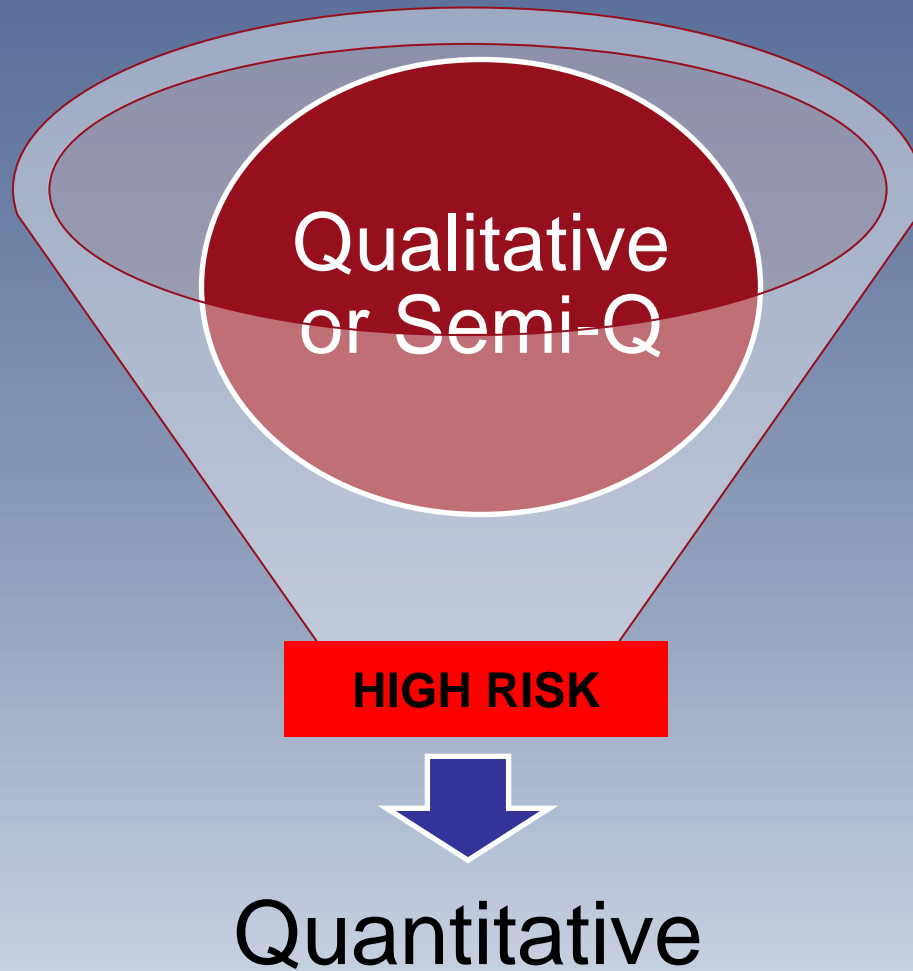
FMECA WORKSHEET

Components	Failure Mode	Effect of Failure	Sev Eff	Causes of Failure	Current Controls	Prob Occ	Prob Det	RPN	Preventive Action	Re-Eval Date	Prob Occ	Sev Eff	Prob Det	RPN
1 Spindle nut	Loose threads	Won't mate w/ threaded spindle	3	Poor mfg; mechanical wear	Test prototype; visual inspection	3	1	9	No need					
	Out of specs sync holes	Won't mate w/ spanner	5	Poor mfg & design	Test prototype	2	1	10	No need					
2 Hex nuts (large & small)	Loose threads	Won't mate w/ threaded spindle	3	Poor mfg; mechanical wear	Test prototype; visual inspection	3	1	9	No need	Replaced with ____				
3 Threaded spindle	Loose threads	Won't mate w/ nuts	3	Poor mfg; mechanical wear	Test prototype; visual inspection	3	1	9	No need					
	Out of specs end piece	Won't mate w/ connecting rod	7	Poor mfg	Visual inspection; caliper	3	1	21	No need					
	Out of specs end piece hole	Won't mate w/ connecting lock	8	Mechanical wear	Visual inspection	3	1	24	Create matrix of inter-relationship					
4 Sliding carriage	U/S dia of sliding carriage hole	Won't mate w/ threaded spindle	8	Poor mfg & design	Caliper	1	1	8	Create matrix of inter-relationship					
	Sliding carriage arm breakage	Won't hold the clamp feature	8	Poor welding & design	Test prototype; visual inspection	4	2	64	Improve welding	6/24/09	2	8	2	32
	U/S dia of sliding carriage arm	Breakage	8	Poor design	Test prototype; caliper	3	2	48	Finite Element Analysis	6/24/09	2	8	2	32
