

ICMM
International Council
on Mining & Metals

MINING WITH
PRINCIPLES

FATALITY PREVENTION

Eight Lessons Learned

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INTRODUCTION

Safe and healthy working conditions are a fundamental human right. ICMM supports members adherence to worker's rights in accordance with the laws in their jurisdiction and applicable company policies. Significant progress in occupational health and safety across our industry has been made in recent years, but more needs to be done to ensure work can be completed without injury or illness.

Over time, the mining industry has delivered substantial improvements in safety through a range of measures including enhanced critical control management. This can be seen within ICMM where, in 2018 our 27 company members recorded 50 fatalities, down from 90 in 2012, for 22 company members. While the latest figure demonstrates improved performance, we still have a long way to go to if we are to achieve a fatality-free industry.

The catastrophic failure of a tailings storage facility at Vale's Corrego do Feijão mine in Brumadinho, Brazil, on 25 January 2019 is a stark reminder of this. When the dam collapsed, 11.7 million cubic meters of mining waste surged through the mine site towards the local town and countryside below. As of 9 September 2019, 248 people are confirmed dead and 22 are still missing.

ICMM members are committed to the implementation of the ICMM 10 principles, and Principle 5 is to "pursue continual improvement in health and safety performance with the

ultimate goal of zero harm". ICMM members are steadfast in this goal, but more work based on true, open and honest introspection on the underlying causes and lessons from fatalities is needed to advance this goal.

ICMM Council recognises that further improvements should be made, and that effort is needed to change practices to improve health and safety.

This document provides an articulation of the collective discussions that have been taking place at ICMM on the lessons learned on why the industry continues to have fatalities, as well as provide some additional context and provide some thoughts on key messages.

ICMM encourages all interested stakeholders to take this report and see how it applies to their own organisation and ask the question – what else can we be doing to truly get to zero fatalities?



SETTING THE SCENE: MINING HEALTH AND SAFETY IN NUMBERS

Fatalities in the mining industry

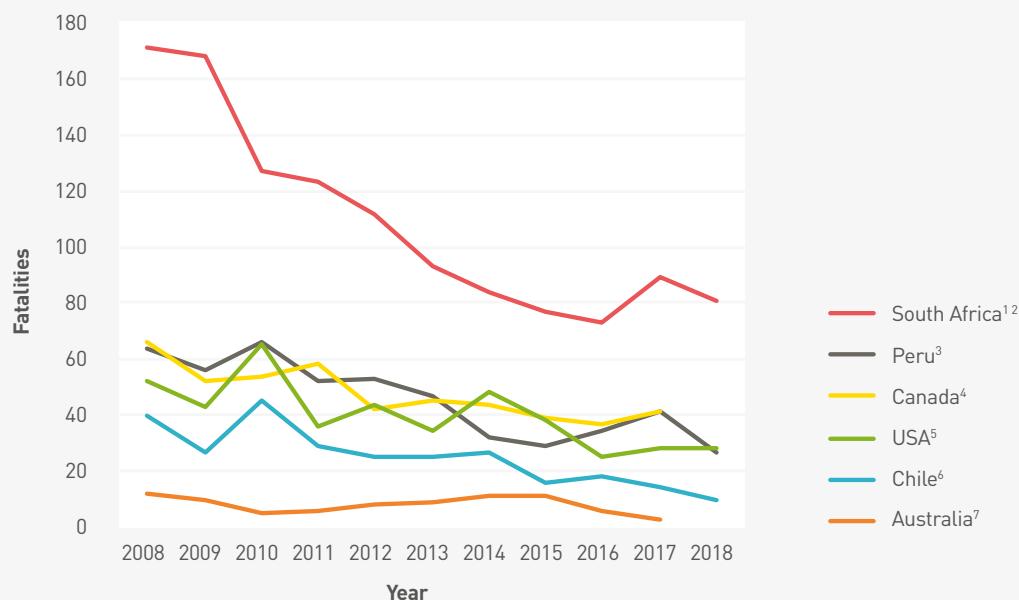
In the past, mining work has been physically demanding and often dangerous with a history of explosions, rockfalls, cave-ins, rock bursts, heavy mobile equipment interaction

and other incidents, resulting in a high number of deaths and serious injuries to workers. Many of these hazards remain a feature of mining today. In addition, workers in the industry have faced a risk of occupational disease.

Table 1: Mining fatalities in selected countries 2008–2018

Country	Year										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
South Africa	171	168	127	123	112	93	84	77	73	90	81
Peru	64	56	66	52	53	47	32	29	34	41	27
Canada	66	52	54	58	42	45	44	39	37	41	-
USA	52	43	65	36	44	34	48	38	25	28	28
Chile	40	27	45	29	25	25	27	16	18	14	10
Australia	12	10	5	6	8	9	11	11	6	3	-

Figure 1: Summary of fatalities for South Africa, Peru, Canada, USA, Chile and Australia



1. <https://www.mineralscouncil.org.za/industry-news/publications/facts-and-figures>

2. <https://www.miningreview.com/health-and-safety/dmr-decrease-fatalities-2018-safety/>

