INTERNATIONAL MINES RESCUE BODY

conference

colombia

2019

MRS Approach to Critical Hazard Management in Mining

IMRB Colombia 2019

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Culture

- **<u>If you cannot mine safely don't Mine</u>**

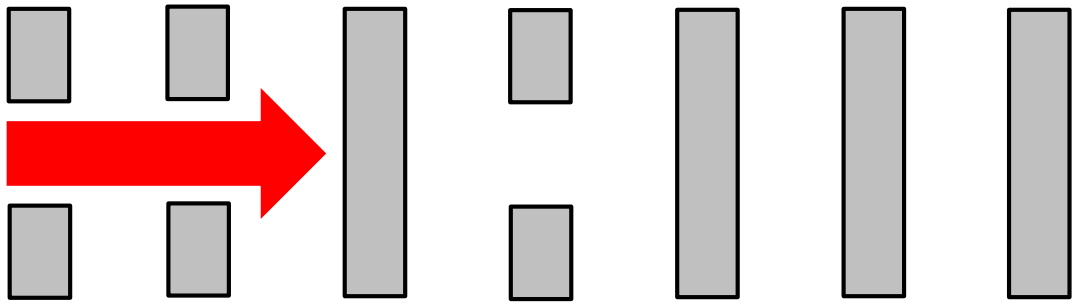
  (Albert Wheeler CBE Deputy Chairman British Coal)

  The point is he meant what he said

  - Starting point: Comply with the relevant legal requirements
  - Realise this is not enough – be proactive
  - Its your mine know your hazards and control them
  - You should understand these better than anyone else
  - Safe production is possible and effective. Believe it
  - Have standards – if you don't measure it you can't improve it

The principle of avoiding incidents

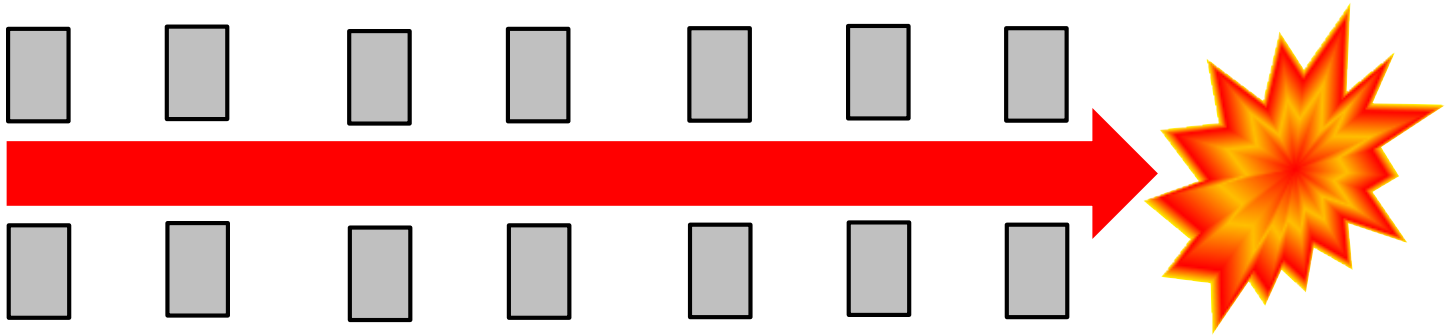
The hazard that we are trying to control



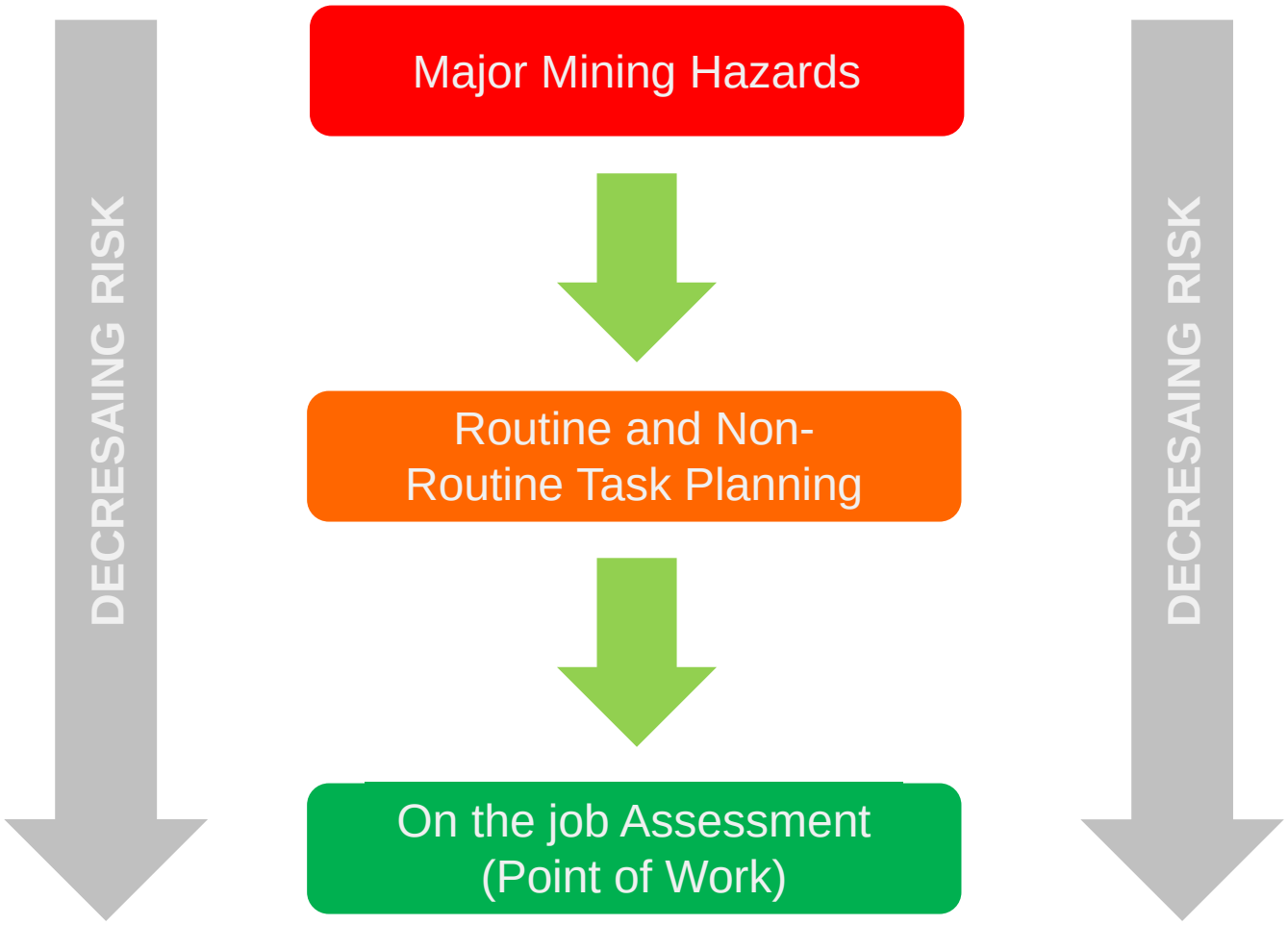
Barriers Work the risk of an incident is reduced

THE RISK | BARRIERS or CONTROLS PUT IN PLACE | ACCIDENT or INCIDENT

The hazard that we are trying to control



Layered approach to risk assessment



What is Major Hazard Assessment About?