5 Tightening nuts	Loose threads	Won't mate w/ clamp rod	3	Poor mfg; mechanical wear	Test prototype; visual inspection	3	1	9	No need					
6 Sliding sleeves	U/S dia	Won't mate w/ clamp rod & connecting rod	8	Poor mfg & design	Caliper	1	1	8	Create matrix of inter-relationship					
7 Connecting lock	Breakage	Lost connection w/ clamp feature	8	Poor welding	Test prototype	3	2	48	Improve welding	6/24/09	2	8	2	32
	Loose threads	Won't lock rod & spindle	3	Poor mfg	Test prototype; visual inspection	3	1	9	No need					
	U/S threaded part	Won't lock rod & spindle	8	Poor mfg	Caliper	2	1	16	Create matrix of inter-relationship					
	U/S adjusting part	Difficulty in locking	2	Poor mfg & design	Visual inspection	1	1	2	No need					

Which One Should We Use?



Tiered Approach



Formula To Calculate Risk (Quali & Semi-Quan)



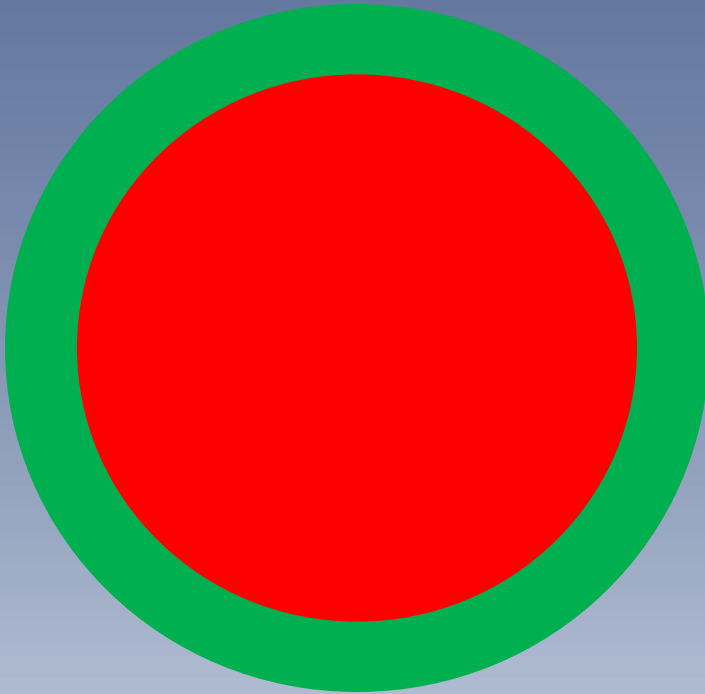
What is Likelihood?

- The state or fact of something's being likely; probability
- The chance of something happening.
- High chance? Low chance?

Score	Rating
5	Expected
4	Highly likely
3	Likely
2	Not likely
1	Slight

What is Likelihood?

Someone is playing dart. What is the likelihood of hitting bullseye?



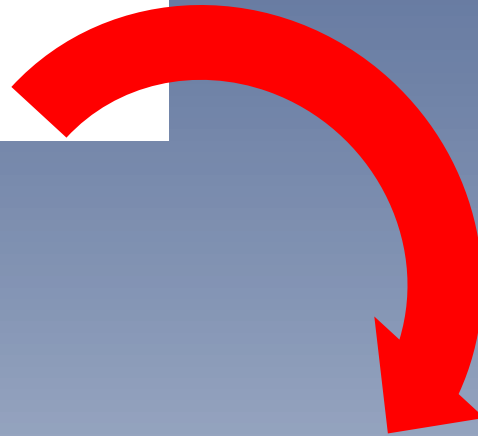
HIGHLY LIKELY

If:

- The player is not blind, or vision impaired or drunk etc.
- The player knows how to play dart
- The person is not too far away from the target
- The dart is a real dart

This is what we call as 'under normal circumstances'

What is the likelihood of crashing?