3. http://www.minem.gob.pe/_estadistica.php?idSector=1&idEstadistica=12464

4. http://awcbc.org/?page_id=14#fatalities

5. <https://www.msha.gov/msha-glance>

6. <https://www.sernageomin.cl/seguridad-minera-fallecidos-se-redujeron-en-un-69-tras-accidente-ocurrido-en-mina-san-jose>

7. <https://www.safeworkaustralia.gov.au/collection/work-related-traumatic-injury-fatalities>

SETTING THE SCENE: MINING HEALTH AND SAFETY IN NUMBERS

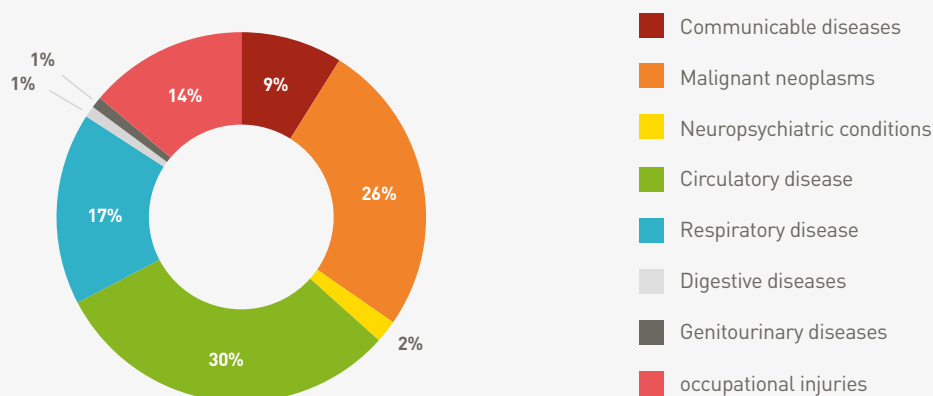
There is currently limited available data concerning the number of fatalities – from safety incidents or occupational diseases – that have occurred in the global mining and metals industry due to gaps in some mining jurisdictions. This makes a comprehensive analysis difficult; however, figures are available from various regulators and mining associations in some key mining jurisdictions. Table 1 and Figure 1 show some of the long-term, downward, fatality trends from USA, Canada, South Africa, Australia, Chile and Peru.

However, figure 1 does not consider those fatalities associated with occupational diseases. Globally, across all industries, there was an estimated 2.78 million deaths

from occupational injury and diseases annually⁸. Work-related mortality accounted for 5% of global total deaths with the biggest share coming from work-related diseases which accounted for 2.4 million (86.3%). Fatal accidents accounted for the remaining 13.7%.

More specifically, the study shows that respiratory diseases (17%) were among the top three illnesses after circulatory diseases (30%) and malignant neoplasms (26%). Together, they contributed more than three-quarters of total work-related mortality, followed by occupational injuries (14%) and communicable diseases (9%), as seen in Figure 2 below.

Figure 2: Breakdown of the estimated fatal work-related mortality by cause in 2015



Safety related fatalities in ICMM member companies

ICMM member companies have seen an overall decrease in the number of fatalities in the membership over the past few years. In 2018, ICMM members suffered a total of 50 fatalities with 11 companies being fatality-free. The highest number of safety fatalities have consistently occurred in South Africa, and the top hazards linked to transportation/mobile equipment and fall of ground. Despite this decrease,

we have yet to see the next step change that moves the industry to zero fatalities.

Since 2012, ICMM has benchmarked the lagging indicator safety data for its members in a consistent way. Annual reports are now produced and are available on the ICMM website.

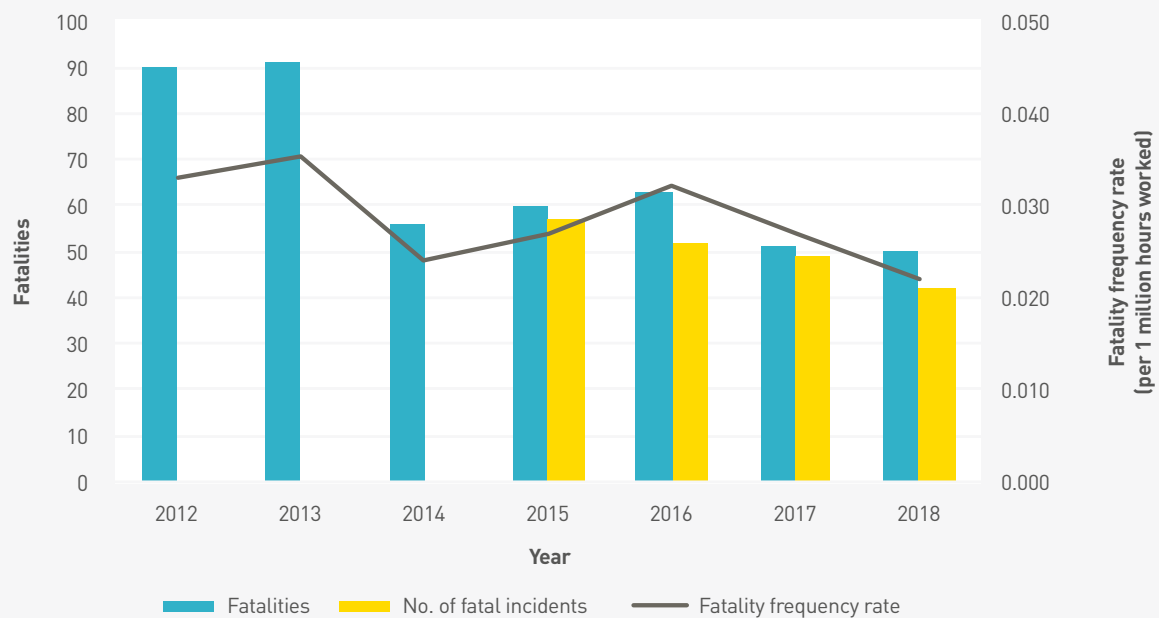
Table 2 and Figures 3 – 6 provide an insight into the trend of the safety performance of ICMM members.