Avoiding fatal/ other injuries to employees

Avoiding the loss of expensive assets

Avoiding the deployment of the Rescue Services

About protecting the families from tragedies

TRAINING & RESCUE
Safe in our hands

Highest level –Major Mining Hazard

Major Mining Hazards

Definition; An incident or accident that has the potential for a multiple casualty, multiple fatality outcome or something that would significantly impact the reputation of the business or country

Responsibilities

- The **operator** has the responsibility to consider the issues that may impact the people, the site or the business
- The manager has the responsibility for ensuring that the systems and process are in place and the people are competent to operate these systems
- The **regulator** has the responsibility for assisting the organisation and enforcing the legislative requirements

Examples

Underground

- Fire
- Explosion
- Ground Control (Fall of Ground)
- Inrush
- Transport

Surface

- Shafts
- Surface structures
- Tips and lagoons (land slide)

Mainly design and engineering considerations

Need to consider how they transition to the workplace

Approach to major hazard assessment

Step 1 – Conduct a high level Risk Assessment

Step 2 – Develop the key performance indicators

Step 3 – Work with management to embed

Objective

- To provide a quick impact – see this as the most important step in creating the urgency (consciously incompetent)
- Assist on challenging and changing the thinking of the leadership (senior and middle management levels)
- Developing the questioning and intervention at the leadership level

Step 4 – Review and produce the control documents

Step 5 – Introduce the controls through education

Objective

- Review the procedure and controls to ensure that the outcomes from the bowtie assessment is captured
- Define the roles and responsibility for the key controls
- To provide the training to defined standards
- Develop the leadership/ management and workforce competence

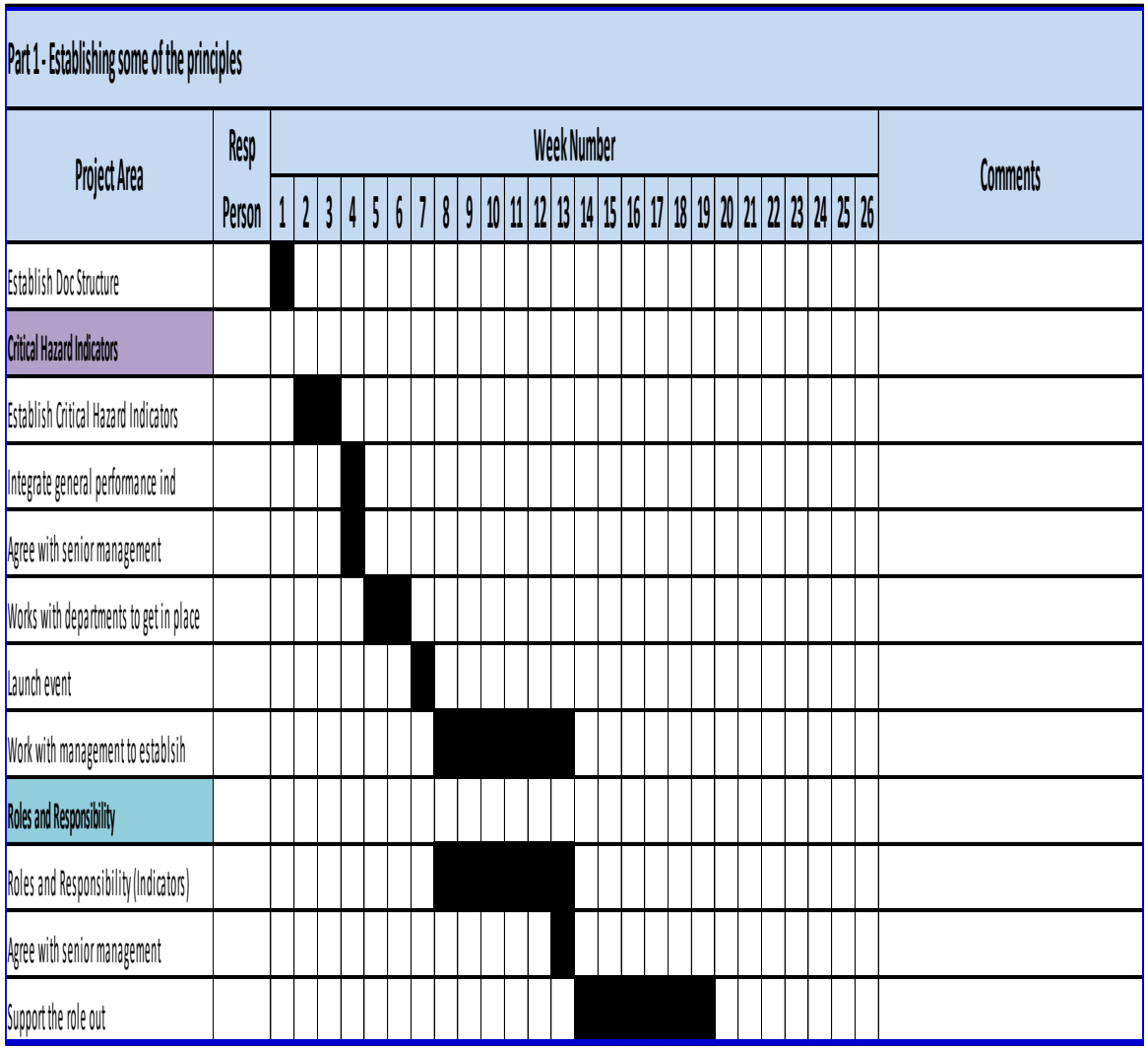
Step 6 – Review and refine the KPI's

Step 7 – Audit the system

Objective

- To refine the controls using observation and inputs from managers and workforce
- To audit and review the effectiveness of the system

Steps 1 -3 - Create the sense of urgency



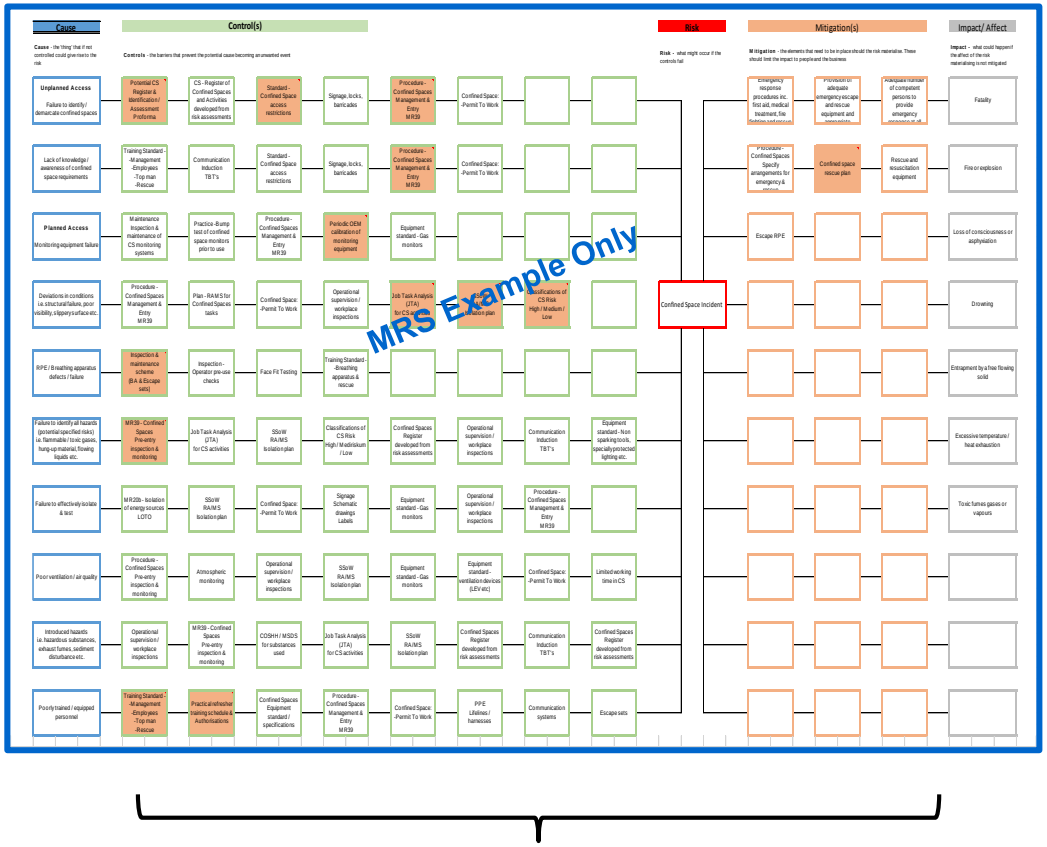
Part 1- Includes Steps 1 – 3

- Developing the position of consciously incompetent (know what we don't know)
- Developing the imperative for change
- An assessment of the risk
- The generation of major hazard (and if appropriate fatal hazard indicators)
- The role out and support in to the organisation
- The generation of roles and responsibility for the gathering of information and the forming of reports

Major Hazards – Management Control

Basic Bowtie Diagram

CAUSE CONTROL RISK MITIGATION AFFECT



The controls and mitigations have to be built in to the safety management system and company procedures

Bow Tie

- Use a basic bowtie for the initial analysis
- Use knowledge that the business has already developed
- Use control documents that are already in place
- Identify clearly
  - **Risk** – what is it that the process aims to control
  - **Cause** – the thing that might result in the risk materialising
  - **Controls** – the things that need to be in place to prevent the risk from being realised
  - **Mitigations** – the things that stop the situations from developing further
- Use the information to form the key performance indicators