Likelihood is very unlikely, based on past accident data, on the assumption that weather is good, the pilot is fit, healthy, trained and experienced, and the helicopter is in good condition

What is Severity of Harm?

degree of something undesirable



**What would
happen to
him?**

Severity of Harm

What would happen to him?	Type	Level	Classification
Scratches/small wound	Injuries	Least	Minor
Big wound/ Laceration	Injuries		Moderate
Loss of bodily function (temporary)	Disability		Moderate
Loss of bodily function (permanent)	Disability		Major
Lose parts of his body	Disability		Major
Lose his life	Death	Worst	Extreme

Determining Risk Result

		Severity of Harm			
		Minor 1	Moderate 2	Major 3	Extreme 4
Likelihood	Very Unlikely 1	1	2	3	4
	Unlikely 2	2	4	6	8
	Likely 3	3	6	9	12
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Interpreting Risk Result

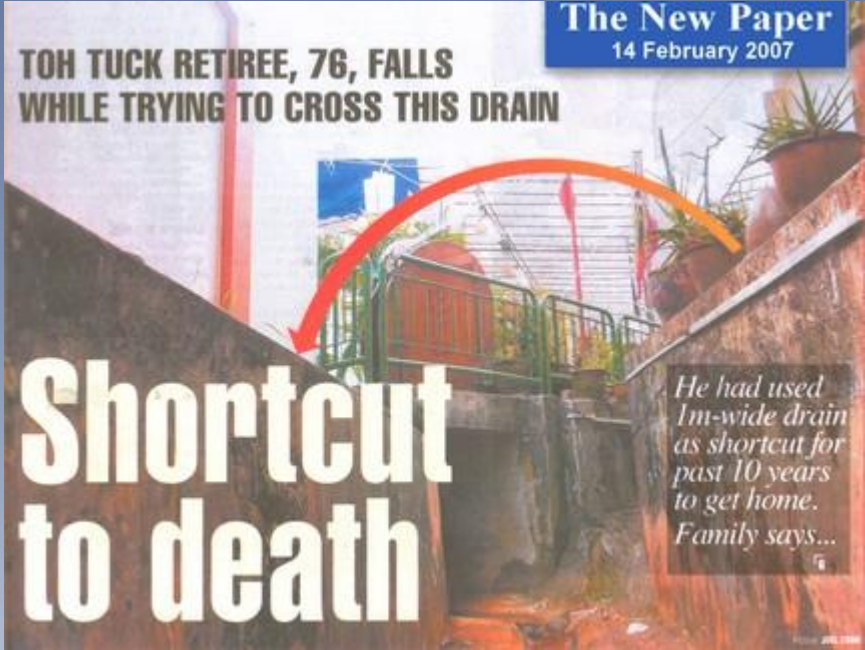
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Likelihood	Very Unlikely 1	1	2	3	4
	Unlikely 2	2	4	6	8
	Likely 3	3	6	9	12 ?
	Very Likely 4	4	8	12	16

Interpreting Risk Result

Number	Color	Term	Tolerability	Action Plan
1-2	Green	Low Risk	Acceptable	No additional controls are required. Monitoring is required to ensure that the controls are maintained.
3-9	Yellow	Medium Risk	Tolerable	Efforts should be made to reduce the risk, but the costs of prevention should be carefully measured and limited. Risk reduction measures should be implemented within a defined time period.
12-16	Red	High Risk	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.

