A systems approach to improved safety in the South African gold and platinum sectors, post 2006.

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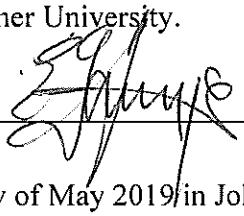
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Signed on 1 May 2019 in Johannesburg.

DECLARATION

I declare that this Thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



_____ (Signature of candidate)

1st day of May 2019 in Johannesburg.

ABSTRACT

The safety performance in the South African mining industry has been a contentious issue for decades when compared to international benchmarks. Although mining safely has always been part of the mining business proposition, a step change was required after 220 fatalities occurred in 2007, which were unacceptable and threatened the sustainability of mining (COM 2017).

A holistic safety and health approach is necessary for a company to succeed in achieving 'Zero Harm'. It is imperative to understand the interdependencies of various leadership aspects in dealing with the achievement of 'Zero Harm', a safety culture which is evolving in the South African mining industry.

Safety cannot be synthesised out of leadership, management, supervisory acts or executing work as it remains as an integral part of all these activities. Leadership from a safety perspective can become very sophisticated in the minds of some, so much so that some become confused what to do. However, the essentials of leadership boil down to Plan, Do, Check and Act, which is not a new concept (Moen, 2009).

The South African Mining Industry fatalities reduced from 220 in 2007 to 73 in 2016 as shown in Chapter 1-Figure 3. The improved safety performance is viewed as a business imperative to ensure long term sustainability, however the industry recognises that much remains to be done as one fatality is one too many (COM 2017).

Research was conducted at six major South African gold and platinum deep level mining companies for the period 2007 to 2016 to determine the emerging themes that resulted in the improved safety performance. The companies concerned were responsible for on average more than 50 percent of the fatalities in the South African mining industry.

It was found that the leadership of the mining companies had been following a multi-tiered approach in order to reduce safety related incidents in mines. One of the most important drivers of the company's safety performance is for the company's leadership to take heed of the broader society's expectation that mining must take place safely. This awareness must subsequently be institutionalised to articulate the company's approach to 'Zero Harm' and by creating an enabling environment to achieve 'Zero Harm'. All the activities required to achieve 'Zero Harm' should be systemised and enable the transfer of relevant knowledge to employees and establish the required behaviour of all individuals throughout the organisation in order to operationalise the safety management system and by actively reducing workplace risks. The successful implementation of the aforementioned holistic approach will dictate the company's safety outcomes which should be continuously improved to achieve 'Zero Harm'.

DEDICATION

This research is dedicated to all the persons who died in mining accidents. If this research is able to prevent the death of one person, it was worth it.

ACKNOWLEDGEMENT

Thanks to my wife Linda and granddaughters Victoria and Taylor for supporting me during the research.

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NOMENCLATURE

ABS - Anti-lock braking system.

AGA - AngloGold Ashanti.

AIFR - All Injury Frequency Rate.

ALLeRT - Apply Lonmin Life Rules and Triggers.

AMCU - Association of Mineworkers and Construction Union.

AMMSA - Association of Mine Managers of South Africa.

BowTie - An analytical method for identifying and reviewing controls intended to prevent or mitigate a specific unwanted event.

BPF - Business Process Framework.

COM - Chamber of Mines of South Africa.

CEO - Chief Executive Officer.

CTF - Culture Transformation Framework.

CUSATO - Congress of South African Trade Unions.

DMR - Department of Mineral Resources.

ERM - Enterprise Risk Management.

EBD - Electronic brake force distribution.

FIFR – Fatality injury frequency rate.

FOG - Falls of ground.

GRI - Global Reporting Initiative.

HPI - High Potential Incidents.

ICAM - Incident Cause Analysis Method.

ICMM - International Council on Mining and Metals.

IMSRS - International Mine Safety Rating System.

ISO 9001 - is the international standard that specifies requirements for a quality management system codified by the International Organisation for Standardization.

ISO 14001 - is the international specification for an environmental management system codified by the International Organisation for Standardization.

ISO 31000 - is a standard relating to risk management codified by the International Organisation for Standardization.

ISO 45001 - Occupational health and safety management systems codified by the International Organisation for Standardization.

LTIFR - Lost time injury frequency rate.

MHSC - Mine Health and Safety Council.

MHSI - Mine Health and Safety Inspectorate.

MOSH - Mining Industry Occupational Safety and Health.

MHSA - Mine Health and Safety Act, Act 29 of 1996.

MRAC - Mine Regulation Advisory Committee.

MOHAC - Mining Occupational Health Advisory Committee.

NUM - National Union of Mineworkers.

OHS - Occupational health and safety.

OHSAS 18001 - Occupational Health and Safety Assessment Series.

OH&SPC - Chamber's Occupational Health and Safety Policy Committee.

PDS - Proximity detection systems.

PPE - Personal protective equipment.

Section 54 - Section 54 of the Mine Health and Safety Act 29 of 1996.

SCSR - Self-contained self-rescuers.

SD - Sustainable Development.

SHEC - Safety Health Environment and Community.

SIMRAC - Safety in Mines Research Advisory Committee.

SMS - Safety Management System.

SOLIDARITY - is a South African trade union.

SPM- Safe Production Management.

SP - System for People.

SPR - Safe production rules.

TARP - Trigger Action Response Plan.

VFL - Visible Felt Leadership.

WiM - Women in Mining.

ZIP - Zero Incident Process

1 OVERVIEW

1.1 Introduction

The collective realisation that a country's safety performance is no longer acceptable in the eyes of the global and national society is a compelling argument for change. Change in this instance is necessitated essentially through desperation, which is turned into inspiration for leaders to create a vision and an enabling environment to achieve 'Zero Harm' in the long term.

The South African mining companies in working together with unions, employees and the regulatory authorities have made significant strides in improving safety on South African mines (COM 2017).

1.2 Historical perspective

The safety performance in the South African mining industry has been a contentious issue for decades when compared to international benchmarks. Although mining safely has always been part of the mining business proposition, a step change was required as the unacceptable safety performance threatened the sustainability of mining.

Although the number of fatalities has decreased significantly in recent times, it still occurs too often to be acceptable by society. Below are examples of major disasters, including incidents where multiple fatalities occurred in the South African mining industry in recent times:

- In 1986, 177 mineworkers died at the Kinross Gold Mine near Secunda, in the Mpumalanga Province (SAHISTORY 2018);
- In 1993, 53 people died due to a major methane explosion at Middelbult Colliery near Secunda in Mpumalanga Province (SAHISTORY 2018);
- In 1994, 17 people died when a Harmony Mine tailings dam failed and flooded the suburb of Merriespruit, Virginia, Free State Province (Tailings 2018);

- In 1995, 104 mineworkers died in the worst shaft accident in Vaal Reefs Mine disaster near Klerksdorp in the North West Province;
- In 1997 there were 18 fatalities in a rockburst at Hartebeestfontein Mine, near Stilfontein in the North West Province;
- In 1997 there were 10 fatalities in a rockburst at the Deelkraal Mine, near Carletonville in the North West Province;
- In 1999 there were 19 fatalities in a methane ignition at Mponeng Mine, near Carletonville in the North West Province;
- In 2001 there were 13 fatalities in methane explosion at Beatrix Mine near Virginia in the Free State Province (SA Colliery Managers 2018);
- In 2007 more than 3 000 people were stranded underground following the fall of a compressed air column into the Harmony's Elandsrand shaft near Carletonville in the North West Province. Not a single person was hurt in this incident (Appendix C: HAR 2007);
- In 2009 82 'illegal miners' died from inhalation of poisonous gasses created by a fire in the workings of Harmony's Eland Shaft, a previously closed down mine shaft in Welkom in the Free State Province (Appendix C: HAR 2009);
- In 2015 a methane explosion occurred at the Brand 1A ventilation shaft in Welkom in the Free State Province, which was being rehabilitated causing R25m damage (Appendix C: HAR 2015), and
- In 2016, 3 miners died, and 76 trapped miners were rescued due major land subsidence at Lily mine in Barberton in the Mpumalanga Province. As at July 2018 the 3 bodies of the deceased had not been retrieved (Business Day 2018).

The aforementioned examples point out some of the inherent risks associated with mining.

51 430 Fatalities occurred in the South African mining industry during the past 100 years between 1917 and 2016, as shown in Figure 1. Although the number of

deaths has been decreasing substantially during the past 20 years since 1997, it remains unacceptably high at 73 fatalities in 2016, as shown in Figure 3 and 4.

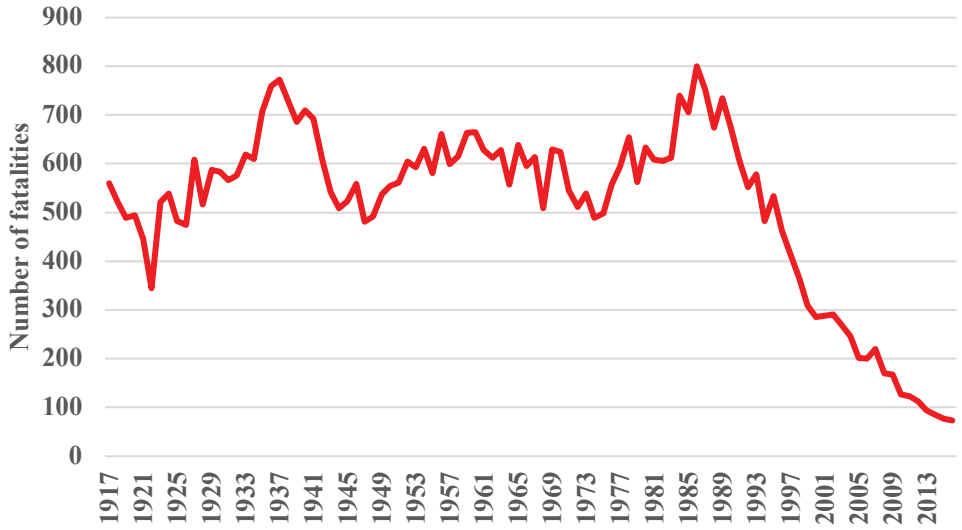


Figure 1 South African Mining Industry Fatalities between 1917 and 2016. (Wagner, 1988. Leon Commission, 1995. HSRC, 2011. Phakati, 2016).