8. Global Estimates of occupational accidents and work-related illnesses 2017, published by the Workplace Safety and Health Institute, Singapore. September 2017

Table 2: ICMM fatalities, total injuries, hours worked and rates (per million hours worked) 2012–2017

Year	Total Recordable Fatalities	Fatality Frequency Rate	TRI (total recordable injuries)	TRI frequency rate	Total hours worked
2018	50	0.022	7751	3.41	2,275,510,188
2017	51	0.027	7478	3.95	1,894,875,090
2016	63	0.032	8445	4.26	1,981,148,588
2015	60	0.027	10494	4.70	2,231,437,832
2014	56	0.024	10,455	4.50	2,324,525,784
2013	91	0.035	11,636	4.52	2,571,500,557
2012	90	0.033	13,895	5.07	2,738,579,590

Figure 3: Total ICMM fatalities. Incidents and fatality rate for 2012–2018



SETTING THE SCENE: MINING HEALTH AND SAFETY IN NUMBERS

Figure 4: Total recordable injuries and frequency rate for ICMM members 2012–2018

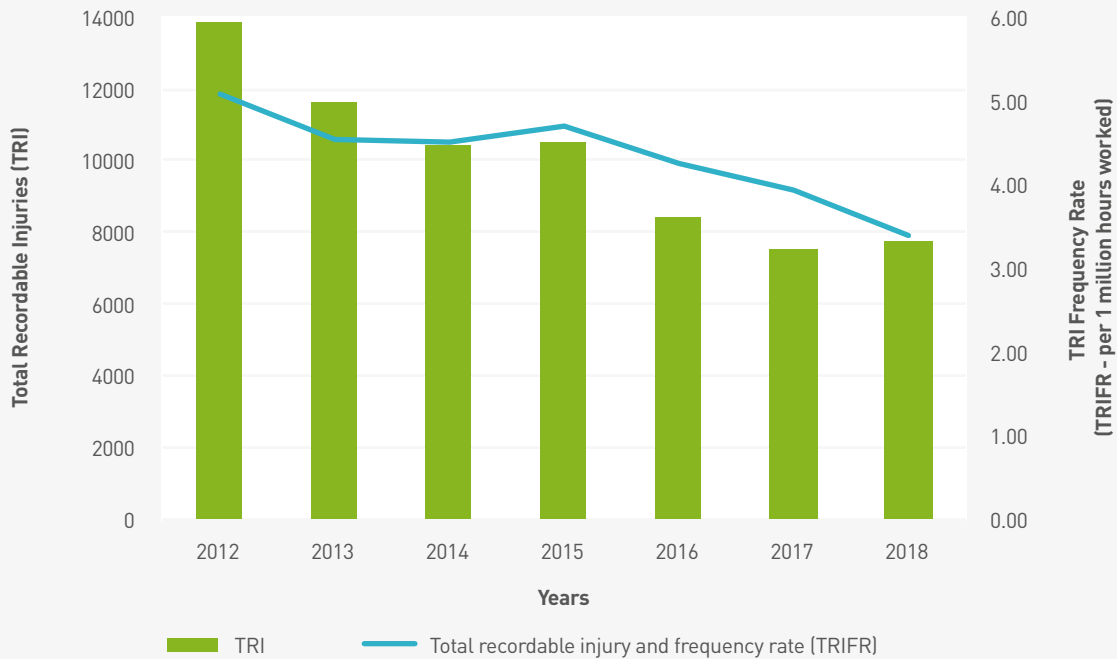


Figure 5: Fatalities per country for ICMM members 2015–2018

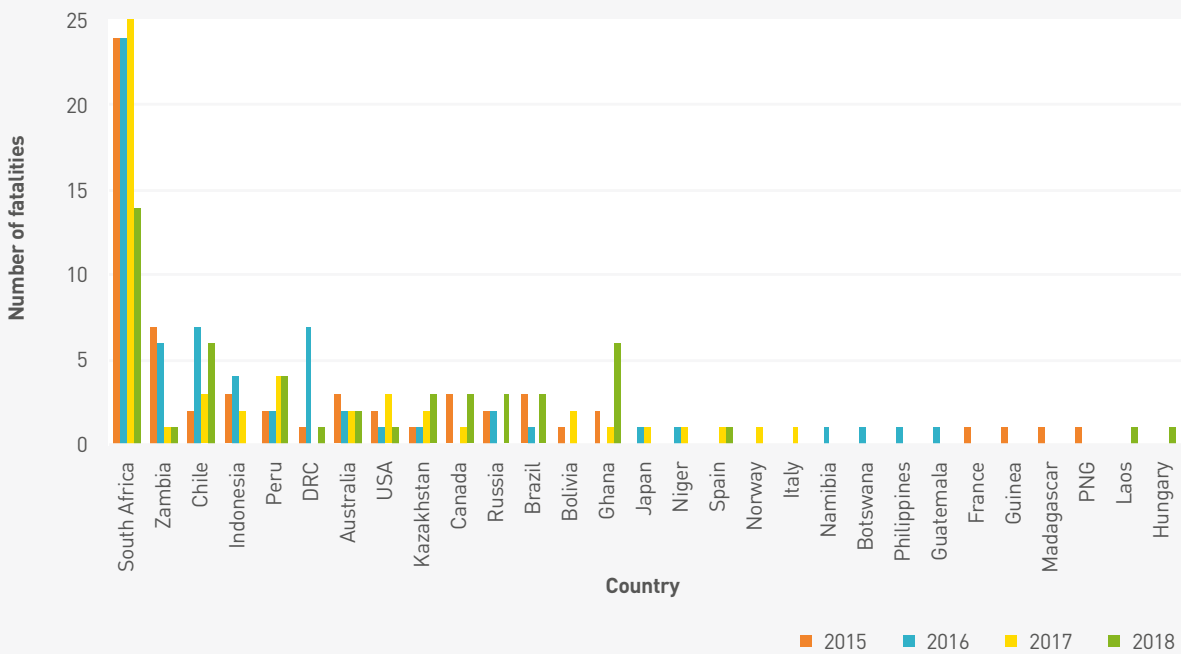
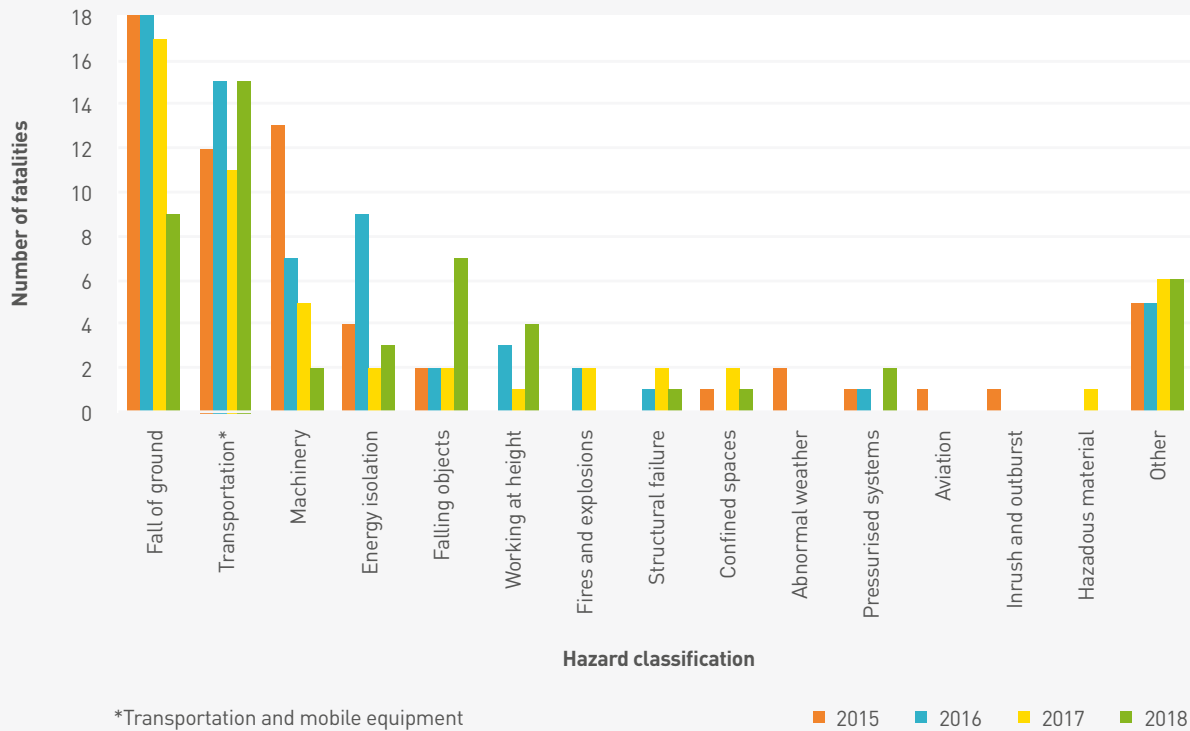


Figure 6: Fatalities by hazard classification for 2015–2018



ICMM's efforts on health and safety

Health and safety have been a central pillar of work at ICMM since its creation in 2002, reflecting the high level of priority that the membership gives to health and safety in the industry. ICMM has produced various good practice guidance and reports ranging from HIV/AIDS, TB and Malaria to the 'Leadership Matters' (a guide for Senior Leaders in their relentless drive to prevent fatalities), and more recently guidance on [critical control management](#) and the latest thinking on [occupational health](#). ICMM has also organised two large international health and safety in mining conferences in 2006 and 2012.