Major Hazards– Management Control

Fatal Hazard Standard

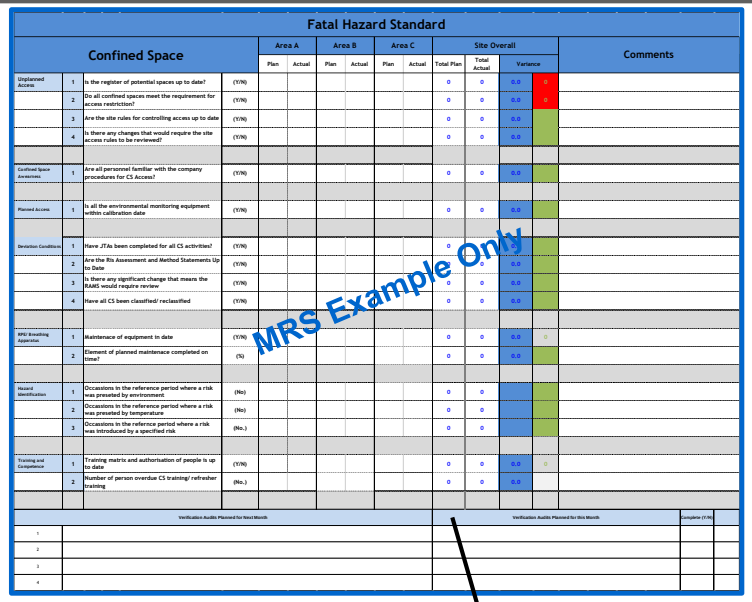
Confined Space				Area A		Area B		Area C		Site Overall				Comments
				Plan	Actual	Plan	Actual	Plan	Actual	Total Plan	Total Actual	Variance		
Unplanned Access	1	Is the register of potential spaces up to date?	(Y/N)							0	0	0.0	0	
	2	Do all confined spaces meet the requirement for access restriction?	(Y/N)							0	0	0.0	0	
	3	Are the site rules for controlling access up to date	(Y/N)							0	0	0.0		
	4	Is there any changes that would require the site access rules to be reviewed?	(Y/N)							0	0	0.0		
Confined Space Awareness	1	Are all personnel familiar with the company procedures for CS Access?	(Y/N)								0	0.0		
Planned Access	1	Is all the environmental monitoring equipment within calibration date	(Y/N)							0	0	0.0		
Deviation Conditions	1	Have JTAs been completed for all CS activities?	(Y/N)							0	0	0.0		
	2	Are the Ris Assessment and Method Statements Up to Date	(Y/N)							0	0	0.0		
	3	Is there any significant change that means the RAMS would require review	(Y/N)							0	0	0.0		
	4	Have all CS been classified/ reclassified	(Y/N)							0	0	0.0		
RPE/ Breathing Apparatus	1	Maintenace of equipment in date	(Y/N)							0	0	0.0	0	
	2	Element of planned maintenace completed on time?	(%)							0	0	0.0		
Hazard Identification	1	Occassions in the reference period where a risk was preseted by environment	(No)							0	0			
	2	Occassions in the reference period where a risk was preseted by temperature	(No)							0	0			
	3	Occassions in the refernce period where a risk was introduced by a specified risk	(No.)							0	0			
Training and Competence	1	Training matrix and authorisation of people is up to date	(Y/N)							0	0	0.0	0	
	2	Number of person overdue CS training/ refresher training	(No.)							0	0	0.0		

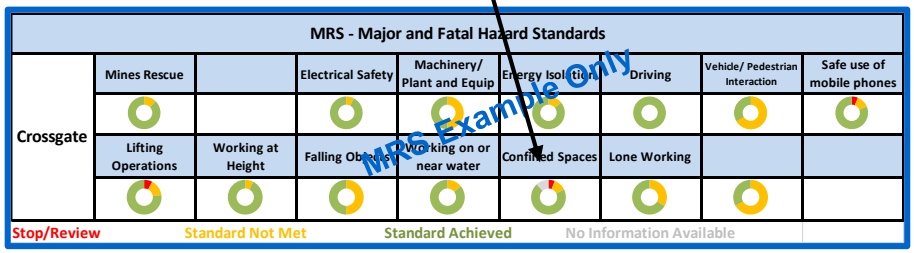
	Verification Audits Planned for Next Month	Verification Audits Planned for this Month	Complete (Y/N)	
1				
2				
3				
4				

Key Performance Indicators

- From the bowtie the critical control barriers are defined
- From the bowtie the critical mitigation elements are defined
- Don’t pick everything to be represented in terms of KPIs
- Develop a means of presenting that to the operational teams (and if required an up/ down cascade)
- Work with the operational teams to develop the data/ challenge the data
- To start with we like to see some aspirational elements, things that they don’t do but want to do – provides some goal setting and improvements

Critical Hazards– A high level review





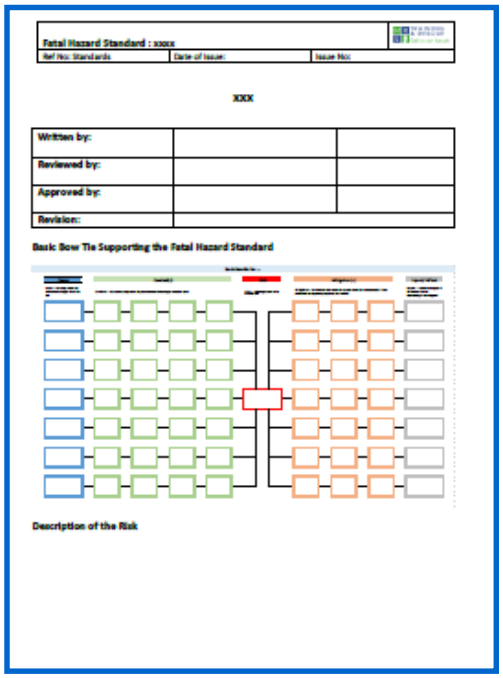
A High Level Summary

- Operational Managers/ Directors can get a quick summary of how their parts of the business are performing
- Questioning can be by exception
- Monitors;
  - **Stop/ Review** – there was an event or condition that resulted in the process/ job or site being stopped to review the situation and put in place revised measures
  - **Standard Achieved** – the site is indicating that the required standards and the performance indicators have been met
  - **Standard Not Met** – the site has failed to achieve this particular part of the performance indicator
  - **No Information Available** – the site has been unable to supply the information for the period

Audit and Review

- Site Managers are responsible for the provision of information
- The information is auditable, and can be reviewed, helps drive the required behaviour

Retaining the corporate memory


Fatal Hazard Standard : xxxx

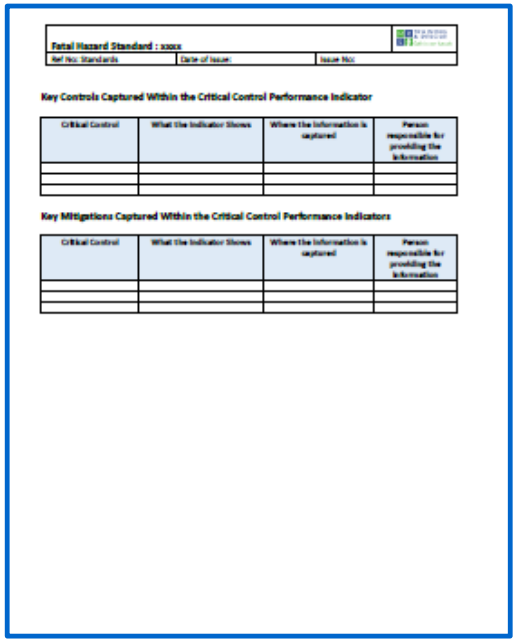
Ref No: Standards | Date of Issue: | Issue No:

xxx

Written by:		
Reviewed by:		
Approved by:		
Revision:		

Basic Bow Tie Supporting the Fatal Hazard Standard

Description of the Risk


Fatal Hazard Standard : xxxx

Ref No: Standards | Date of Issue: | Issue No:

Key Controls Captured Within the Critical Control Performance Indicator

Critical Control	What the Indicator Shows	Where the Information is captured	Person responsible for providing the information

Key Mitigations Captured Within the Critical Control Performance Indicators

Critical Control	What the Indicator Shows	Where the Information is captured	Person responsible for providing the information

Retaining Corporate Memory

- Once the major hazard indicators are developed the process is documented
- Recognise that people and roles change
- A number of key elements is recorded for each or the major hazard indicators:

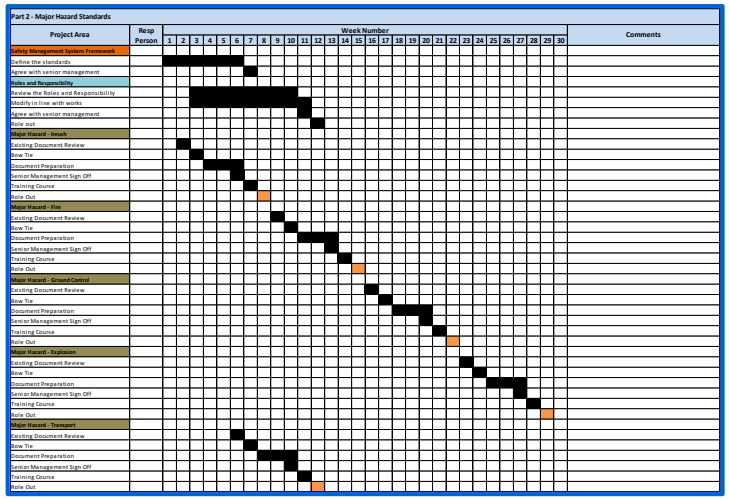
Critical Controls/ Mitigations – from the bowtie, a number of controls and mitigations are identified

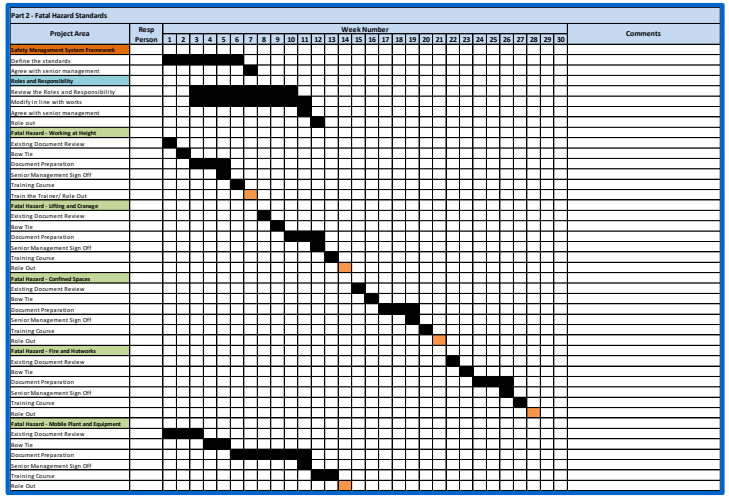
What the Indicator Shows – why was this indicator chosen, what is it designed to record, and what are the potential implications if the control fails

Where the Information is Captured – a reference that assists in maintaining the system for capturing the information

Who is responsible – define the role that is responsible capturing and recording the information that is required

Steps 4 and 5 – Define the standards

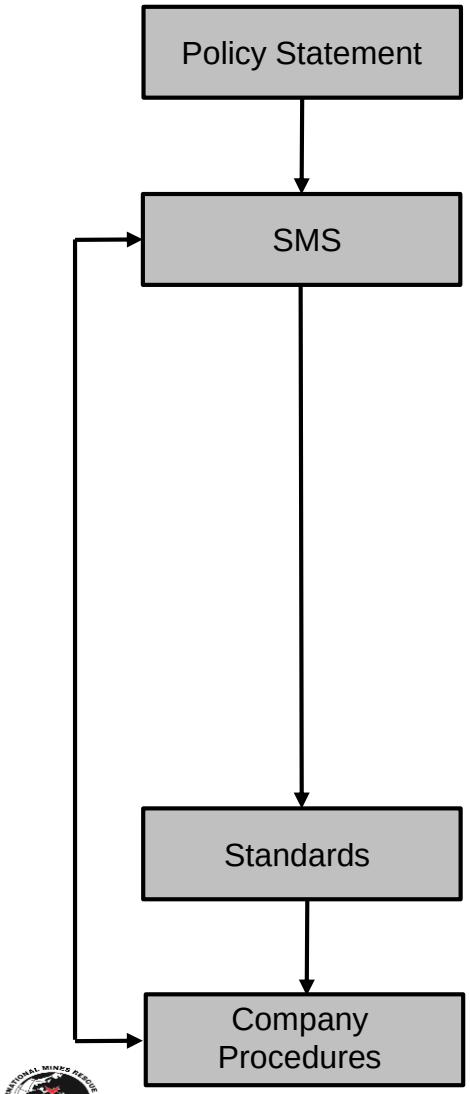




- Consider that there are two areas for consideration depending on the business;
  - **Major Hazards** – these would be the high risk elements that are more traditionally associated with underground operations
  - **Fatal Hazards** – these would be the high risk elements that are more traditionally associated with conventional heavy duty industry

- Within steps 4 and 5, define in detail;
  - **The standards** – how these fit in to the overall safety management system
  - **The controls and mitigations**, and how these flow through the control documents and emergency procedures
  - **The roles and responsibility**, what people are supposed to do at each level of the organisation to ensure that the controls, mitigations and emergency procedures work effectively
  - **Training**, produce a training package and train the trainers to make it repeatable, start to develop the competence against the standard

Introduction of a revised safety management system



Policy Statement, the company statement that makes it publically clear what the aims and objectives are in relation to SHEQ management

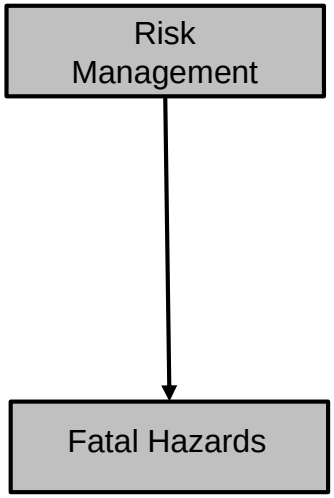
SHEQ Management System, these are the collection of documents that require a number of things. :

- Leadership and Accountability
- Risk Management
- Compliance Assurance
- Objectives, Targets and Performance Management
- Training and Competence
- Communication and Consultation
- Management of Change
- Control of Contractors and Visitors
- Operational Management
- Control of Documents
- Emergency Procedures
- Incident Investigation
- Monitoring Audit and Control
- Environmental Process and Control
- Customer Management

Standards, these consider the risks ranging from individual to fatal risk and aim to put in place key controls

Company Procedure, these are the things that the Company will do to support the delivery of the standards. Sometimes they are not risk related

Development of the fatal hazard standards



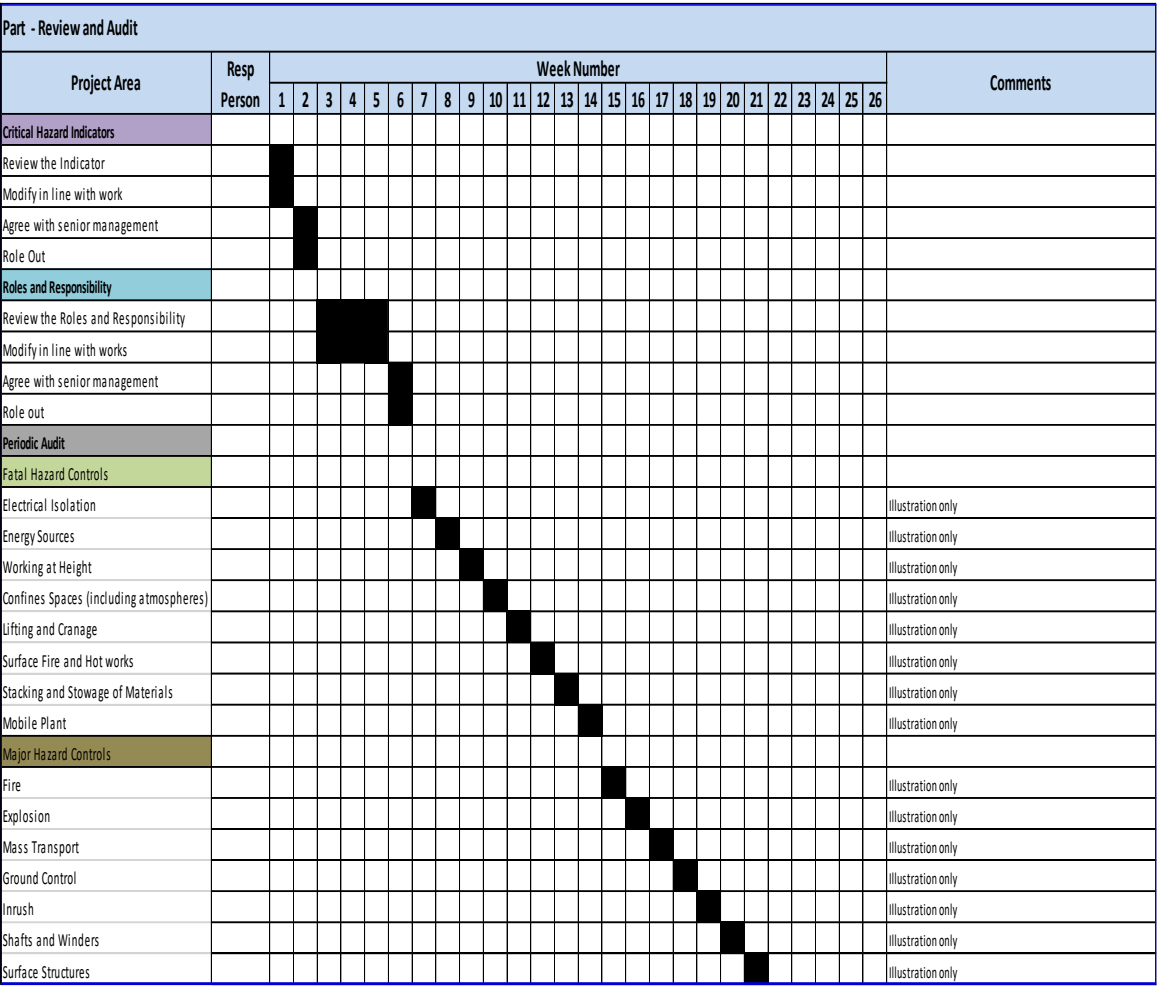
SHEQ Management System, this introduces the concept of **risk management**, and requires to think about it a number of ways:

- **Individual hazard,** day to day activities can be controlled through simple procedures, but is better through on site assessment
- **Task hazards**, these are specific to individual tasks being performed and require the site to think about the risk and put control sin place (e.g. RAMS documents)
- **Fatal hazards**, these are the highest level of risk identified by the Company, and it requires that there be some controls pout in place to manage these types of risk

Fatal hazards, risk that the Company has identified as having the potential for single or multiple casualty or fatality type incidents, which can adversely affect the families and business reputation.

- There are likely to be 10-12 standards, between 1 and two pages maximum
    - Rescue from mines*
    - Confined spaces
    - Use of BA
    - Charging of BA cylinders and use of oxygen
    - Lifting equipment
    - Fall from height
    - Driving
    - Vehicle pedestrian interaction
    - Machinery plant and equipment
    - Electricity
    - Etc.

Steps 6 and 7 – Review and Audit



Part - Review and Audit																											
Project Area	Resp Person	Week Number																									Comments
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Critical Hazard Indicators																											
Review the Indicator																											
Modify in line with work																											
Agree with senior management																											
Role Out																											
Roles and Responsibility																											
Review the Roles and Responsibility																											
Modify in line with works																											
Agree with senior management																											
Role out																											
Periodic Audit																											
Fatal Hazard Controls																											
Electrical Isolation																											Illustration only
Energy Sources																											Illustration only
Working at Height																											Illustration only
Confines Spaces (including atmospheres)																											Illustration only
Lifting and Cranage																											Illustration only
Surface Fire and Hot works																											Illustration only
Stacking and Stowage of Materials																											Illustration only
Mobile Plant																											Illustration only
Major Hazard Controls																											
Fire																											Illustration only
Explosion																											Illustration only
Mass Transport																											Illustration only
Ground Control																											Illustration only
Inrush																											Illustration only
Shafts and Winders																											Illustration only
Surface Structures																											Illustration only

Review

- The review is used in two areas;
  - Major Hazard and Fatal Hazard Indicators, ensuring that these capture all the information from the formation of the standards and the document review
  - An update of the roles and responsibilities to ensure that these are updated to reflect the requirement of the standards

Audit

- Creating a repeatable audit from the stand
- Going in to the workplace and observing the application of the standard
- Making any recommendations for improvements or changes

The link to competence

Step 1 – Conduct a high level risk assessment

Step 2 – Develop the key performance indicators

Step 3 – Work with management to embed

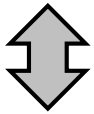
Step 4 – Review and produce the control documents