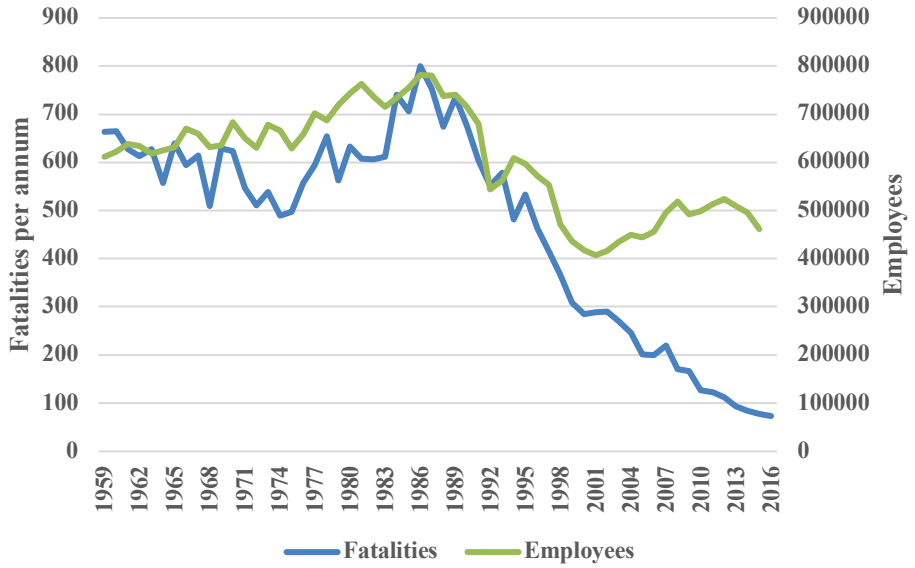


Figure 2 Fatalities and employees in the SA mining industry 1959-2016. (Wagner, 1988; Leon Commission, 1995; HSRC, 2011; Phakati, 2016).

This reduction in fatalities has been partly as a consequence of the reduced number of employees up to about 2003 as shown in Figure 2. However, it can also

be seen that subsequently there is no correlation between the number of employees and fatalities as the risk exposure has been reduced.

The South African Mining Industry has in recent times made significant inroads in improving safety as it is viewed as a business imperative to ensure long-term sustainability. A total of 1 246 Mineworkers lost their lives during the period 2007-2016 and the fatalities reduced from 220 in 2007 to 73 in 2016 as shown in Figure 3.

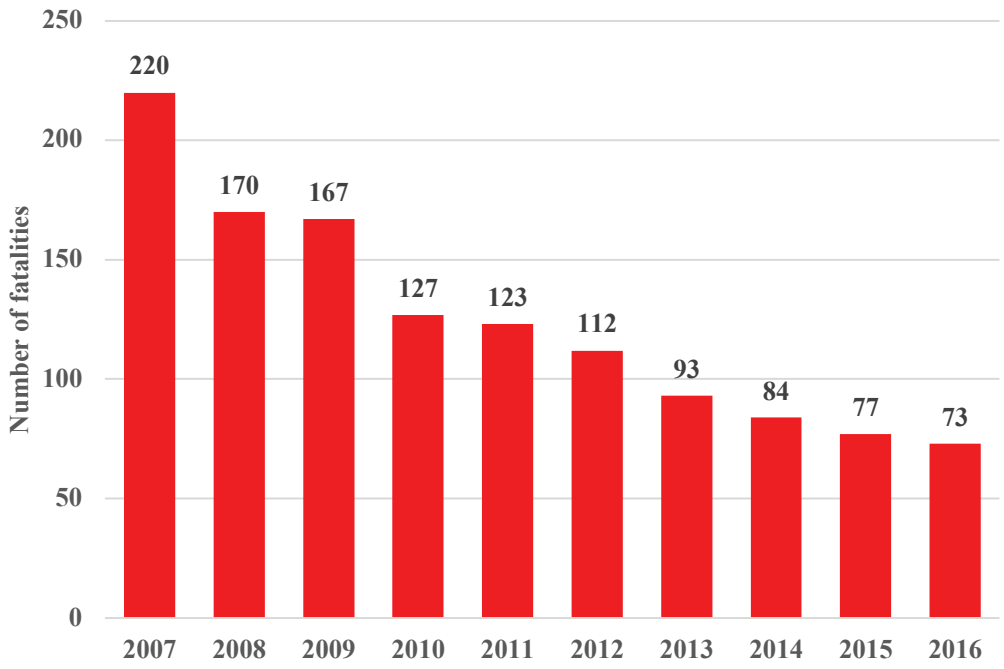


Figure 3 1 246 Fatalities between 2007 and 2016. (COM 2017).

The National Union of Mineworkers (NUM) was formed in 1982 (Leon Commission 1995) and was recognised by the South African Chamber of Mines in 1983 as a representative union (Hocking 1997). In the same year Hlobane Colliery methane explosion resulted in 68 fatalities (Hocking 1997). In 1985 NUM expressed concern over the mining industry safety record.

In 1986 a fire at Kinross fire resulted in 177 fatalities followed in 1987 by a methane explosion in the Ermelo coal mine which resulted in 34 fatalities (Leon

Commission 1995). In the same year St Helena mine had a shaft explosion causing a cage to fall down the shaft resulting in 67 fatalities (Hocking 1997). NUM had a National strike for 3 weeks in 1987 calling for improved safety conditions in the mines (Hocking 1997). It was a watershed period in the South African mining industry as there was a step change in the society-at-large holding mine management accountable for the safety performance at the mines (Leon Commission, 1995).

Safety improvement in the South African mining industry basically commenced in 1986, as shown in Figure 3. At the time there was significant company restructuring and refocusing as some mature shafts were closed, some shafts were sold to 2nd and 3rd tier companies and NUM's presence was felt in the mining industry.

In 1988, the Association of Mine Managers (AMMSA) Council decided that safety would be at the top of all agendas and AMMSA organised a safety symposium (Hockings, 1997).

In 1993, the Leon Commission of Inquiry was launched into safety and health in the mining industry with wide scope to inquire into all aspects of the Regulation of OHS. The findings built on previous inquiries done in 1911, 1925, 1960. The Mine Health and Safety Act (MHSA), Act 29 of 1996 was promulgated following the outcomes of the Leon Commission.

In October 2007 three thousand two hundred workers were trapped underground for 42 hours at one of the Harmony mines (Appendix C: HAR, 2008-1). This incident prompted the South African President to establish an audit of the health and safety legal compliance at mines during 2008 (Presidential safety audit 2008). The reasons for the audit included that the number of mining fatalities reached a plateau around two hundred per year in 2007, which was deemed too high. Additionally, the mining sector needed to consider what could be done differently in order to improve the mining safety performance and the elimination of fatalities.

In 2007 Cynthia Caroll, the Chief Executive Officer of Anglo American closed two platinum shafts in South Africa following a number of fatalities until the workforce received more safety training. This level of consequence management was unheard of in South Africa at the time (Harvard 2012). The Department of Mineral Resources has subsequently been stopping shafts or part of the operations at regular intervals for transgressions, despite lacking consistency in the approach.

In 2008 the Presidential Mine Health and Safety Audit was commissioned, and recurring themes were again recognised as was the case in the 1960 Marais Commission (Leon Commission, 1995).

Why were some of these recommendations not implemented at the time? The compelling answer is probably that the mining industry at large was not held accountable for their actions and non-compliance had insignificant consequences for the individual companies in the past. The mining industry response to safety has changed significantly in the past two decades and the historical prerogative to 'ignore' safety issues is no longer an option as mining companies are being held accountable for their actions.

Some of the findings of the Presidential audit in 2008 included the recommendation that the Mine Health and Safety Council (MHSC) needs to be strengthened to continue to make a meaningful impact in rapidly reducing the levels of injuries and death in the mining sector. Additionally, that the Mine Health and Safety Inspectorate (MHSI) be restructured to provide flexibility for the Inspectorate to deliver on its mandate around safety and health in the mining industry.

The Chamber of Mines (COM) became a conduit to operationalise the strategic safety thrusts that the MHSC determined through tripartite processes. The MHSI increasingly held mine management accountable for safety transgressions by issuing Section 54 stoppages for mines. The net result was that there were real consequences for no adherence to legal requirements.

In 2012 the COM established the CEO ‘Zero Harm’ Task Team to visibly lead by example, to drive health and safety initiatives and to share experiences to help address key challenges in a manner that will enable the industry to achieve the 2024 milestones and accelerate the industry’s journey to ‘Zero Harm’. The appointment of this task team has had a major effect on the safety of the South African mining industry, as CEO’s had a peer group where they held each other accountable for improved safety performance (COM 2018).

1.3 Research methodology

Safety is an emotive subject as people could die in an industrial setting where risks associated with the work environment has sources of potential energy that could be inadvertently released due to inadequate design, processes, equipment, materials and activities, or a combination thereof.

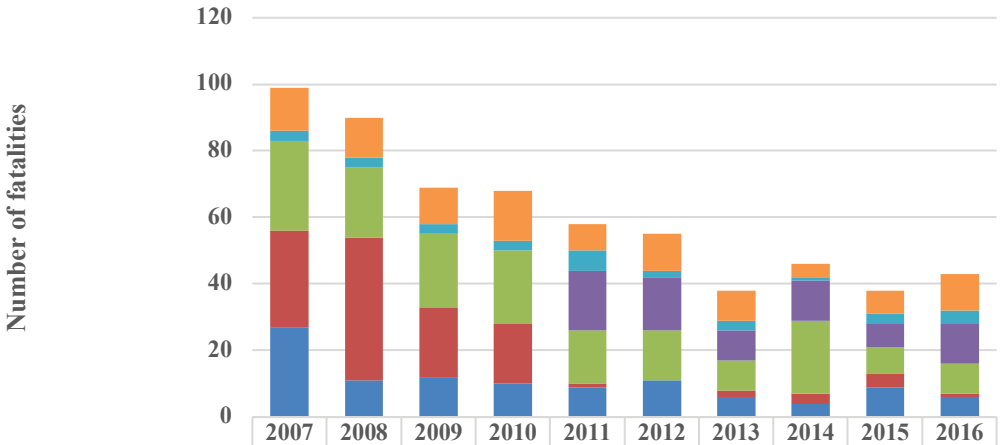
The mining industry is an industrial setting where historically deaths and injuries occur as a matter of routine although significant effort is expended by all relevant stakeholders to reduce the risks. Ultimately the government, mining companies and organised labour have obligations to the society at large to be safe and so has the individual to himself and his family and friends.