At the 2012 ICMM H&S conference, ICMM member companies agreed on the need to step up collaboration to collectively work towards the goal of zero fatalities. This has been facilitated by bi-annual health and safety forums as well as the development of a platform for critical control risk management. Although these have been a significant change in our industry, fatalities have continued to occur.

Using the H&S Forums, members of the ICMM safety and health working groups have considered the key reasons for ongoing fatalities in our industry – the trends – and what this means for our work individually, as well as collectively.

THE LESSONS LEARNED ON FATALITY REDUCTION IN OUR INDUSTRY

Overview

This document can aid the discussion on achieving zero fatalities in the mining industry by articulating and bringing forward the identified collective lessons and the challenges that the industry should focus on and address.

Eight key learnings have been articulated across three, interlinking categories: cultural, organisational and engineering/controls (see Figure 7 below). They interlink as the right organisational culture – that places health and safety as a value – needs to be in place for any of the learnings to be successfully implemented.

Figure 7: The 8 lessons



It provides some thinking and observations relating to the eight lessons, but in short, some of the key points are that as an industry we must:

1. Set the tone at the top and demand that all levels of leadership from the Board to a supervisor champion the tone through their actions. Fatalities in our industry are still a painful reality; therefore, setting the tone for a progressive health and safety culture is vital. Never underestimate this.
2. Note the zero harm versus zero fatalities debate. It is important that total recordable injury frequency rates (TRIFR) do not become a distraction to fatality prevention.
3. Get change management processes right and be steadfast in how they are applied. This is particularly important during times of turnover, downturn or divestment at the management level.
4. Get better at learning from our mistakes – internally and with others. More targeted benchmarking is required.
5. Go beyond the simple act of sharing and improve active learning.
6. Increase the sharing of results of member piloting of technology and encourage more rapid uptake of technological applications.
7. Continue to support critical control risk management as a positive game changer for health and safety in the industry. The same approach should be considered for technological solutions. A balanced, holistic approach is needed.
8. Be prepared to see radical changes in our current mining processes in some contexts. For example, a large portion of fatalities are in South Africa from fall of ground incidents. We may need to explore better methods to move people out of the line of fire.
9. Raise occupational health and occupational disease as a prominent issue. We must drive exposure to key substances (DPM, silica, coal dust) to as low as reasonably practicable (ALARP).



1. Zero fatalities mindset

As an industry we have shifted our focus to fatality prevention. This needs to be sustained, whilst continuing to work on overall injury reduction.

Moving from zero harm to zero fatalities

The campaign on zero harm has been useful in driving a focus on health and safety in the industry. However, the lack of common definition of zero harm has proven to be problematic. Nonetheless, there is a common objective in the industry of zero fatalities. Currently absent, an increased consideration of fatalities from disease needs to be incorporated into the zero-fatality mindset.

The objective is common: zero fatalities

There remains no agreement on the precise definition of 'zero harm' because of the subjectivity of the concept of harm. 'Zero fatalities' is, however, an indisputable term, and there is a firm belief that zero fatalities can be achieved.

Companies have different approaches to reaching zero fatalities. The passion and commitment to achieve zero fatalities is palpable throughout ICMM's membership, as is the need to engage

with each other and collaborate within the industry on this goal. It is recognised that zero fatalities are realised every day in many mines globally; but that this state of safe production needs to be extended, shift by shift and day by day.

That injuries have now globally reached a plateau is an indication that we have been able to address the 'easy wins', but that the industry must address more systemic cultural and organisational issues.

What to measure

Proactive (leading) and reactive (lagging) indicators are both needed, across all aspects of the safety system: technical, systems, process, critical control effectiveness, culture and behaviour. Recognising that improvements in lost-time injuries do not necessarily lead to improvements in fatalities, particular attention should be made to assessing the integrated nature of critical controls with high potential incidents (HPIs).



2. Safety leadership at all levels

This is critical to achieve and sustain a fatality free mining industry. Where missing, we need to build a true, positive culture of safety and work to sustain it.

A new type of values-based leadership is needed

It is broadly recognised that leadership affects all aspects of organisational performance. To some, leadership is defined as the ability to connect with people's values through their emotions to influence behaviour and culture. Contrary to the traditional 'leader is boss' notion that has prevailed in the industry, the type of leader needed to deliver safe and healthy production makes these matters personal. Such leaders understand and pursue

a conscious change from the traditional default of managing to emotionally engaged visionary leading, through building relationships of trust.

Leaders firstly understand their own values in order to act consistently and with integrity in the field. Part of this involves leaders being passionate and honest about their values and emotions linked to safety, which requires a degree of vulnerability. These visible and courageous – but most of all authentic – leaders lead by example.

THE LESSONS LEARNED ON FATALITY REDUCTION IN OUR INDUSTRY

The role of top leadership

The most senior executives in the company set the tone that enables or disables good health and safety performance. In order to affect change, top leaders need to be active in the field as a matter of normal business and be unrelentingly consistent in matching their words with actions.