Step 5 – Introduce the controls through education

Step 6 – Review and refine the KPI's

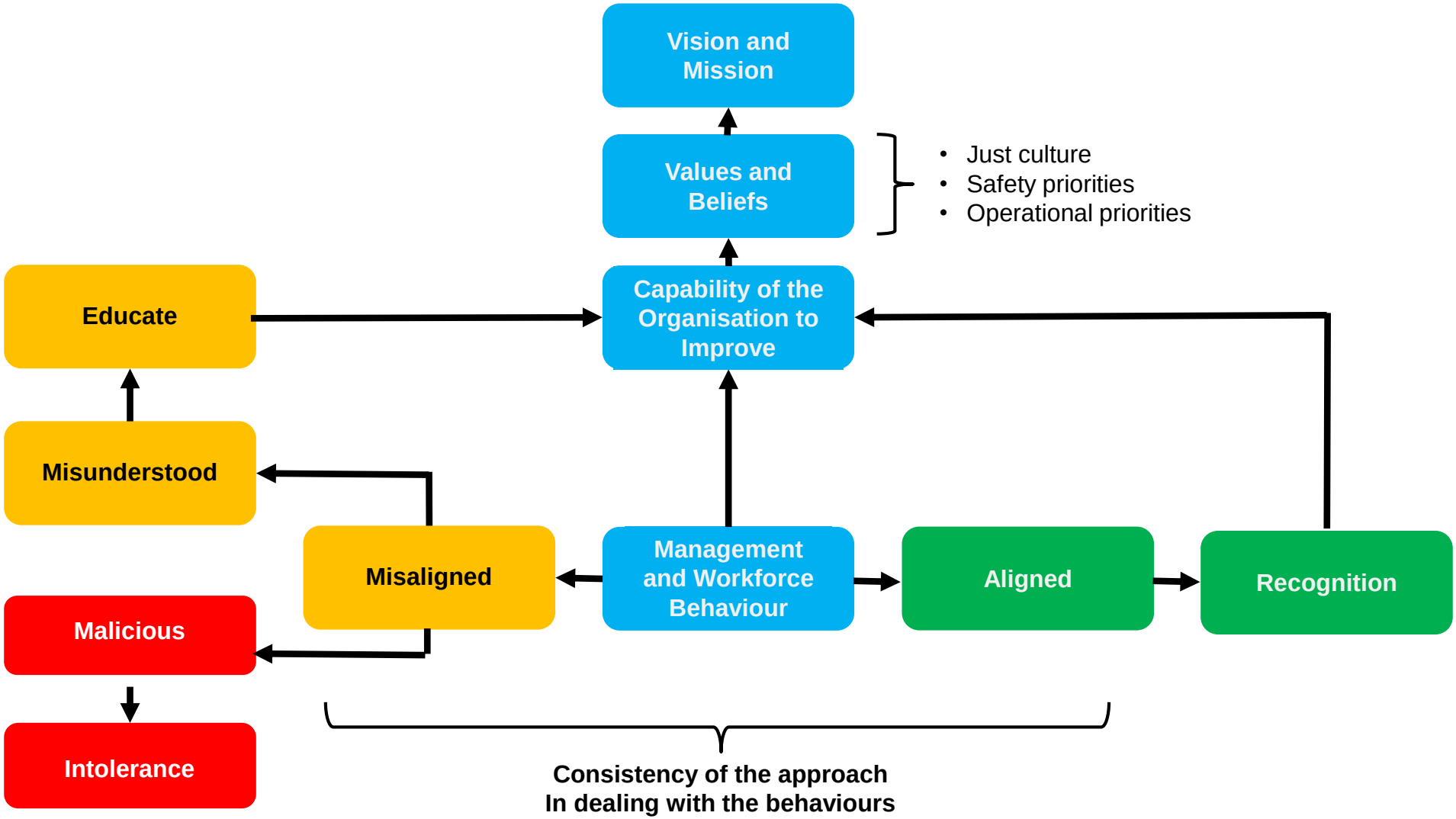
Step 7 – Audit the system

The development of a competency management and assessment system

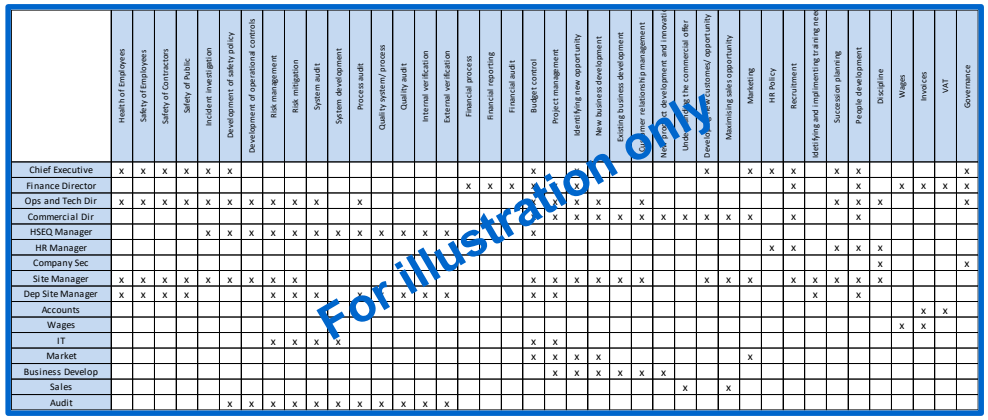


Consider the effectiveness of the competence development

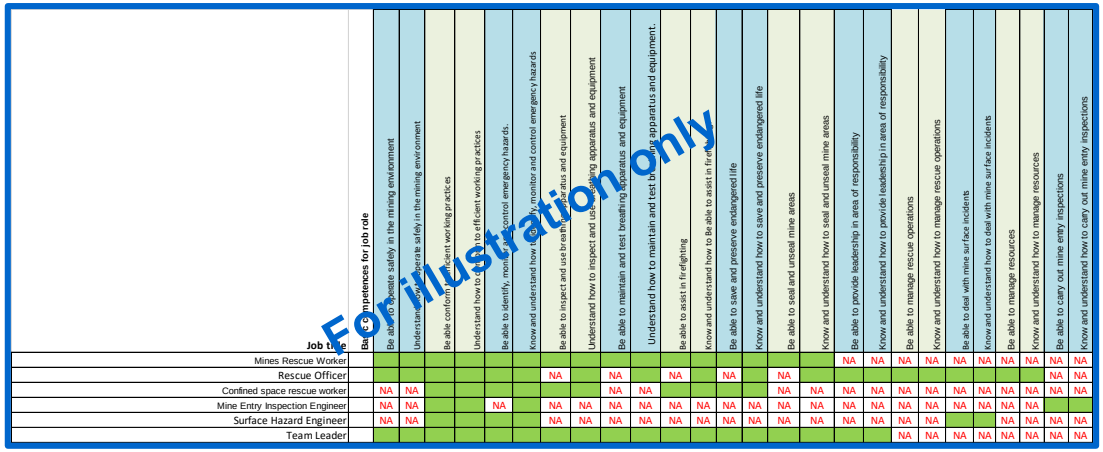
The importance of creating the right behaviour



competency management



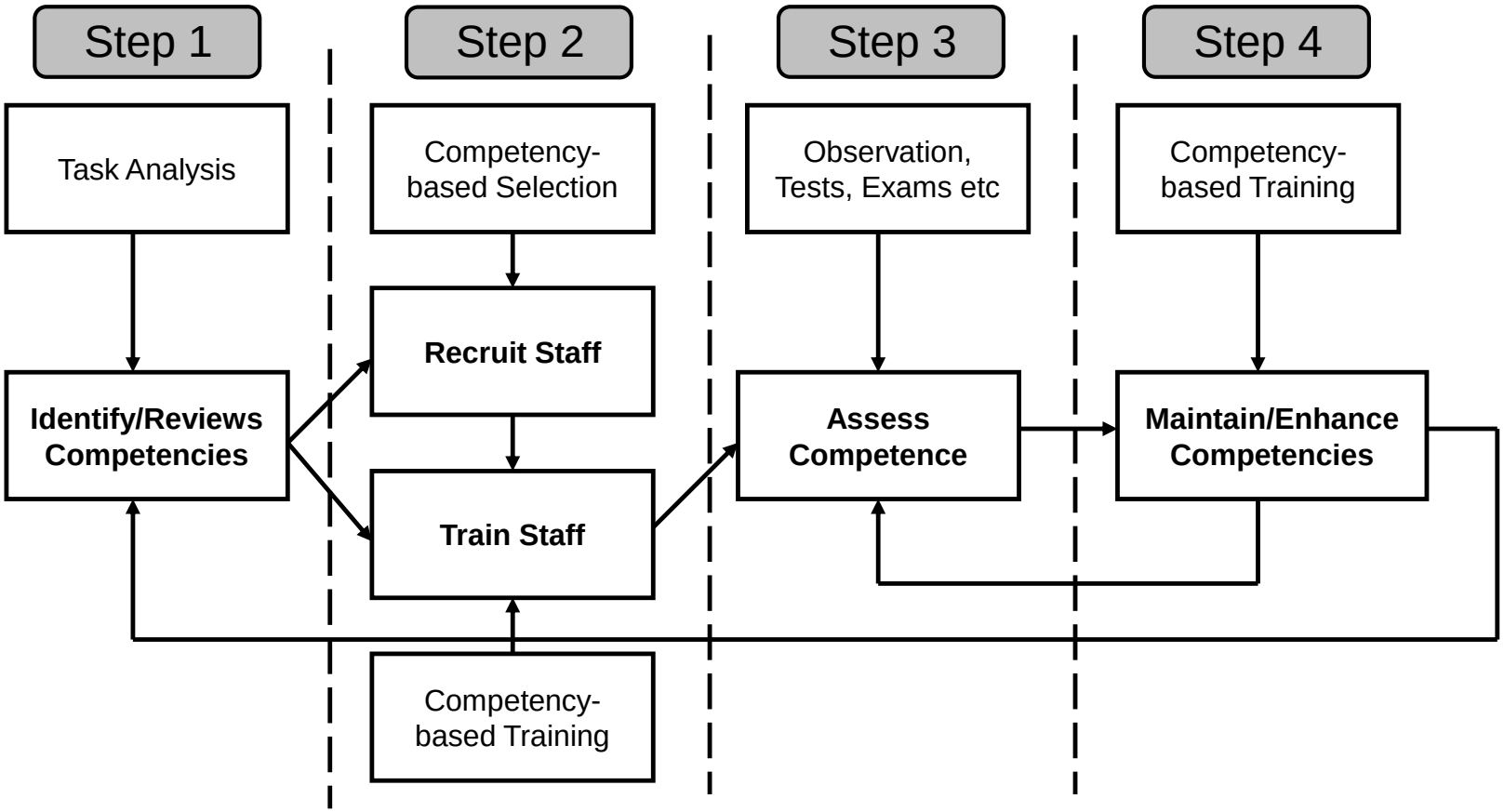
	Health of Employees	Safety of Employees	Safety of Contractors	Safety of Public	Incident investigation	Development of safety policy	Development of operational controls	Risk management	Risk mitigation	System audit	System development	Process audit	Quality system/ process	Quality audit	Internal verification	External verification	Financial process	Financial reporting	Financial audit	Budget control	Project management	Identifying new opportunity	New business development	Existing business development	Customer relationship management	New product development and innovation	Understanding the commercial offer	Developing new customer/ opportunity	Maximising sales opportunity	Marketing	HR Policy	Recruitment	Identifying and implementing training needs	Succession planning	People development	Discipline	Wages	Invoices	VAT	Governance
Chief Executive	x	x	x	x	x	x														x		x						x		x	x	x			x					x
Finance Director																	x	x	x			x										x			x		x	x	x	x
Ops and Tech Dir	x	x	x	x	x	x	x	x	x	x		x									x	x			x								x	x	x				x
Commercial Dir																					x	x	x	x	x	x	x	x	x		x				x				
HSEQ Manager					x	x	x	x	x	x	x	x	x	x	x	x				x														x	x					
HR Manager																															x	x		x	x	x				
Company Sec																																			x					x
Site Manager	x	x	x	x	x	x	x	x	x											x	x	x	x	x	x			x	x	x		x	x	x	x				
Dep Site Manager	x	x	x	x				x	x	x		x	x	x	x					x	x												x		x					
Accounts																																					x	x		
Wages																																				x	x			
IT								x	x	x	x									x	x																		
Market																				x	x	x	x							x									
Business Develop																					x	x	x	x	x														
Sales																											x		x										
Audit							x	x	x	x	x	x	x	x	x	x																								