The motives and actions of the stakeholders are mostly focused on achieving ‘Zero Harm’ through tripartite alliances including government, mining companies and organised labour, although not always successful due to diverse expectations. Ultimately the mining companies are accountable to ensure that ‘Zero Harm’ is achieved through collaboration of the stakeholders.

The individual companies shares their safety approach and outcomes if they are publicly listed through annual reports that complies to the Global Reporting Initiative for transparency and disclosure. The research was conducted using this publicly available information as the basis of the research as mining companies, government and organised labour are reluctant to share more safety related detail with individuals who do independent research.

Six South African deep level mining companies i.e. AngloGold Ashanti, Harmony, Gold Fields, Sibanye Stillwater, Lonmin and Impala Platinum were researched for the period 2007-2106. These were all publicly listed companies who produced annual reports which complied to the Global Reporting Initiative (GRI) requirements. The GRI is an international independent standards organisation that helps businesses, governments and other organisations understand and communicate their impacts on issues such as climate change, human rights and corruption.

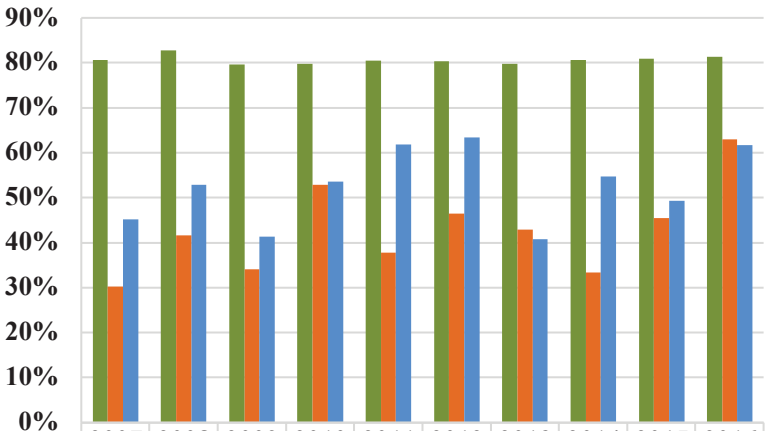
The companies researched were responsible for 606 fatalities (48,7%) out of the 1 245 fatalities that occurred during 2007-2016 in the South African mining industry as shown in Figures 4 and 5.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Implats Fatals	13	12	11	15	8	11	9	4	7	11
Lonmin Fatals	3	3	3	3	6	2	3	1	3	4
Sibanye Fatals Gold					18	16	9	12	7	12
Harmony Fatals	27	21	22	22	16	15	9	22	8	9
GF Fatals	29	43	21	18	1	0	2	3	4	1
AGA Fatals	27	11	12	10	9	11	6	4	9	6

Figure 4 Number of fatalities in companies researched (COM 2017 and companies researched annual reports 2007-2016).

The focus was on the South African operations only as the broader society expectations are similar, the same legal framework is applicable and the collaborative approach through the Chamber of Mines was explored.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
% Gold fatalities researched	81%	83%	80%	80%	80%	80%	80%	81%	81%	81%
% Platinum fatalities researched	30%	42%	34%	53%	38%	46%	43%	33%	45%	63%
% of Industry fatalities researched	45%	53%	41%	54%	62%	63%	41%	55%	49%	62%

Figure 5 Percentage of the SA mining industry fatalities researched. (COM 2017 and companies researched annual reports 2007-2016).

The annual company reports were mostly found useful but, in some instances, there were inconsistencies to reconcile numbers. Some of the safety indicators used by the companies concerned were changed as soon as it no longer served the purpose of getting the company's storyline across. In several instances the same information was padded and dished up differently in the same reports which resulted in the repetition of the same message. However, the information was useful enough to determine the strategic thrusts that the companies pursued in their quest for 'Zero Harm'. The specific areas focused on to determine the different company safety approaches included:

- The safety commitments to all stakeholders in the form of vision statements, values and policies;
- The influence of external safety advocacy and the inclusion of it in the overall safety strategy;
- The articulation of the intent to achieve 'Zero Harm' by the company board, Chairperson, Directors and Chief Executive Officer;

- The governance as well as the leadership approach at Board level on safety related issues;
- The leadership approach to safety and the formulation of a safety strategy to achieve ‘Zero Harm’;
- The creation of an enabling environment to achieve ‘Zero Harm’;
- The systemisation of the elements required to achieve ‘Zero Harm’;
- The humanisation of the system requirements by dealing with creating competency and wellbeing to achieve ‘Zero Harm’, and
- The actions taken by the leadership to reduce the risk exposure of the employees, and the resultant safety outcomes.

The findings from the annual reports were compiled by year per company and subsequently aggregated over the ten year period between 2007-2016 to determine emerging themes per company. The emerging themes of the six companies were then analysed to determine the collective ‘industry’ safety approach as well as unique company approaches.

The national advocacy by the Department of Mineral Resources, Chamber of Mines and organised labour proved to be equally difficult to get information from. The published information from these entities was analysed as per the previously highlighted process. The international advocacy by the International Council on Mining and Metals as well as the Global Reporting Initiative were considered in the research.

Historical information was researched to get a perspective on when safety started improving as well as to determine historical safety approaches and emerging themes for the South African mining industry. Discussions were held with senior mining leadership who were previously involved with safety on mines as well as some who are currently responsible for safety in the South African mining industry.

The holistic approach was then compared to the theoretical safety approach researched from available academic information. The net result is what the South African mining industry has been doing to achieve a reduction in the fatalities in the South African Mining Industry.

The historical South African mining industry's safety performance and the theoretical approach to achieve 'Zero Harm' is discussed in Chapter 2 - *Literature review*. The overall storyline of the research conducted is described in Chapters 3-7 as follows:

- Chapter 3 – *Leadership taking heed of the broader society's safety expectation*, describes the national and international safety advocacy that the company's leadership should take heed of.
- Chapter 4 – *Institutionalise the approach to 'Zero Harm'*, describes how the external advocacy is institutionalised in the company with reference to the articulation of the strategic intent within the company.
- Chapter 5 – *Systemise the safety activities*, describes how the strategic intent of achieving 'Zero Harm' is systemised to get consistency throughout the company.
- Chapter 6 – *Humanise the safety system*, describes how to give life to the safety system by capacitating the relevant human interfaces required to achieve 'Zero Harm'.
- Chapter 7 – *Operationalise the management system*, describes the real risk reduction initiatives in the companies researched.
- Chapter 8 - *Company safety performance*, describes the safety outcomes of the companies researched in comparison with the international achievements.
- Chapter 9 – *Conclusion and recommendation,* summarises the research and describes the overall recommended safety approach.

The Appendices include a timeline of the journey towards achieving 'Zero Harm' as well as detail of the companies researched:

- Appendix A: *Journey towards 'Zero Harm' timeline.*
- Appendix B: *The safety journey of AngloGold Ashanti between 2007 and 2016.*
- Appendix C: *The safety journey of Harmony between 2007 and 2016*.
- Appendix D: *The safety journey of Gold Fields between 2007 and 2016.*
- Appendix E: *The safety journey of SibanyeStillwater between 2012 and 2016.*
- Appendix F: *The safety journey of Lonmin between 2007 and 2016.*
- Appendix G: *The safety journey of Implats between 2007 and 2016*.

2 LITERATURE REVIEW

2.1 Historical South African mining industry safety performance

51 430 Mineworkers died in a 100-year period between 1917 and 2016 as shown in Chapter1-Figure 1. 4 116 (8%) of the 51 430 fatalities occurred during the period between 1997 to 2016, a 20-year period and 92% the previous 80 years as shown in Figure 7 and 8. The number of fatalities has steadily been declining since 1986 as shown in Figure 8 and 9.

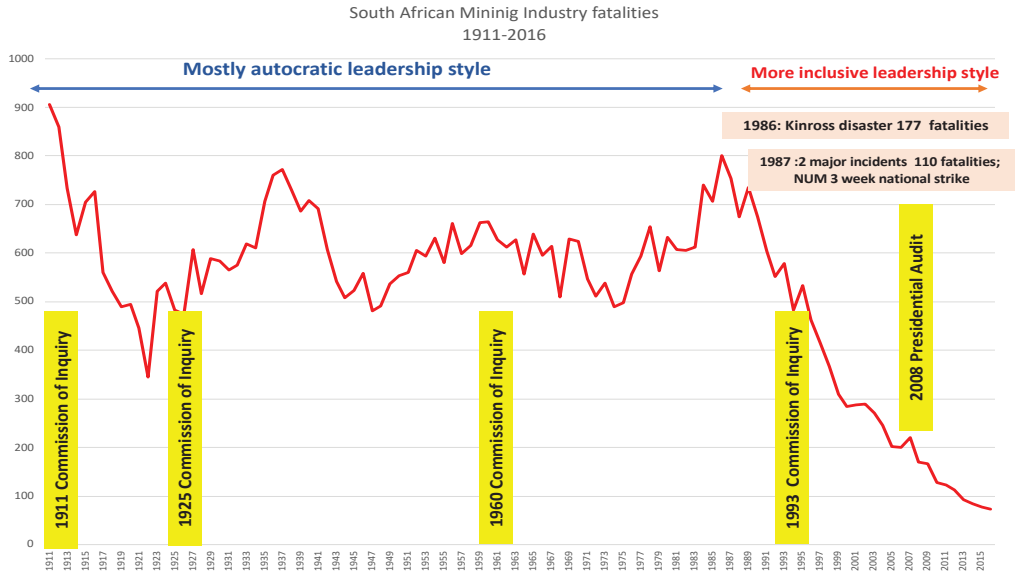


Figure 6 South African mining industry – Major governmental interventions. (Wagner, 1988; Leon Commission, 1995; HSRC, 2011; Phakati, 2016).

In the decade 1997 to 2006, 2 870 fatalities occurred compared to 6 049 the previous decade between 1987 to 1996. It was a -52% variance, decade on decade. In the decade 2007 to 2016, 1 246 fatalities occurred compared to 2 870 the previous decade between 1987 to 1996. It was a -56% variance, decade on decade as shown in Figures 9.