Front-line supervisors: stuck in the middle

Huge responsibility for healthy and safe production lies with front-line supervisors who need to manage competing priorities within the workplace which are set by the organisation leadership. It is at the supervisory level where the reality of production pressures and the stated intent of safe and healthy production meet, causing high levels of stress if these messages are not aligned. It is the responsibility of senior leaders to empower supervisors and to ensure that expectations, trust and a consistent process are clear and in place, and to actively remove any dissonance there may be between safety and production.

Barriers to effective safety leadership

Barriers include poor leadership at the top level, demoralisation, underlying beliefs, cynicism, persistent unsafe behaviours, under-

representation of interpersonal skills, complex communication structures and shareholder indifference to safety and personal barriers. More specifically, the rapid erosion of safety culture can come from unjust decisions made post incident. Quite often, the organisation has set the worker up to fail. This can also be exacerbated by the lack of awareness of top leadership decisions or communication and the unintended consequences thereof ie budget cuts, production pressure.

Driving culture through appropriate indicators

The need to develop and maintain behavioural reliability (what things people need to do consistently), control integrity (how things are done consistently) and leadership capability (how it is consistently determined whether the other two aspects are in place) are crucial to the culture change needed for integrated health and safety management. These three aspects should be regularly reviewed, as over reliance on existing controls can reduce the ability to accurately observe and address new risks. It is also important that these aspects and a review of their effectiveness is systematised and formalised to ensure that they do not rely on the presence and passion of any single leader.



3. Change management

Our approach to safety as a value will remain a constant focus and must not flex and wane with industry cycles, divestments and joint venture (JV) partnerships.

All change

Divestment of an operation or even a simple change in management can be tough for those involved. Very real human responses can include a sense of vulnerability, fear of job loss, adapting to a different corporate culture under new management, new thinking and new (possibly less stringent) standards. This leads to complacency as workers become distracted. A sense of vigilance and effective change management need to be in place to alleviate this.

Who's in charge?

The question of accountabilities regarding Joint Venture (JV) operations has been thrown into sharp focus following recent tragic incidents. Are all our members' JV's suitably covered and being held to the same performance standards as their parent companies?



4. Learning from the past

“Those who fail to learn from history are doomed to repeat it”. We must learn from past fatalities and proactively apply critical controls to known fatal risks.

No single solution

A greater use of engineering controls is needed in the industry. Some have described mining companies as ‘fast followers’ when it comes to implementing new technologies and innovation to new and emerging issues. But this may not be the case in all instances.

A survey of six member companies was undertaken which focussed on the uptake of collision avoidance and fatigue detection technologies in their companies. Responses showed that companies were generally reactive in applying these engineering controls.

Learning from others and own mistakes

The result of the survey raised the following questions:

- Are we learning and communicating learnings properly?
- Is the quality of our incident investigations enough to identify key learnings?

- Can we communicate these learnings in an effective way so that it can loop back and validate implementation effectiveness?
- Is there a culture of learning in place?

Many companies are involved in piloting various control solutions from multiple providers and vendors on these types of issues. However, the results of piloting rarely, if ever, get shared amongst the wider industry, resulting in potential loss of time, effort and money within companies having to run similar pilots themselves.

However, learning and information overload should be considered as it takes time to learn. There is a need to focus on the few issues and ensure they are implemented effectively and are linked closely to budgeting and planning. Caution is also needed to ensure new hazards are not introduced through the change process and that technology by itself is not a single, one off solution.



5. Risk management capability

We have structured our fatality prevention around risk management. We must become better at building adequate capability to undertake high quality risk assessments and address the variation in tolerance to risk seen at operations across the world.

The risk with risk management

The risk management processes within organisations can often be incomplete, typically only qualitative and there is a lack of clarity on acceptable risk tolerance. Knowledge can also be lost between project teams and operations, and therefore there is a question on where accountability lies. Companies also need to ensure that all risks are considered when companies buy new mines or are considered in financial models. The concept of ‘safety in design’ needs to be checked in all phases of a project,

especially upfront within the commissioning phase of operations where the hierarchy of controls can be effectively applied.

Table 3 provides a summary of some of the common approaches to risk management seen in the industry, with suggested alternative good practice.

Red is our friend

There is also a need to gain a greater understanding of whether risks are being

THE LESSONS LEARNED ON FATALITY REDUCTION IN OUR INDUSTRY

effectively managed. This usually comes down to monitoring a risk register with a traffic light system of indicators. An area to be mindful of is the get it in the green mentality that can permeate in more reactive organisations. Senior leaders need to build a culture where it is acceptable to have 'red' areas within a risk management system, with proactive actions to remedy the situation. It is better to understand that there is a problem and fix it in a non-judgmental way, compared to being blinded by less generous markings of green.

In order to undertake effective risk assessments, the right elements must be in place: subject matter expertise, engaged and curious team members, the right research, documentation and process technology. This also applies to field level risk assessment where this really matters and can save a life. It needs to be simple and effective and focus on the elements that matter ie the critical controls with the right level of sign off or approval needed. For example, making sure supervisors are on hand to oversee hazardous activities.

Table 3: Difference between the common approach and what is considered good practice for risk management with companies.