Risk assessment of man planning to cross drain

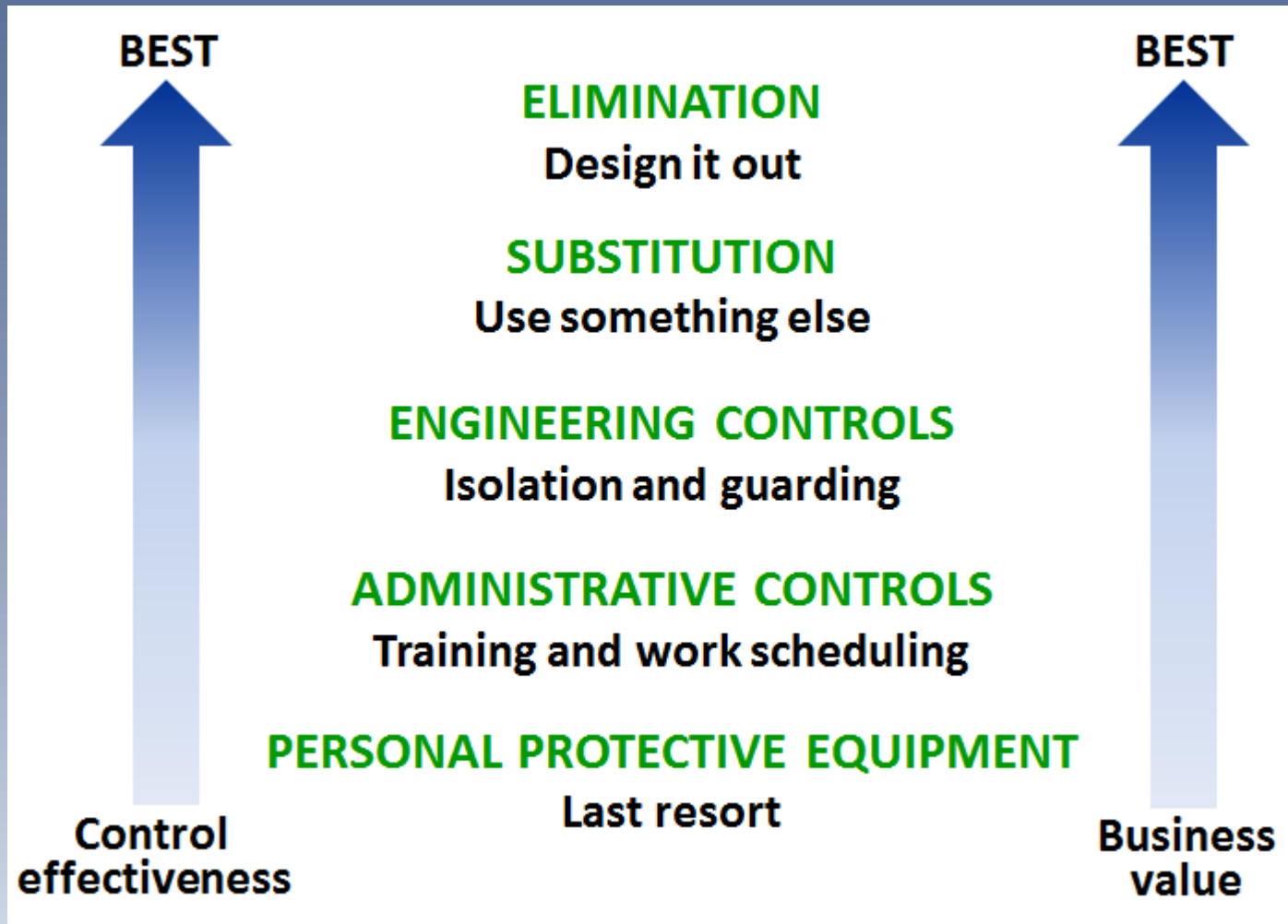
nk	Low Likelihood w = 500mm	Medium Likelihood w = 1m	High Likelihood w = 2m
High Severity d = 2m			
Medium Severity d = 1m			
Low Severity d = 50mm			