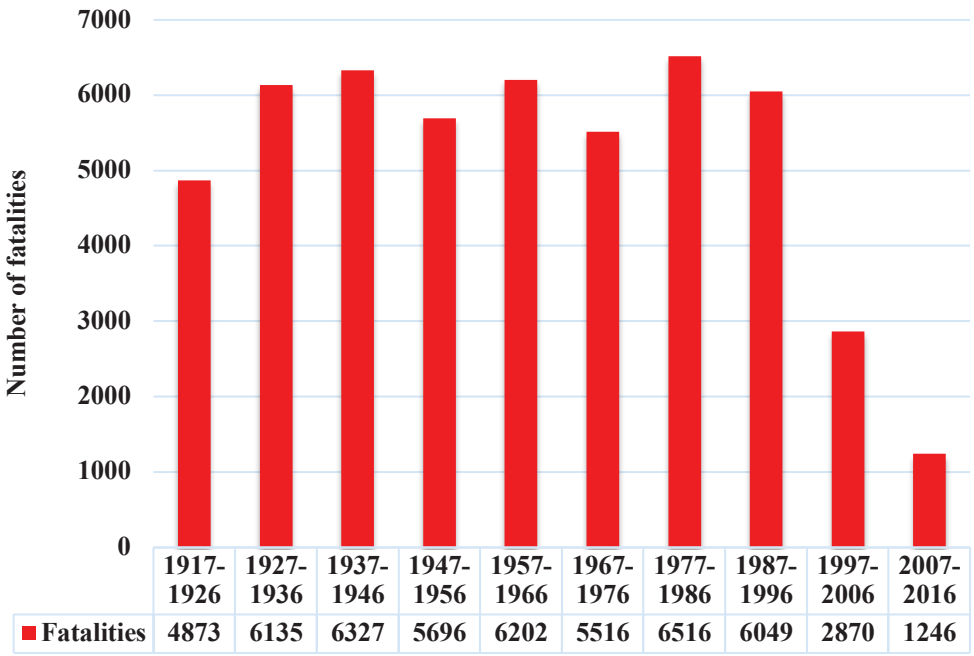


Figure 7 South African mining industry fatalities between 1917 and 2016. (Wagner, 1988; Leon Commission, 1995; HSRC, 2011; Phakati, 2016).

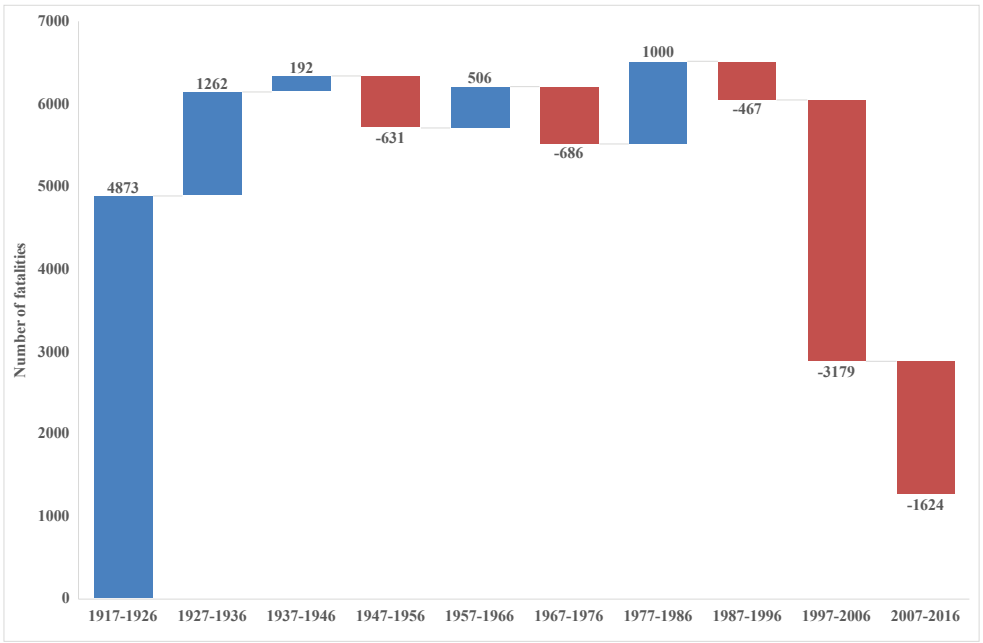


Figure 8 South African Mining Industry fatalities variance per decade

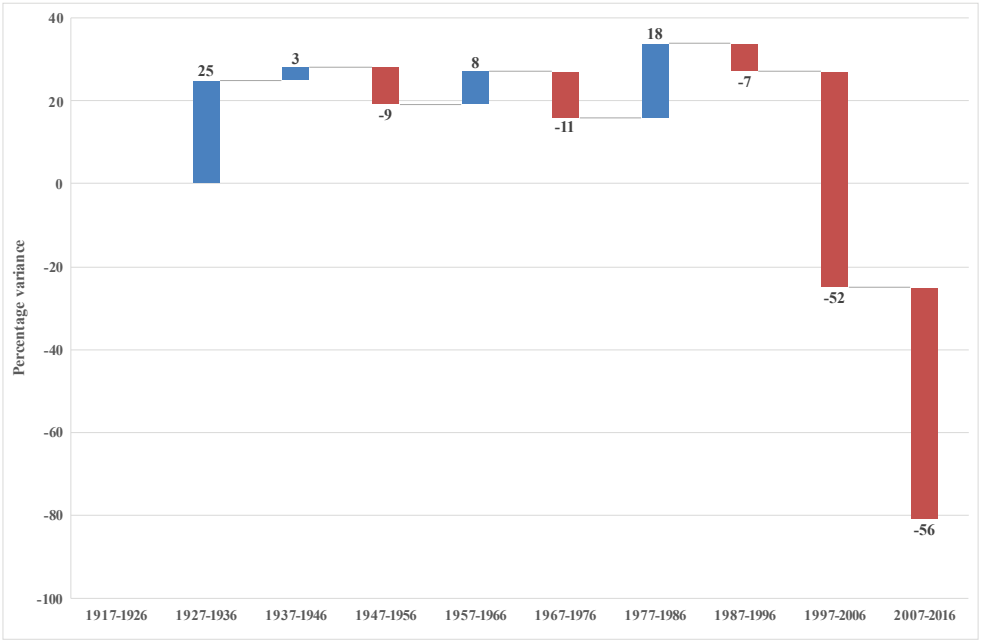


Figure 9 South African mining industry percentage variance per decade (Wagner, 1988; Leon Commission, 1995; HSRC, 2011; Phakati, 2016).

The safety improvement in the South African mining industry basically commenced in 1986 after the Kinross mining disaster. The fatalities in subsequent years generally followed a downward trend as shown in Figure 8 and 9. The fatalities reduced from 219 per annum in 2007 to 73 per annum in 2016 which is a 56% improvement as shown in Figure 3. This collective improvement is partly due to the co-operative approach in the South African mining industry in order to reduce fatalities and embracing the MHSC initiatives.

2.2 Historical safety performance in the United States of America.

Coal miner safety and health in the United States of America has improved significantly in recent years and the fatality rates continue to decrease as shown in Figures 10 and 11. Many of the hazards that plagued miners in the past, such as coal bumps, methane and coal dust explosions, ground fall accidents and health issues have been significantly reduced (Esterhuizen and Gurtunca 2006).

Mining remains one of the high risk industries in the U.S. with injury and fatality rates that exceed the national average. The societal expectation of ‘zero accidents’ maintains a continuous demand for further improvements (Kohler 2005). The achievements in mineworker safety have been the result of concerted efforts of industry, government agencies, employee organisations, researchers and manufactures.

The mine health and safety research strategic goals included the reduction of respiratory diseases; reduction of noise-induced hearing loss; reduced repetitive/cumulative musculoskeletal injuries; prevention of traumatic injuries; disaster prevention; machine safety research; reduction of ground failure fatalities and injuries as well surveillance and training.

Interestingly, a close proximity warning device was licenced in the early 2000’s and technical guidance in the application of the proximity warning systems was given by the National Institute for Occupational Safety and Health (NIOSH). The implementation of automatic fire suppression systems on conveyor belt drives successfully controlled the spread of belt fires.

Ground failure software was designed that addressed most aspects of coal pillar designs, roof support and retreat mining to longwall panel layouts. Guidelines were developed for coal pillar recovery and widespread use of mobile roof supports as well as for designing deep-cover mines to prevent violent failures of highly stressed coal.

A research and educational campaign focussed on increasing awareness about rock fall injuries and the use of surface controls in coal mines. Mine design technologies such as the Coal Mine Roof Rating and Analysis of Horizontal Stress in Mines and guidelines for preventing massive pillar collapses were developed. Ground control short courses were conducted and ground control training was provided for all coal mine inspectors of Mine Health and safety Administration (Esterhuizen and Gurtunga 2006).

2.2.1 USA mining legislation history

From a legal perspective, the USA Congress passed the first federal statute governing mine safety in 1891, marking the beginning of what was to be an extended evolution of increasingly comprehensive federal legislation regulating mining activities. It established minimum ventilation requirements in underground coal mines and prohibited operators from employing children under 12 years of age.

In 1910 following a decade in which the number of coal mine fatalities exceeded 2 000 annually, Congress established the Bureau of Mines as a new agency in the Department of the Interior. The Bureau was charged with the responsibility to conduct research and to reduce accidents in the coal mining industry, but was given no inspection authority until 1941, when Congress empowered federal inspectors to enter mines. In 1947 Congress authorized the formulation of the first code of federal regulations for mine safety.

The Federal Coal Mine Safety Act of 1952 provided for annual inspections in certain underground coal mines, and gave the Bureau limited enforcement authority, including power to issue violation notices and imminent danger withdrawal orders. The 1952 Act also authorized the assessment of civil penalties against mine operators for noncompliance with withdrawal orders or for refusing to give inspectors access to mine property, although no provision was made for monetary penalties for non-compliance with the safety provisions. In 1966, Congress extended coverage of the 1952 Coal Act to all underground coal mines.

The first federal statute directly regulating non-coal mines did not appear until the passage of the Federal Metal and Non-metallic Mine Safety Act of 1966. The 1966 Act provided for the promulgation of standards, many of which were advisory, and for inspections and investigations; however, its enforcement authority was minimal.