Common approach	Good practice
Broad, engagement processes	Targeted, technical exercises
Broad focus, from low-level hazards to significant risks	Focus only on <i>material</i> risk events
Broad participation in risk identification and risk analysis	Targeted participation to include the right people at the right time. Subject Matter Experts predominantly driving risk analysis
Broad definitions of risks (eg 'Fire in processing plant')	Specific risk events (e.g. Fire in conveyer transfer station) to enable detailed understanding of causes and associated controls
Broad description of consequence	Detailed consequence analysis (based on modelling where possible)
Broad description of 'controls' (including reference to documents – "Traffic Management Plan")	Focus on specific activities, and associated accountabilities, required to prevent a cause or mitigate a consequence.
Long lists of supposed 'critical controls'	Analysis to identify the 'critical few'



6. Critical controls

We must continue to recognise fatal risks and the need to eliminate them or upgrade critical controls to be more reliable rather than relying on procedural or behavioural controls.

Behaviour dominates

We are advocating an industry shift towards a controls-based approach to managing risks through the critical control management (CCM) process, reinforced by leadership and safe behaviours. In an ideal world, all the risks that cannot be eliminated or substituted would have a technological or engineering control solution in place that would prevent harm. This has driven industry to look for and pilot suitable technological solutions. However, it has been observed that many controls currently in place at operations rely on the behaviour of a person to make sure it is in place and effective (an approximate 80/20 split) which bring with it some inherent human frailties.

Moving our focus from risks to controls

The CCM process is a practical method of improving managerial control over rare but potentially catastrophic events by focusing on the critical controls. These sorts of events are called Material Unwanted Events (MUEs) and represent a material risk to the business. Mining industry examples of MUEs include tailings storage facility failures, underground fires, coal dust explosions and overexposure to diesel particulate matter. These all have the potential to cause multiple casualties, but they can also affect the ongoing viability of a business. However, knowing that the risks exist is not enough – understanding what controls a risk is at the heart of CCM. It is flexible enough to allow the level of focus to be specific and task dependent. The process provides knowledge of necessary controls to plan work before it begins and help us understand what compliance and effectiveness looks like.

Will CCM get us to zero harm?

CCM is not a single one-off solution. CCM is part of the solution, as a process that can help focus on key areas, but the management of safety requires a multi-faceted holistic approach, underpinned by the role of leadership and overall culture.

What can CCM help the industry to achieve?

Prevention of MUEs requires specific attention at the highest level of an organisation alongside other material business risks. The approach is based on:

- Having clarity on those controls that really matter: critical controls.
- Defining the performance required of the critical controls – what the critical control must do to prevent the event occurring. A performance standard is the critical set of performance requirements for a Critical Control that, if met, provides confidence the risk is managed to a level of risk that has been agreed to.
- Deciding what needs to be checked or verified to ensure the critical control is working as intended ie how to know the critical control is meeting its performance standard requirements. A verification activity is not a safety interaction, visible felt leadership (VFL), observation or audit.
- Assigning accountability for implementing the critical control – who must make it work? CCM is the work of operational leaders in the field. It is not new work but refocused on what is most important: everyone goes home safe at the end of each day.
- Reporting on the performance of the critical controls: what gets managed gets done.

Are engineering controls the way to go?

This may be true in some instances, but probably not in all situations. A move to implementing controls higher up the hierarchy of controls has been recognised. However, this requires technology and innovation ie money and management of change, a need for organisations to define mandatory minimum non-negotiable controls, and to ensure that verification of control effectiveness is in place as this is key to ensuring a level of comfort that controls are doing their job.

However, many of the critical controls identified for MUEs rely on behaviours and require human

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interaction. Therefore, a range of cultural, leadership and behavioural human factors play an interlocking role over the effectiveness of these controls, something that the industry should not lose sight of, even if it is less tangible compared to solid engineering solutions. Behavioural and procedural controls are here to stay. Therefore, there is a need to make sure their inherent frailty is understood, what the level of effort is

needed to make them work, and what industry needs to do to improve them. This includes an increased understanding of social, psychology, organisational, culture and culture change as well as an appreciation of human error/reliance. There is also a need for there to be a balance between technical and soft skills of workers as well as appropriate coaching and training of front-line managers and supervisors.



7. Fall of ground

Operating deep, high-stress mines requires continued efforts to better protect individuals from rock bursts and falls of ground.

There are multiple causes of fatalities in the mining industry as seen in Figure 6. This section looks at one particular hazard – fall of ground – but this does not negate the importance of the other hazards mentioned.

The leading cause of fatalities

In previous years, fall of ground incidents have been the number one cause of fatalities in ICMM member companies, with the vast majority occurring in South Africa. Advances have been made with controls and mining techniques and there are examples of mines being closed due to seismic concern – but fatalities continue to occur. Therefore, it begs the question: does the industry really understand the risk?

Action by industry to date

Seismic monitoring has evolved significantly over time since the installation of seismic networks underground. The understanding gained from analysing and interpreting the data in terms of the rockmass response to mining has shaped mining strategies significantly over time with the aim of reducing the overall seismic hazard. However, prediction remains a research topic and there are no tools available that can consistently, and to any level of accuracy, predict individual events in space and time.