Risk Control Action Plan

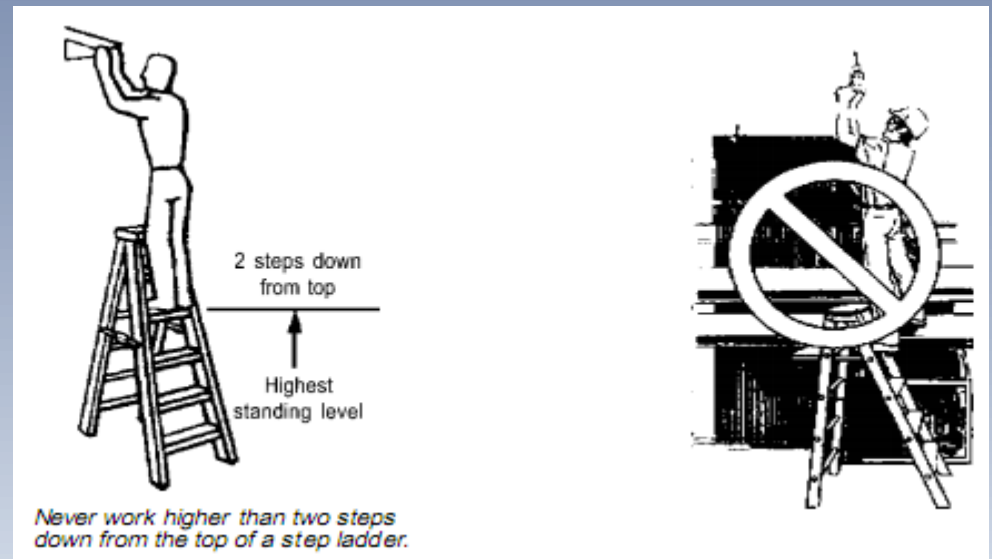
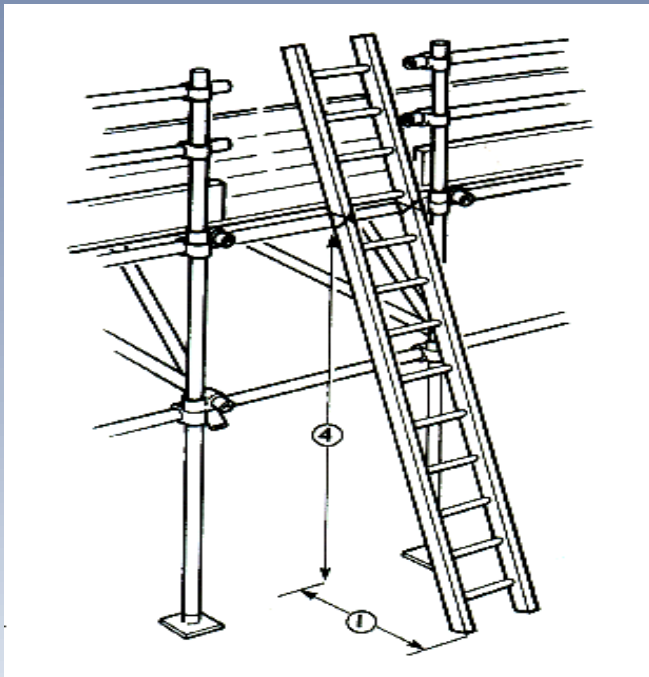
- Risk level form the basis for deciding whether improved controls are required and the timescale for action.
- The outcome of a risk assessment should be an inventory of actions, in priority order, to devise, maintain or improve controls.
- The action plan should be reviewed before implementation, typically by asking:
 - Will the revised controls lead to tolerable risk levels?
 - Are new hazards created?
 - Has the most cost-effective solution been chosen?
 - What do people affected think about the need for, and practicality of, the revised preventive measures?
 - Will the revised controls be used in practice, and not ignored in the face of, for example, pressures to get the job done?

The Hierarchy Of Control



Performance Standard

- It is usually embedded in the rules or procedures of doing work.
- Take for example: using a ladder, performance standard may indicate a worker to:
 - Use a specified ladder that suitable for the type of work
 - Setting up the ladder according to safety rules such as below:



Safety Critical Elements & Performance Standard

- Safety critical elements (SCEs) are those systems and components (e.g. hardware, software, procedures etc.) that are designed to prevent, control, mitigate or respond to a major accident event (MAE) that could lead to injury or death.
- A good example is the Fire Protection system in a building such as sprinklers, detectors, fire panel, etc.
- Management of the identified SCEs ensures that the safety barriers are in place and functional.