The Federal Coal Mine Health and Safety Act of 1969, generally referred to as the Coal Act, was more comprehensive and more stringent than any previous Federal legislation governing the mining industry. The Coal Act included surface as well as underground coal mines within its scope, required two annual inspections of every surface coal mine and four at every underground coal mine, and dramatically increased federal enforcement powers in coal mines. The Coal Act also required monetary penalties for all violations, and established criminal penalties for knowing and wilful violations. The safety standards for all coal mines were strengthened, and health standards were adopted. The Coal Act included specific procedures for the development of improved mandatory health and safety standards, and provided compensation for miners who were totally and permanently disabled by the progressive respiratory disease caused by the inhalation of fine coal dust pneumoconiosis or ‘black lung’.

In 1973, the Secretary of the Interior, through administrative action, created the Mining Enforcement and Safety Administration (MESA) as a new departmental agency separate from the Bureau of Mines. MESA assumed the safety and health enforcement functions formerly carried out by the Bureau to avoid any appearance of a conflict of interest between the enforcement of mine safety and health standards and the Bureau's responsibilities for mineral resource development.

Congress passed the Federal Mine Safety and Health Act of 1977 (Mine Act), the legislation which currently governs MSHA's activities. The Mine Act amended the 1969 Coal Act in a number of significant ways, and consolidated all federal health and safety regulations of the mining industry, coal as well as non-coal mining, under a single statutory scheme. The Mine Act strengthened and expanded the rights of miners, and enhanced the protection of miners from retaliation for exercising such rights.

Mining fatalities dropped sharply under the Mine Act from 272 in 1977 to 86 in 2000. The Mine Act also transferred responsibility for carrying out its mandates

from the Department of the Interior to the Department of Labour, and named the new agency the Mine Safety and Health Administration (MSHA). Additionally, the Mine Act established the independent Federal Mine Safety and Health Review Commission to provide for independent review of the majority of MSHA's enforcement actions.

In 2006 Congress passed the Mine Improvement and New Emergency Response Act (MINER Act). The MINER Act amended the Mine Act to require mine-specific emergency response plans in underground coal mines; added new regulations regarding mine rescue teams and sealing of abandoned areas; required prompt notification of mine accidents; and enhanced civil penalties (MHSA 2017).

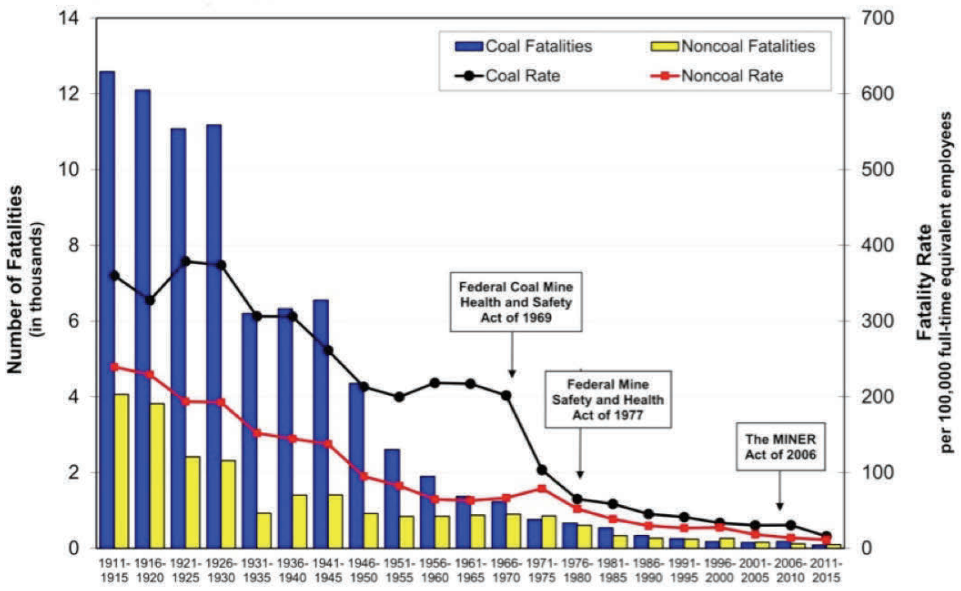
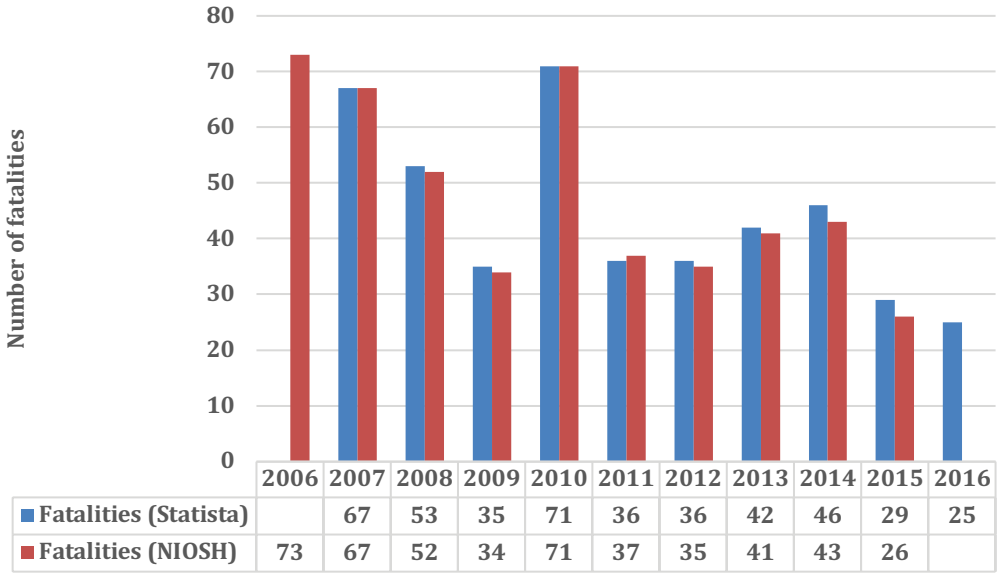


Figure 10 Number of fatalities and fatality rates (5-year aggregates) in the United States mining industry by sector, 1911-2015 (NIOSH).



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fatalities (Statista)		67	53	35	71	36	36	42	46	29	25
Fatalities (NIOSH)	73	67	52	34	71	37	35	41	43	26	

Figure 11 The number of fatalities in the United States of America for the years 2006-2015 (NIOSH and Statista).

2.3 Mining legislation history of Australia

During the colonialism era during 1788-1850, ownership of minerals and petroleum in Australia passed to those who were granted title to land by the colonial governors according to common law concepts. The exception was that precious metals of gold and silver which remained vested in the Crown by virtue of Royal entitlement. From 1855, colonial parliaments legislated for ownership of minerals to be retained by the Crown in future grants of freehold titles which resulted in the State owning nearly all the minerals.

Specific mine safety legislation was introduced in Queensland 1898. The Mines Regulation Act was introduced in 1910. A Separate Coal Mining Act was introduced in 1925 following from the Royal Commission into the Mt Mulligan disaster which 75 men and boys were killed. Despite regular amendment and update, the 1925 Coal Mining Act remained in force until 2001, when it was replaced with the Coal Mining Safety and Health Act 1999 following the Moura 2 explosion and inquiry in 1994.

In New South Wales, the Coal Mines Regulation Act was introduced in 1912, followed by the Coal Mining Act of 1973, Coal Mining Regulation Act 1982 and Coal Mine Health and Safety Act 2002 (Mine Accidents). Each of the States and Territories has its own legislation regulating the exploration for and production of onshore minerals. A myriad of laws are collectively used in the Australian mining industry to ensure safety (safeworkaustralia.gov.au). These include:

New South Wales

- Work Health and Safety (Mines and Petroleum Sites) Act 2013.
- Health and Safety (Mines and Petroleum Sites) Regulation 2014.

Victoria

- Chapter 5 of the Occupational Health and Safety Regulations 2007.

Queensland

- Mining and Quarrying Safety and Health Act 1999.
- Mining and Quarrying Safety and Health Regulation 2001.
- Coal Mining Safety and Health Act 1999.
- Coal Mining Safety and Health Regulation 2001.

Western Australia

- Mines Safety and Inspection Act 1994.
- Mines Safety and Inspection Regulations 1995.

South Australia

- Chapter 10 of the Work Health and Safety Regulations 2012 (SA).

Tasmania

- Mines Work Health and Safety (Supplementary Requirements) Act 2012.
- Mines Work Health and Safety (Supplementary Requirements). Regulations 2012

Australian Capital Territory

- Work Health and Safety Act 2011.
- Work Health and Safety Regulation 2011.

Northern Territory

- Work Health and Safety (National Uniform Legislation) Act.
- Chapter 10 of the Mines Work Health and Safety (National Uniform Legislation) Regulations.

The Australian mining industry has made significant improvements in health and safety over the last decade, reducing the incidence rates of both fatalities and serious injuries. However, the mining industry still has one of the highest rates of fatalities of any industry in Australia as is shown in Figure 12 (dmp.wa.gov.au).