In South Africa, the Minerals Council of South Africa's (MCSA) Mining Industry Occupational Safety and Health (MOSH) learning hub initiative has developed several best practices for implementation at operations: start of shift entry examination, in stope and development bolting and netting, value added drilling and blasting

practices, leading best practice and integrated Trigger Action Response Plans (TARP).

Within MCSA member companies, several other changes have also been implemented:

- Introduction of centralised blasting.
- Changes in mining methods eg longwall versus sequential grid.
- Mine design changes eg mining spans, pillar size / spacing.
- Backfilling by placing rock material in the mining excavation.
- Preconditioning to move the high stress zone deeper ahead of the panel faces to reduce the likelihood of localised strainbursts.
- De-risked mining plans and reduced extraction rates.

Difficult challenges remain

Given the current working conditions of predominantly conventional labour-intensive stoping operations in South Africa, there are limited higher order control solutions, and therefore there is a high reliance on administrative and human behaviour-based controls. The risk profiles remain high. South Africa also has additional socio-economic considerations leading to the familiar safety/ automation versus jobs debate. However, the question that must be asked is, is this true 'zero harm' behaviour? If zero harm were the primary driver for operational decision making, then arguably this may be absent in some mines. In purely safety terms, the solution returns to the need to remove workers from the line of fire.

However, an assumption must be made on whether mining would take place with or without ICMM member companies. Is a local community

better off with a company with higher ethical practices, striving for continuous improvement, or a company that is not as advanced?



8. Prevention is better than cure

The burden of occupational disease in mining results in more fatalities than we have recognised in the past and we need different controls to prevent them compared to other fatal risks.

Occupational disease – the slow killer

Globally across all industries, there are an estimated 2.78 million deaths from occupational injury and diseases annually.⁹ 2.4 million of these deaths (86.3%) are thought to be from occupational disease. More specifically to mining there has been:

- A landmark silicosis ruling that allowed a class action against gold firms in South Africa. A fund will be established by the mining companies involved.
- New diagnosis of black lung cases in Australia.
- National Institute on Occupational Safety and Health (NIOSH) has identified a prevalence of coal workers pneumoconiosis (CWP) in approximately 4% of the US underground coal mining workforce – and approximately 2% in the US surface coal mining workforce.
- Diesel particulate matter (DPM) has been classified as carcinogenic which has led to an acceleration of innovation and technology thinking.

This sets the scene for the ongoing drive by regulators to lower occupational exposure limit values (OELVs), especially linked to occupational carcinogens and subsequently improving the science regarding dose-response relationships. In addition, fatalities from exposure to physical health hazards such as heat stress continue to occur in mining related industries.

Workers may be dying of occupational diseases that do not manifest until they have moved on to a new job or have retired. They are effectively out of sight, something for a future senior leader to deal with. Industry has not been able to adequately articulate the risk and potential impacts to secure

the required support from senior leadership. Confounding health factors, such as smoking and other personal lifestyle choices, are also an issue which can cause a distraction and some confusion in the discussion.

The industry is rapidly coming to terms with the fact that the burden of occupational disease (including mortality) is significant and much larger than the burden attributed to acute safety incidents.

Prevention is better than cure

The industry has applied CCM principles to reduce exposures across our industry, however there is room for improvement. The application of CCM to health exposures has been implemented in a small number of mining organisations and is proving to be successful but there is still a long way to go. Recognition of occupational diseases as a fatality risk, that requires the same management as the safety discipline, is gaining ground. Traditional modes of managing occupational health have been focussed on consequences management (a focus on the disease) with less focus on managing the cause ie the control of health hazards in the workplace and the prevention of exposure.

There is also a historic over-reliance on regulated OELVs versus up to date health science. OELVs can be variable across the world and there is often a lag that exists between advances in scientific understanding of risk and appropriate updates by regulators. To this end, it should be incumbent on members to continue reducing occupational exposure to harmful materials to levels that are as low as is reasonably practical to achieve (ALARP).

⁹ Global Estimates of occupational accidents and work-related illnesses 2017, published by the Workplace Safety and Health Institute, Singapore. September 2017.

CONCLUSION

While there has been a lot of improvement in the health and safety performance of the industry over the past decades, there remain some persistent and continuing challenges.

Most of the eight lessons identified are directly linked to business and safety culture and leadership – aspects that need to be maintained in perpetuity. The industry must also get better at learning from its mistakes – going beyond the simple act of sharing to improve active learning. Increased transparency needs to also extend to the sharing of the results of technology pilots, as a means of encouraging more rapid uptake of technological critical control applications.

ICMM will continue to reflect on these lessons which will provide the strategic direction for further work and development. This will include continued knowledge sharing amongst members in dedicated Health and Safety forums dissemination of members' safety data that will be

made publicly available each year and extensive work on a key cause of fatalities in the industry – vehicle interactions – through the [Innovation for Cleaner Safety Vehicles \(ICSV\) programme](#) that was launched in October 2018.

The outlined lessons should prove useful for the broader mining and metals industry. Senior leaders across the sector can view the key issues which are a barrier to the industry collectively achieving zero fatalities.

We encourage any interested stakeholders to consider how this guide can be applied to their own organisation and ask the question 'What else can we be doing to truly get to zero fatalities?'

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