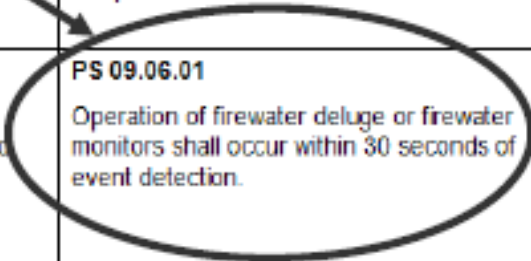
Performance Standard

- When SCEs are identified, Performance Standards (PS) for each SCE needs to be defined.
- Is the performance required by the SCE for managing hazard in terms of:
 - Functionality - How does an SCE achieve its goal, what must it actually do.
 - Availability - When would the SCE be required to function
 - Reliability - What's the failure rate like for the SCE
 - Survivability - Will it work when required
 - Interaction/Dependency - Which other system are required to work before SCE do.

Performance Standard

FUNCTIONALITY				
Ref	Function	Criteria	Objective Evidence and Activities	ICP
09.05	<p><u>Fixed water spray (deluge) systems</u></p> <p>Deluge systems shall provide direct application to wellheads and general area coverage where required in other areas.</p>	<p>PS 09.05.01</p> <p>Fixed water spray systems shall be provided to enable general area coverage and direct application to wellheads at a rate commensurate with the hazards identified in each fire zone.</p> <p>(Guidance Notes)</p> <ul style="list-style-type: none"> Deluge systems should be provided, sized in accordance with the requirements of the appropriate safety studies. Where installation of deluge systems is impractical, use of appropriately sized oscillating firewater monitors should be specified. 	<p><u>Design</u></p> <p>D1 Project review of design specifications, Fire Hazards Assessment (Ref 2, Page 45) and drawings.</p> <p><u>Onshore Construction</u></p> <p>C1 Confirm firewater ring main and distribution piping constructed in accordance with design drawings.</p> <p>C2 System performance test to confirm coverage.</p> <p><u>IN SERVICE</u></p> <p>IS1 SAP Ref: BUIN420 DELUGE SKID DRY TEST 3 Monthly</p> <p>IS2 SAP Ref: BUIN421 DELUGE SKID WET TEST 12 Monthly</p> <p>IS3 SAP Ref: BUIN424 FIRE MONITOR OSCILLATING CHECKS 3 Monthly</p>	R I T T T
09.06	<p><u>Fixed water spray (deluge) systems</u></p> <p>Deluge system shall respond rapidly on demand.</p>	<p>PS 09.06.01</p> <p>Operation of firewater deluge or firewater monitors shall occur within 30 seconds of event detection.</p>	<p><u>HUC</u></p> <p>H1 System performance test to confirm response time.</p> <p><u>IN SERVICE</u></p> <p>IS1 SAP Ref: BUIN421 DELUGE SKID WET TEST 12 Monthly</p> <p>IS2 SAP Ref: BUIN423 OSCILLATING MONITOR FUNCTION TEST 12 Monthly</p>	T T T