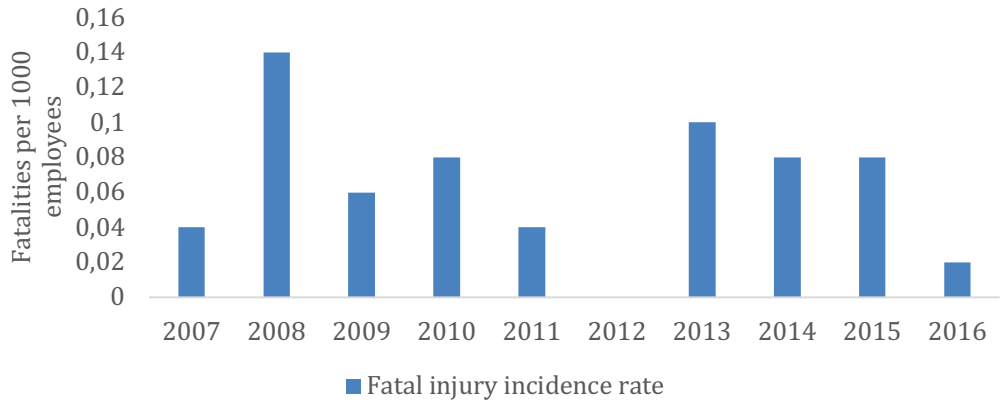


Figure 12 Western Australia Mining Fatal Injury Incidence Rate (Department of Mines, Industry Regulation and Safety)

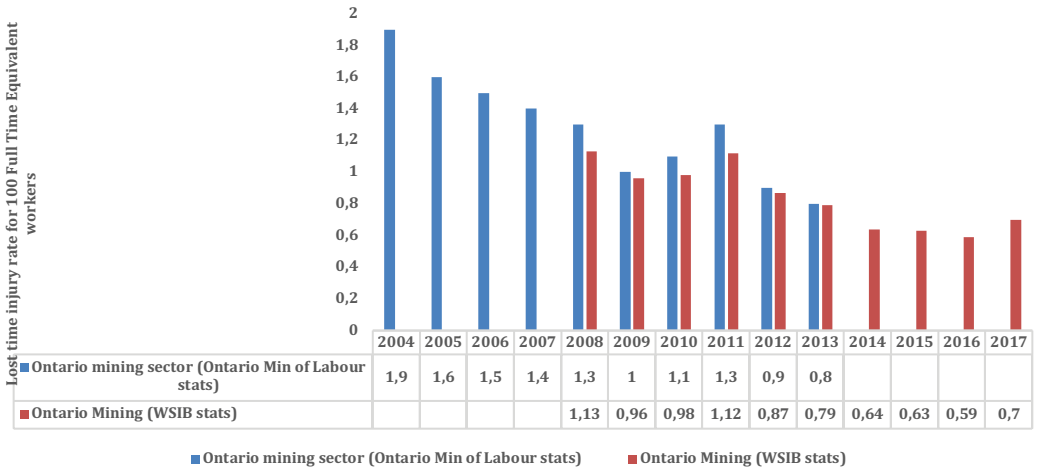
2.4 Mining legislation history of Ontario, Canada

In Canada, mining health and safety is mostly the responsibility of the provincial and territorial governments. Each of the ten provinces in Canada has its own Occupational Health and Safety legislation. The federal government is responsible for certain federally owned mines in the provinces and, through the Canadian Nuclear Safety Commission, for uranium mines (Canadian Encyclopaedia).

Ontario is the largest producer in Canada of gold, platinum group metals and nickel, and the second largest producer of copper. It is one of the safest mining jurisdictions in the world achieving a 96% improvement in lost time injury frequency over the past 30 years (oma.on.ca).

Up until the early twentieth century, employers were not responsible for providing compensation or care for injured workers unless the accident was deemed to be entirely the fault of the workplace. The overriding legal principle was that the onus was on the workers who, upon accepting employment, assumed and accepted all the risks associated with their occupation. The Depression during the 1870's resulted in worsening working conditions for the workers which was exacerbated by the lack of legal and compensation remedies. The concern for improved health and safety can be traced back to the introduction Workmen's Compensation for Injuries Act (1886).

The evolution of the legislative in Ontario, Canada commenced in 1890 and has been progressively updated. The mining legislative progression has resulted in Ontario being one of the safest mining jurisdictions in the world as shown in Figure 13 (oma.on.ca).



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ontario mining sector (Ontario Min of Labour stats)	1,9	1,6	1,5	1,4	1,3	1	1,1	1,3	0,9	0,8				
Ontario Mining (WSIB stats)					1,13	0,96	0,98	1,12	0,87	0,79	0,64	0,63	0,59	0,7

Figure 13 Ontario mining lost time injury rate (WSIB: Ontario Ministry of Labour).

The evolution of the mining legislation includes:

1890: Mining Operations Act: Rules were established for ventilation, blasting, manholes, lifting devices, shafts, signals, brakes, machinery and boilers.

1912: Mining Act: New requirements for care and handling of explosives, ladderways, shafts, hoists, scaling equipment, signals, dressing rooms, first aid, dust protection, electricity and worker refuge places.

1914: Workmen's Compensation Act: The Workmen's Compensation Board was established with responsibility for worker compensation and rehabilitation.

1920: Ontario Mining Association was established.

1929: Ontario Mine Rescue created under the Department of Mines.

1930: Mines Accident Prevention Association of Ontario created - now Workplace Safety North.

1976: The Report of the Royal Commission on the Health and Safety of Workers in Mines. The Ham Report was published, introducing the Internal Responsibility System whereby all parties in the workplace contribute to detecting and correcting workplace anomalies that can lead to injury and illness.

1978: Occupational Health and Safety Act.

1979: Mandatory specialised training established: Common Core / Specialised Skills for Underground Hard Rock Mining.

1982: Burkett Commission report on mine safety leads to a governance model for incident investigations.

1985: Stevenson Commission on mine safety resulted in improved training and communication.

1988: Workplace Hazardous Materials Information System was established.

2015: Mining Health, Safety and Prevention Review. The Ontario government, in cooperation with the Ontario mining industry and labour, conducted a comprehensive underground mining health, safety and prevention review led by

Ontario's Chief Prevention Officer. Several issues were examined to assist in ensuring an even stronger and safer underground mining sector.

2.5 Historical safety advocacy context in South Africa

In 1982 the National Union of Mineworkers (NUM) was recognised by two mines as a representative union and in 1983 it was recognised by the South African Chamber of Mines as a representative union (Hocking 1997).

In 1983 the Hlobane Colliery had a methane explosion resulting in 68 fatalities. In 1985 NUM criticised the mining industry safety record (Leon Commission 1995). In 1986 the Kinross fire resulted in 177 fatalities followed in 1987 by a methane explosion in the Ermelo coal mine which resulted in 34 fatalities. In the same year St Helena mine had a shaft explosion causing the cage to fall down the shaft resulting in 67 fatalities. NUM had a National strike for 3 weeks in 1987.

In 1988, the Association of Mine Managers (AMMSA) Council decided that safety would be at the top of all agendas and AMMSA organised a safety symposium (Hocking 1997).

However, in 1993, the Leon Commission of Inquiry was launched in South Africa into safety and health in the mining industry with wide terms of reference to inquire into all aspects of the regulation of OHS. The findings built on previous Inquiries done in 1911, 1925, 1960. Subsequently a Presidential Mine Health and Safety Audit was conducted in 2008 as safety deteriorated (Leon Commission 1995).

2.5.1 1911 Prevention of explosions Commission of Inquiry

In 1911 a Commission of Inquiry was appointed in South Africa to determine the most practical means to be adopted for the prevention of explosions of gas and coal dust in the Natal collieries. In its conclusions the Commission referred, among others, to the inadequacy of mining law, the importance of good

relationships between the inspectorate and mine officials, the general administration of a mine and the importance of the relationship between the mine officials and the workforce.

At the time, the safety of South African mineworkers was provided for in the Mines and Works Act No.12 of 1911 and its applicable regulations (Leon Commission 1995).

2.5.2 1925 Mining Regulation Commission

In 1925 the Mining Regulation Commission was established to inquire the effect of regulations dealing with the supervision of underground working places, on the accident rate, the safety and health conditions in the mines, and the extent to which mining regulations affected good relations between employers and employees. Some of the findings included that the Mine Inspectorate was understaffed and an insufficient number of inspections were done. The inspectorate relied on the reports and accident records provided by the managers.

The employers and employees disregarded regulations and the risk of contraventions of regulations being detected was minimal. The relationship between the enforcing inspectorate and mine managements was important but a contributing factor to the non-compliance of regulations lay in the relations between senior inspectors, the Government Mining Engineer's Department and mine management. It was recommended that the Inspectors needed to keep management more at arm's length.

In the case of breaches of regulations by a miner and a 'mine worker', they were prosecuted, and in the case of breaches of regulations by a manager he was advised to take steps to remove the probability of the offence being repeated.

In summary, the managers were not held accountable for their actions and consequence management was minimal. From a behavioural perspective management knowingly violated legal requirements (Leon Commission 1995).

2.5.3 Mines and Works Act No. 27 of 1956.

The Mines and Works Act No.12 of 1911 was repealed by the Mines and Works Act No. 27 of 1956.

2.5.4 1960 Marais Commission of Inquiry

In 1960 the Marais Commission of Inquiry was appointed following the Coalbrook Colliery disaster in which 437 persons lost their lives. One of the comments from this commission was: 'Mining is inherently dangerous both to life and health. Those who wish to extract anything from under the surface of the earth by digging a hole must be prepared to devote some of their resources to safety. It is an unnatural activity giving rise to unnatural conditions. But safety measures invariably cost money and the employer must bear its expenditure. Thus, a perpetual conflict of interest arises between employer and employee as to the nature and extent of the safety measures that may be considered reasonably practical and reasonably necessary'.

In summary, the poor safety performance was justified and the divide between management and workers was perpetuated. From a behavioural perspective, management probably knowingly violated legal requirements (Leon Commission 1995).

2.5.5 Minerals Act No.50 of 1991.

The Mines and Works Act No. 27 of 1956 was repealed by the Minerals Act No.50 of 1991.

2.5.6 1993 Leon Commission of Inquiry

In 1991 the National Union of Mineworkers (NUM) first called for the establishment of a Commission of Inquiry at the Mining Industry Summit. In

1993 the Leon Commission of Inquiry into safety and health in the mining industry was established with wide scope to inquire into all aspects of the regulation of OHS.

The submissions by NUM demonstrated their concern and determination to obtain better standards of health and safety for the workforce in the mining industry. The number of deaths and serious injuries at the time were considered unacceptable in most advanced mining countries. It was foreseen that the large number of injuries and fatalities would be less and less acceptable in future in South Africa.

At the time, South Africa prided itself as being amongst the most advanced mining countries in the world, but it was certainly not valid with regard to safety. Deep gold mines had onerous hazards, which had the potential to increase the risks of mining considerably (Leon Commission 1995).

2.5.7 Mining Companies

The mining companies argued that they had made an investment in establishing the gold mines at a time when the morality of employing people in hazardous situations was not questioned.

It was found by the Leon Commission that in the case of accidents, workers were mostly blamed for carelessness and lack of attention by management. Many senior mining officials attributed the poor safety record to physical and human factors beyond the industry's control. Management had a recurring defence that the systems in place were acceptable and the accidents were due to human error.

The industry was yet to fully implement the recommendations arising from past research. The theoretical safety solutions were relatively obvious, but difficult and slow to implement in practice. There was a very high degree of illiteracy in the labour force and the general level of education was low.

Although about 80 per cent of South African mines had 4 or 5-star ratings in terms of the International Safety Rating System (ISRS) or NOSA 5 Star Rating System which was predominantly used at the time, they had unacceptable levels of accidents and fatalities (Leon Commission 1995).