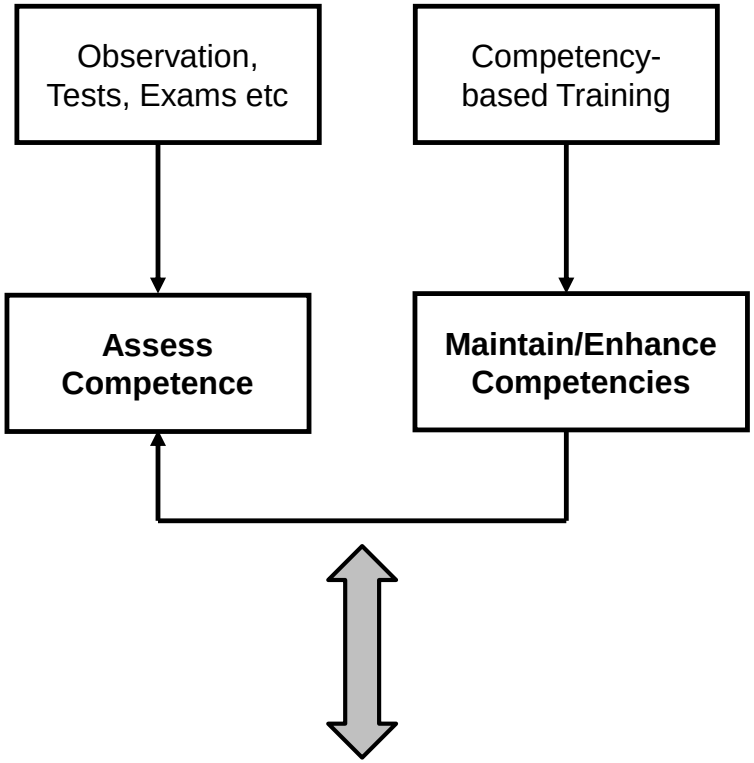
Job title / Basic competences for job role	Be able to operate safely in the mining environment	Understand how to operate safely in the mining environment	Be able confirm efficient working practices	Understand how to confirm efficient working practices	Be able to identify, monitor and control emergency hazards.	Know and understand how to identify, monitor and control emergency hazards	Be able to inspect and use breathing apparatus and equipment	Understand how to inspect and use breathing apparatus and equipment	Be able to maintain and test breathing apparatus and equipment	Understand how to maintain and test breathing apparatus and equipment.	Be able to assist in firefighting	Know and understand how to Be able to assist in fire	Be able to save and preserve endangered life	Know and understand how to save and preserve endangered life	Be able to seal and unseal mine areas	Know and understand how to seal and unseal mine areas	Be able to provide leadership in area of responsibility	Know and understand how to provide leadership in area of responsibility	Be able to manage rescue operations	Know and understand how to manage rescue operations	Be able to deal with mine surface incidents	Know and understand how to deal with mine surface incidents	Be able to manage resources	Know and understand how to manage resources	Be able to carry out mine entry inspections	Know and understand how to carry out mine entry inspections
Mines Rescue Worker																	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rescue Officer							NA				NA		NA		NA					NA					NA	NA
Confined space rescue worker	NA	NA					NA	NA							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mine Entry Inspection Engineer	NA	NA			NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Surface Hazard Engineer	NA	NA					NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA
Team Leader																			NA	NA	NA	NA	NA	NA	NA	NA

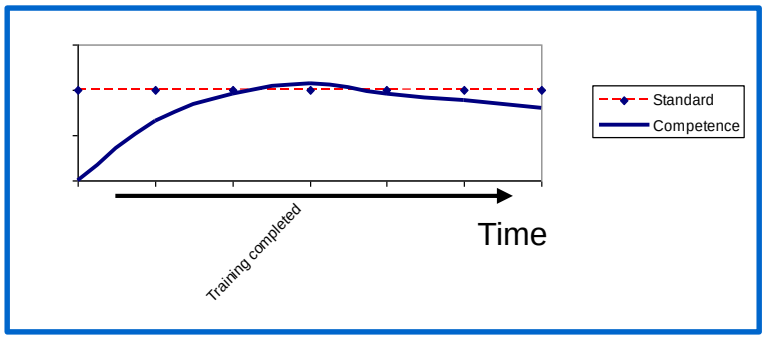
- Aiming to develop competency tables for the various job roles
  - Major and Fatal Hazards associated with these job roles
- These will form part of the competency framework
- To be able to conduct any of the major or fatal hazard role/task, you would be required to be able to demonstrate competency
- Ultimately aim to have this in an automated records system that will prompt;
  - Refreshers
  - Audit
  - Peer review

Competence Management



The impact of time on training and competence



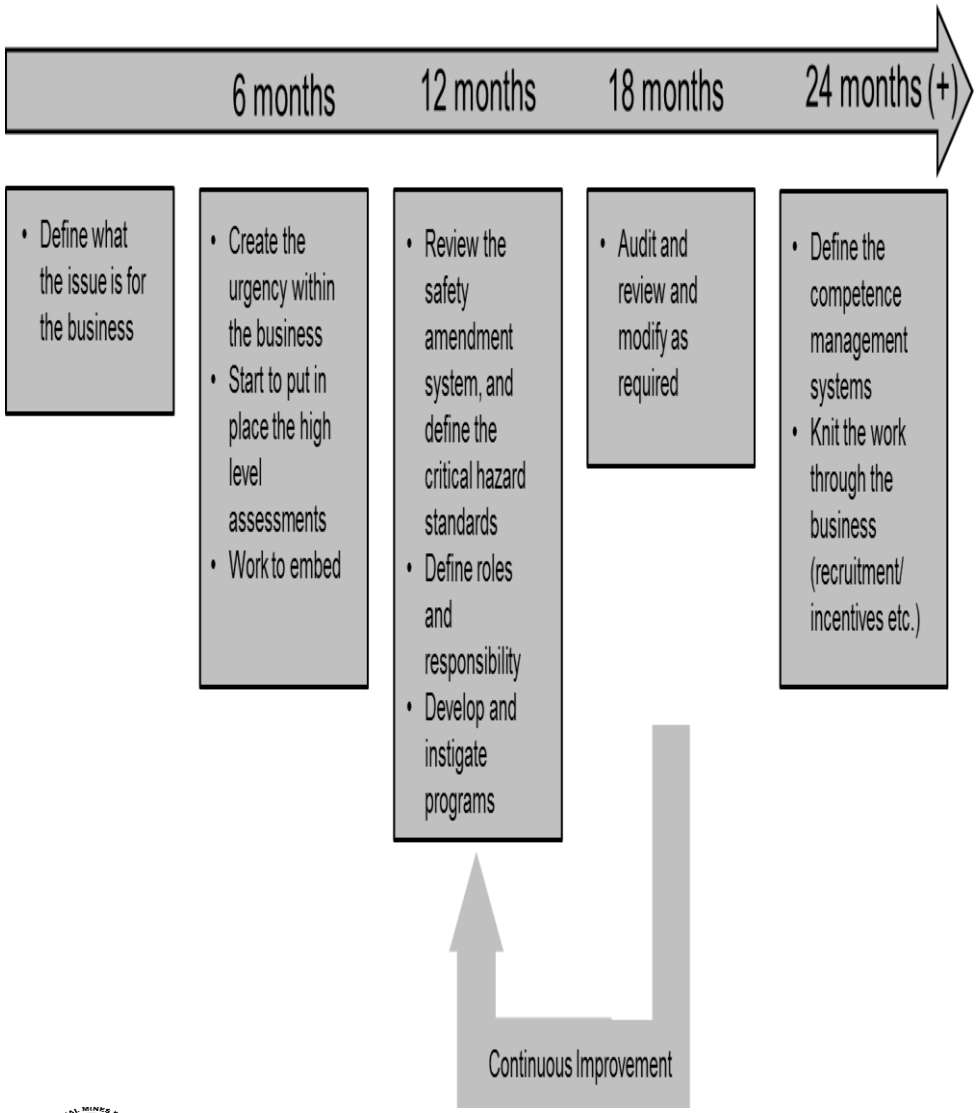


Striking the appropriate balance

- Understand that competence reduces over time
- The business needs to define the training and assessment regime
- It needs to have a process when its employees don't meet the required standard
- It has to allow the time to effectively maintain existing competence and develop new ones that support the safe operation and growth of the business

- Observation
- Simulation
- Testimony
- Evidence of work
- Questioning/discussion

Summary



Approach

- **Believe** that this represents a realistic approach
- **Believe** that this represents a reasonable time line
- If all elements are completed, it would deliver a change in thinking and approach at all levels