Typical Performance Criteria



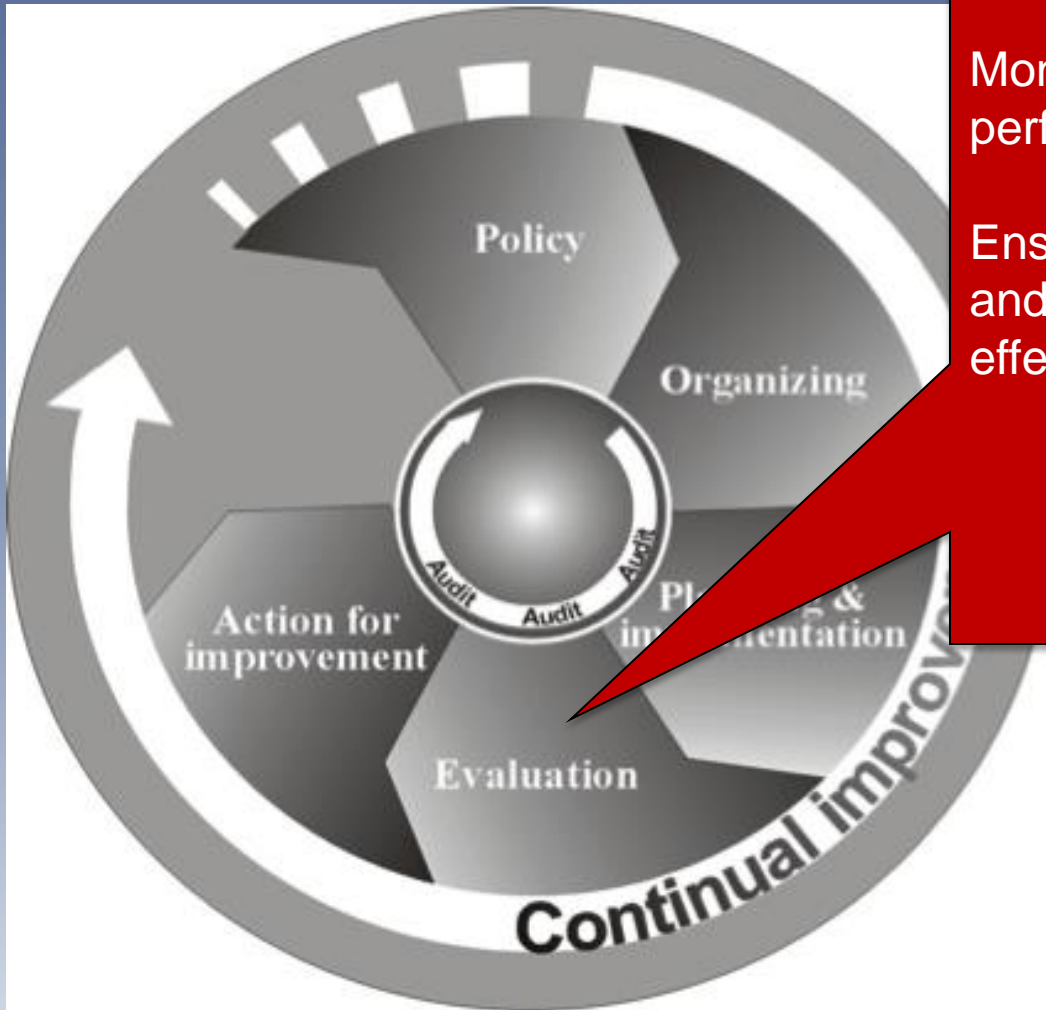
Record Your Findings And Implement Them

- It can be as simple as filling up a form or writing a short report.
- The most important thing is: **Write what you do and do what you write.**
- If you find that there are quite a lot of improvements that you could make, big and small, don't try to do everything at once. Make a plan of action to deal with the most important things first according to risk level.

Review Your Risk Assessment And Update If Necessary

- Few workplaces stay the same. Sooner or later, you will bring in new equipment, substances and procedures that could lead to new hazards.
- It makes sense, therefore, to review what you are doing on an ongoing basis.
- Every year or so formally review where you are, to make sure you are still improving, or at least not sliding back.
- During the year, if there is a significant change, don't wait. Check your risk assessment and, where necessary, amend it.
- If possible, it is best to think about the risk assessment when you're planning your change.

Key Elements Of HSMS



Monitoring, measuring and reviewing performance.

Ensure that the policy, organisations and arrangements are working effectively

Key Elements Of HSMS



Defects identified by the review process must be corrected as soon as possible.

Make adjustments to the policy, organisation and arrangements for implementation.

Key Elements Of HSMS



Identify deficiencies and improve

The performance compared with other organization in order to benchmark progress.

Key Elements Of HSMS



The process of collecting independent information on the efficiency, effectiveness and reliability of the management system in the organisation

The End

Thank You For Your Attention