2.5.8 Mineworkers

Mineworkers raised complaints mainly about areas of neglect and historical issues that should be addressed as expeditiously as possible. They appeared to realise that the speed at which changes were implemented needed to be moderated to preserve the viability of the mines (Leon Commission 1995)

2.5.9 Government

The Government saw itself being in the middle between the employers and mineworker. The revenue, both the direct tax revenue and the generation of foreign exchange through the export of mineral commodities and products was important to the healthy growth of the South African economy. It had a vested interest in preserving the mines and had to ensure that its citizens and all those employed under its jurisdiction were working in a reasonably safe and healthy environment, and the state had to create the appropriate legislation and the mechanism through which it could enforce the legislation (Leon Commission 1995).

2.5.10 Common concerns

Although the need for change was recognised by the workers and employers, there were serious disagreements on the details of the implementation of the changes. It was perceived by the Commission that under ideal conditions most accidents could have been avoided, and the resolution of rockburst management would probably play a determining role in the long-term future of the industry.

Even if the accidents due to falls of ground were to be removed, the safety record was still poor (Leon Commission 1995).

2.5.11 Recommendations

The Leon Commission recommended that the claim of 'special difficulties' in the mining industry did not absolve the boards of companies, the shareholders and the management from the responsibility of caring, and the need to make a special effort to overcome problems.

Management would have to do all within its ability to minimise the possibility of accidents occurring. Sufficient training should be provided so that employees could recognise hazards and know how to take appropriate steps to avoid these. The illiteracy of mineworkers had to be eradicated as it greatly hindered the development of effective safety training and communication and contributed to the poor safety record.

Management had to engineer the systems so as to minimise the opportunity for human error, and train all ranks of the workforce to act in accordance with the sound procedures in place. It was suggested by the mining industry that risk management was the appropriate tool to handle the safety problems of the mining industry and the world wide experience supported this view. It was essential, therefore, to tackle those problems most urgently that were likely to produce the most benefits.

An acceptable health and safety culture was required including the visible safety commitment from the Chairman and Managing Director of the organisation through all the ranks of management committing itself to managing health and safety actively and that safety came before production. Health and safety should be managed like all the other functions of the organisation and be prioritised as people are the most important asset.

Health and safety was a line management's responsibility and the company's safety organisation, headed by the most senior official should demand accountability, and provide resources to implement its policies. Health and safety issues could not be delegated to safety specialists and Government Inspectors. The health and safety committee within the normal management hierarchy should establish sound policies for improving health and safety, provide manpower, resources, materials and motivation for the task, and review progress at frequent intervals. Objectives should be set for health and safety achievements as they were for production and relevant information was essential for this culture to be established.

Rockbursts were a problem that seemed to become more severe as the depth of mining increased. It was concluded that legislative action alone would not alleviate the occurrence sufficiently. The efficacy of the available measures for combating the future rockburst hazard was doubtful, and effective steps were to be taken to develop improvements in these defensive measures and / or in their implementation. The rockfall and rockburst problems would continue unabated and the risk may even increase over time (Leon Commission 1995).

2.5.12 Mine Health and Safety Inspectorate

It was found by the Commission that there were significant weaknesses in the enforcement capacity of the Mine Health and Safety Inspectorate (MHSI). There was an inadequate number of inspectors and insufficient technical training and the inability to attract persons with engineering and other technical qualifications.

Inadequate investigations and inquiries were done into accidents and other dangerous occurrences, and inefficiency and lack of deterrent of the criminal law as the primary mechanism in the imposition of sanctions, all contributed to a serious weakness in enforcement capacity (Leon Commission 1995).

2.5.13 Mine Health and Safety Act, Act 29 of 1996

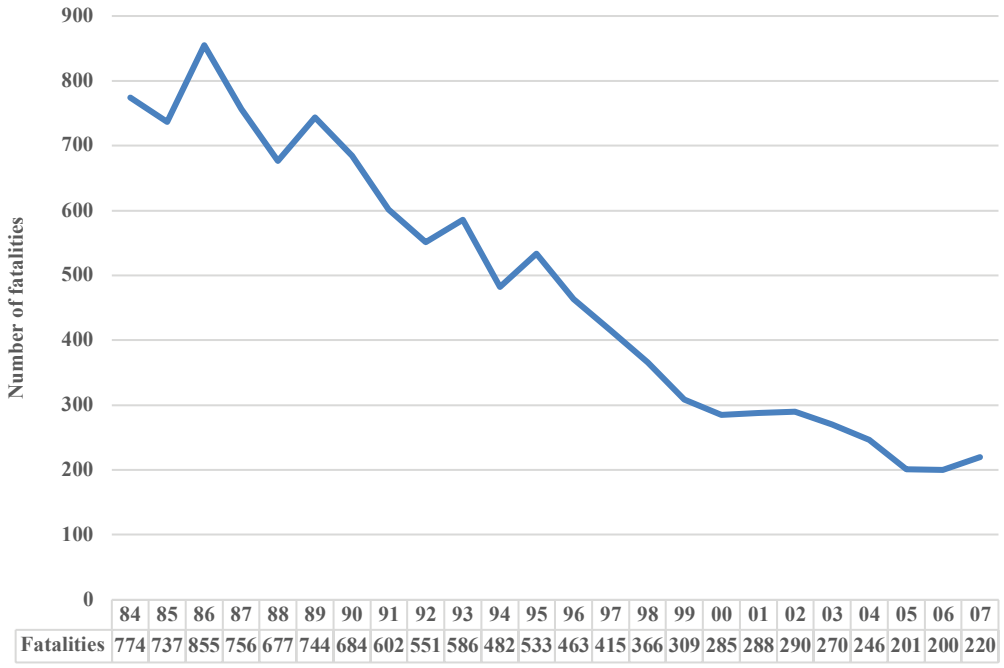
The Mine Health and Safety Act, Act 29 of 1996 (MHSA), was promulgated following the outcomes of the Leon Commission. The MHSA provides for the protection of the health and safety of employees and other persons at mines and, for that purpose:

- to promote a culture of health and safety;
- to provide for the enforcement of health and safety measures;
- to provide for appropriate systems of employee, *employer* and State participation in health and safety matters;
- to establish representative tripartite institutions to review legislation, promote health and enhance properly targeted research;
- to provide for effective monitoring systems and inspections, investigations and inquiries to improve health and safety;
- to promote training and human resources development;
- to regulate *employer*s' and employees' duties to identify hazards and eliminate, control and minimise the risk to health and safety;
- to entrench the right to refuse to work in dangerous conditions; and to give effect to the public international law obligations of the Republic relating to mining health and safety, and
- to provide for matters connected therewith.

2.6 2008 Presidential Mine Health and Safety Audit

In October 2007, 3 200 workers were trapped underground for 42 hours at one of the Harmony mines in South Africa. It prompted the South African President to direct that an audit of compliance with the health and safety legal requirements at mines be conducted in 2008 (Presidential 2008). The reasons for the audit included that the number of mining fatalities reached a plateau around two hundred per year in 2007, which was deemed too high as shown in Figure 14. The mining sector needed to consider what could be done differently to improve the

mining safety performance and the elimination of fatalities. The skill shortage in the mining sector and its impact on safety and concerns around enforcement capacity and lack appropriate health and safety systems as well as the industry health and safety culture concerns.



	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
Fatalities	774	737	855	756	677	744	684	602	551	586	482	533	463	415	366	309	285	288	290	270	246	201	200	220

Figure 14 South African Mining Industry safety statistics, 1984-2007 (Presidential Mine Health and Safety Audit Report, 2008).

It was concluded that there was still a significant amount of work to be done in addressing the health and safety performance of the mining industry. It was found that there was non-adherence to mine planning and that risk assessments and management were not adequately addressed.

Additionally it was found that there was a lack of adequate second outlets underground. In some instances there was no proper system of maintaining machinery and equipment. There was a need for massive capital investment in refurbishing, replacing and improving the current installations.

At the time there was a high labour turnover. Occupational health risk assessment were inadequate or were not addressed at all and there was a lack of formal training on hazard identification and risk assessment.

Some mines did not have Health and Safety Representatives on all their designated working places. There was no procedure in place on the withdrawal or refusing to work in an unsafe working place on some mines, and there were no programs in place on several mines to control all the risks to members of public related to mining (Presidential safety audit, 2008).

2.6.1 Research and systems

It was recommended that the Mine Health and Safety Council needed to be strengthened to continue to make a meaningful impact in rapidly reducing the levels of injuries and death in the mining sector. It had to develop and implement a programme that would promote a culture of health and safety at mines.

The research programme should include rockfalls, engineering and health in order to support health and safety improvements. A national mine seismic network should be developed that would fully be integrated with the Council of Geoscience's seismic network. An integrated system of occupational health management for the mining and minerals sector that linked occupational exposure to harmful substances and the effect on a worker to be established (Presidential safety audit, 2008).

2.6.2 Training

Formal health and safety training at all levels of education and training in the sector had to be improved. The health and safety competency for managerial and supervisory appointees should be updated. The training of health and safety representatives was to be prioritised.

A massive investment was required in skills development in the mining sector for its sustainability. The general low literacy levels of employees compounded the problem of safety and health in the mining. The lack of a common communication undermined the effectiveness of oral communication and had a negative effect on skills development. The South African standard of education in the mining industry was on average several years behind that of the developed world with similar mining economic structures (Presidential safety audit, 2008).

2.6.3 Mine Health and Safety Act

The Mine Health and Safety Act had to be reviewed and address the gaps. The management of health and safety had to be part of the same management structure that was responsible for production (Presidential safety audit, 2008).

2.6.4 Mine Health and Safety Inspectorate

It was found that the Mine Health and Safety Inspectorate (MHSI) was understaffed and had a dwindling capacity and the recruitment and retention of skilled staff in the inspectorate needed to be to be resolved.

It was impossible to operationalise an adequate system of audits and inspections to assess compliance with legislation which was highlighted in previous Inquiries of 1960 and 1993. Inspectors employed different approaches to secure compliance to health and safety standards.

The high levels of injuries and fatalities required that inspector's time was spent more on reactive accident investigations and inquiries as opposed to proactive inspections and audits. The mine inspectorate to employ available technologies to improve planning, targeting and effective regulatory contacts with the regulated community. A major restructuring of the MHSI Head Office components was completed in May 2007 to ensure that the structure met the needs of the Inspectorate. It alleviated the administrative burden on regional inspectors resulted in more time to attend to their core functions including inspections, audits

and investigations. The restructuring of the MHSI provided flexibility for the Inspectorate to deliver on its mandate around safety and health in the mining industry (Presidential safety audit, 2008).