Potential Issues

- Risk that organisations want to 'cherry pick' or vary the order that things are done in
- We can do this, however it makes the foundations more difficult to put in place
- **If the engagement piece is not right, the risk is that they become nice documents on a book shelf**

Middle level –Task Based Assessment

Routine and Non-Routine Task Planning

Objectives;
- To develop the expectations around the safe way to complete a task
  - Guidelines
  - Job plans
  - Standard operating procedures

Responsibilities
- The **operator** has to make sure that there are enough people (management level) available to administer the system
- The **manager** has to make sure that the controls relative to the operations risk are developed, and that people carrying out the task understand how the controls are applied
- The **regulator** checks the effectiveness and understanding of the controls

Examples

Underground
- The systematic setting of support
- The safe use of conveyors
- The operation of the transport system

Surface
- The safe use of welding equipment
- Rules for operating plant and machinery

Mines Rescue
- The safe storage and transport of pressurised cylinders
- The safe charging of oxygen
- Procedures for testing the effectiveness of the BA

Mainly design and engineering considerations

Approach to task based risk assessment

Step 1 – Identify the Hazards

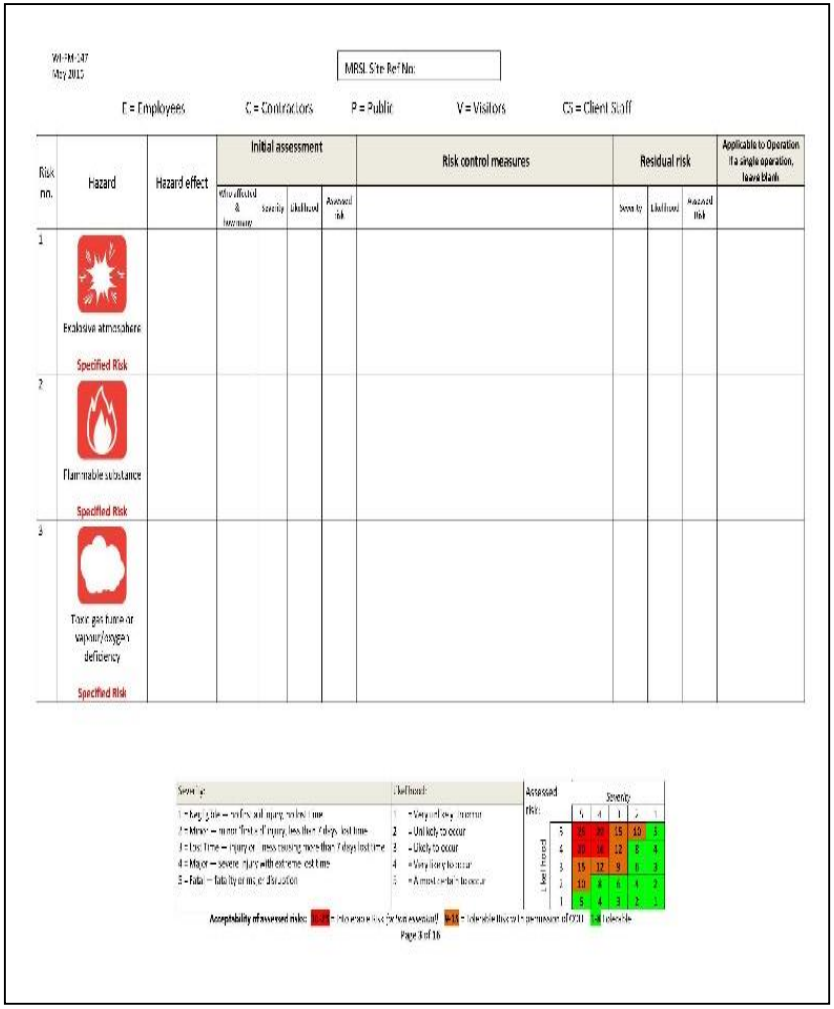
Step 2 – Determine who might be harmed

Step 3 – Apply the hierarchy of controls

Step 4 – Produce the documented risk assessment

Step 5 – Produce the Safe System of Work

Step 6 – Review the Risk Assessment



Lowest level–Point of Work Assessment

On the job Assessment (Point of Work)

Objectives;
- To allow the supervisor and operators to have a very simple way of reviewing how a job is to be done
- To provide a mechanism to allow thinking time

Responsibilities
- The **operator** to make sure that there are adequate people trained to do this type of assessment
- The **supervisor/ person** to use the process to consider the job or any changes and how they might impact

Simple principles;
- Identify what it is that can hurt me? **[hazard]**
- How might that thing hurt me? **[hazard effect]**
- How can I stop it? **[control measures]**
- What is the level of risk remaining?

Examples

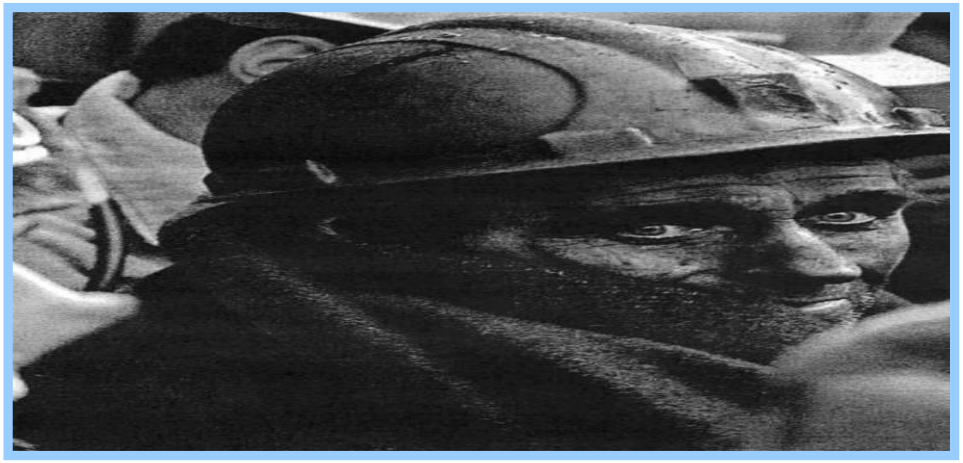
Underground
- Unloading materials
- Lifting something

Surface
- Lifting something

Mines Rescue
- xxx

Mainly about the behaviour of people in the workplace

What we should be avoiding.



Mining Safely and Improving Production By having standards

HSE

Health and Safety Executive

The Mines Regulations 2014

Guidance on Regulations

L149 (First edition)
Published 2015

This is a free-to-download, web-friendly version of L149 (First edition, published 2015).

ISBN 978 0 7176 6647 9

The Mines Regulations 2014 came into force on 6 April 2015 and replace all previous mines-specific health and safety legislation.

This publication provides practical advice and guidance on what you have to do to comply with the Mines Regulations 2014. It also directs the reader to other general health and safety regulations that apply at mines and gives additional guidance where appropriate.

It is particularly relevant to mine operators but will also be useful to others within the mining industry such as mine managers; safety representatives and representatives of employee safety; any employer with employees who work below ground at mines; and self-employed contractors working below ground at mines.

HSE Books

proskills

Mining Operations National Occupational Standards

mpqc

MINING OPERATIONS

National Occupational Standards

The National Occupational Standards (NOS) for Mining Operations were originally developed and approved in 2006. With the increased interest in National Occupational Standards from the Mining Industry this review was authorised by Proskills, the Sector Skills Council for the Manufacturing and Processing Industries, which includes quarrying and mining. The project is overseen by the Mining Qualifications Committee and the review carried out by a working group nominated by that Committee.

The term "mine" refers to an excavated area underground, accessed by shafts and/or tunnels/drifts/adits/levels.

These NOS are specifically to describe the functions involved in the extraction and transportation of extracted materials from a mine. They are not intended to cover warehousemen employed in storage mines, or guides in tourist mines, as these functions are included in other specific occupational standards.

The NOS development devised a wholly flexible qualification structure. However the QCF development has developed certain specific pathways recognised in the industry.

December 2006

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Culture

- **<u>If you cannot mine safely don't Mine</u>**

  (Albert Wheeler CBE Deputy Chairman British Coal)

  The point is he meant what he said

  - Starting point: Comply with the relevant legal requirements
  - Realise this is not enough – be proactive
  - Its your mine know your hazards and control them
  - You should understand these better than anyone else
  - Safe production is possible and effective. Believe it
  - Have standards – if you cant measure it you cant improve it

No more memorials