2.7 Failure to act

If one takes the history of the South African mining industry over the 100-year period between 1917 and 2016 into consideration, it is an astounding to notice that some issues had been in discussion for more that 100 years and still have not been resolved. A classic example is the issue of dust and phthisis which was an issue in 1902 already with the appointment of the Milner Commission of inquiry into health and safety in mines prompted by concern about the mortality among miners on the Witwatersrand (Leon Commission 1995).

115 years later, the South African Mining industry is now still dealing with the consequences of the exposure to dust by employees. Except this time around, it is dealt with in the courts to pay compensation to the affected individuals who are still alive. The overall conclusion of the aforementioned example is that although the mining industry was aware of the issue, not enough was done to manage the exposure to dust successfully.

So, what has made the difference since 1986 in the South African mining industry to improve its safety performance? It appears that the transition from mighty mining companies focused on shareholder returns to an industry where stakeholders including employee organisations and government played a significant role in keeping management accountable for their actions.

Anecdotally, a previous long time standing director of an international, multi-commodity, publicly listed mining company, with the head office in South Africa, explained that safety was not discussed at board level until around 2000. It was only in 2000 that the company published a separate safety report, which was available on request, in conjunction with its annual report.

Many ‘current’ safety initiatives in the mining industry are certainly not new as it has been practiced in mines in South Africa for decades. This includes, risk management, safety management systems, fall of ground management, mechanisation, behavioural safety, rail transportation, shaft safety, fires, flooding, etc. It is just the application thereof that has been renewed, industry wide, through the co-operation of all the relevant stakeholders. The required safety initiatives are no longer only dependent on the whims of a manager in charge of a company and the board that was mostly focused on shareholder returns. Stakeholders now require conformance to legal requirements and a focus on ‘Zero Harm’ to ensure the sustainability of a company.

A key question and an indictment to the mining industry is, when taking previous Commissions of Inquiry findings into consideration, why has it taken so long for the industry to react appropriately? It probably stems from the fact that the Mining Houses pre-1986 were mighty and focussed mostly on shareholder returns. They mostly adopted the prerogative that they could decide what was important to them and would act within their own terms of reference and were not going to be dictated to by others when and what to do.

In and around 1986, some of the first-tier mining companies started to restructure and did away with large head offices, did away with regional office and started selling off mature deep level operations to 2nd and 3rd tier mining companies, as the political changes in South Africa took effect. Some mining houses moved their head offices overseas and some moved their head offices from overseas to South Africa.

New brooms sweep clean and the management was refocussed to be accountable not only to shareholders but increasingly had to take into consideration the expectations of other stakeholders. The remaining 1st, 2nd and 3rd tier companies were held accountable for amongst others, fatalities and a more caring safety culture developed as the focus was increasingly on names of the victims and their families and no longer on numbers and statistics.

2.8 Theoretical approach to achieve ‘Zero Harm’

2.8.1 Introduction

It is imperative that leaders involved in safety and health holistically understand the interdependencies of various safety aspects in dealing with the concept of ‘Zero Harm’ and how to achieve it. It has been experienced that that in large organisations, very few individuals actually understood the interdependencies of the overall safety management ‘system’.

It is important to recognise that safety success is not one strategy or another, but rather a one strategy and another as safety excellence is not the result of a singular strategy. There are no universal answers (Hansen 2007).

In a complex environment or a very large organisation, it is conceivable that only a few people, if any at all, understand the overall interdependencies of all the aspects of the ’Safety Management System’. There should therefore be a consistent, simplified safety storyline available so that the majority of the staff understand how the various components fit together as a whole in order to achieve ‘Zero Harm’.

As a start, the Leadership of a company must have ‘Zero Harm’ as a non-negotiable value for the company. However, it should be understood that ‘Zero Harm’ is a reactive mindset in that it implies that an incident is expected to occur, but that the consequences should result in ‘Zero Harm’. The next desirable pro-active mindset is that of ’zero incidents’, meaning that all risk management controls are appropriate and applied.

Genuine caring for people creates an environment conducive for ‘Zero Harm’. ‘Values’ on a wall poster that are not being applied, especially by leadership, have significant negative consequences on the safety culture in the longer term. Management must be seen to live the values and lead by example.

The company's safety efforts should be documented and contained in a Safety Management System (SMS), agreed to by all and applied by all stakeholders in the company. Participative management is important to the success of the 'Zero Harm' concept.

The SMS must be underpinned by a credible dynamic Risk Management process. Risks at all levels of the organisation must be identified and controls instituted. Controls must be applied by all so as to ensure that activities are within the company's residual risk tolerances.

Safety is a result of pro-active risk management and is a concurrent activity to ensure that controls are in place before and during the execution of any task and not something that is done subsequently. For every task to be performed there should be an agreed safety procedure available and all staff should agree to work to it.

What gets measured gets done. The safety information system must be appropriate for the company with leading and lagging indicators which are relevant, accurate and available timeously. More importantly, appropriate action should be taken should indicators trend negatively.

Human factors, which include the theory of behaviour as well as human errors, should be well understood, including human limitations. This will include the behaviour of leadership as well as the individual who is in the line of fire. Behaviour turns systems and procedures into reality.

Benchmarking of relative industry performance should be undertaken, and system audits should be done regularly to ensure compliance of the company's Safety Policy. The company should strive for continual improvement of their safety performance.

2.8.2 Safety Leadership

The role of leadership is the ability to enable, influence and to motivate others towards achieving same purpose goals contributing to the effectiveness and success of the organisation or group of which they are members.

Leadership must embrace the notion that all injuries are preventable, and that no injury is acceptable. Safety is a priority and schedule, cost or production should not take precedence over an injury free workplace. Studies in safety leadership indicate that the behaviours of supervisors and senior managers have a direct influence on worker behaviours and thus on workplace health and safety.

Safe behaviours at work are influenced by specific leadership approaches. Senior managers are the key influencers on the safety culture of an organisation and effective safety leadership is vital to the success of a safety program Management's safety leadership lays the foundation upon which a solid system is built (Gardner, 1995).

Lead by example

Leadership determines whether safety will be achieved in an organisation through its actions, commitment, measures, example and rewards. Effective safety leadership determines the extent to which safety rules and procedures are adhered to in reality. Top management commitment is expressed through action not only talk. Example and integrity have been noted as supreme qualities of leadership.

Leaders demonstrate safety when the words and deeds match. If you say, 'be safe' and act in ways that do not ensure safety it sends out conflicting messages. Good example and integrity builds good faith, trust, and confidence (de Jager, 2018/1).

Leadership style

Management attitude, behaviour and style tend to be less quantifiable indicators of safety management outcomes than Safety Management Systems. However,

these factors have a very powerful effect on workforce safety and help separate the good from the excellent organisations.

Legislation, in most countries, provides a basis for worker representatives to provide input into decision-making that affects their safety. People work more safely when they are involved in the decision-making process, have specific and reasonable responsibilities and have immediate feedback about their work.

While it is recognised that regulation is necessary for good safety, compliance with legislation and a regulatory regime alone does not lead to an outstanding safety record. However, this commitment must extend beyond satisfying regulatory requirements to achieving improvements in safety management (de Jager, 2018/1). Some of the obstacles to effective safety leadership include:

- Safety is thought of as only a system of discipline;
- Safety efforts are delegated to lower levels in the organisation and leaders have little hands on involvement;
- Passively giving safety leadership to external agencies or companies;
- Lack of participation, poor communication, lack of accountability, lack of enforcement, lack of clarity, Us vs. Them mentality, and
- Safety as a priority is never demonstrated just talked about.

2.8.3 Organisational culture

An organisational culture does not spring up ready-made. Organisations, like organisms, adapt. Safety cultures evolve gradually in response to local conditions, past events, the character of the leadership and the mood of the workforce.

The degree to which control over work organisation and task structure is centralised is an important consideration in the culture of safety, with greater decentralisation making for better safety outcomes (Reason 1998a).

2.8.4 Safety Culture

A safety culture is the product of individual and group values, attitudes, competencies, and patterns of behaviour that determine commitment to safety (Booth, 1996). It is something an organisation is, the beliefs, attitudes and values of its members regarding the pursuit of safety. It is also something that an organisation has, the structure, practices, controls and policies designed to enhance safety. It is the way a company thinks and acts towards safety and it is believed to be a key predictor of safety performance (Correll & Andrewartha 2000).

A safety culture consists of shared values and includes, what is important and beliefs, how things work to produce behavioural norms, the way we do things around here (Strong 2012). A positive safety culture is where there are trustful communications, shared perceptions of importance of safety and confidence in efficacy of preventive measures (Booth 1996). Changing workplace culture may be difficult, but its success is very much dependent on good leadership.

Ideal safety culture

An ideal safety culture is the ' engine ' that drives the system towards the goal of sustaining the maximum resistance towards its operational hazards, regardless of the leadership's personality or current commercial concerns.

The power of this engine relies heavily on a continuing respect for the many entities that can penetrate, disable or bypass the system's safeguards (Reason 1998a).

Safety is invisible in the sense that safe outcomes do not deviate from the expected, and so there is nothing to capture the attention. If people see nothing, they presume that nothing is happening, and that nothing will continue to happen if they continue to act as before. But this is misleading because it takes a number of dynamic inputs to create stable outcomes (Reason 1998a).

Safety Climate

A safety climate is a sub-set of safety culture concerned with the values and attitudes of staff at all levels (Booth 1996). Although a company may have an ideal safety culture, the safety climate or 'mood' may be depressed if there is a serious injury, as an example.

2.8.5 Human Factors

The aim of a study of human factors is to optimise the performance of individuals and teams in the workplace, reduce error, improve safety and efficiency through an understanding of human capabilities and human limitations.

A human factor is any biomedical or psychosocial consideration relating to human characteristics in areas including, but not limited to, human engineering, human-machine interface, personnel selection, training, job performance and human performance.

Human Factors is an applied science that draws on methods and principles from psychology, other behavioural and social sciences, engineering, ergonomics and physiology. The human factors domain includes communication, knowledge, skills, abilities, procedure use, workload on the human, fatigue, situational awareness, attention and safety. The role of 'Human Factors in Management System' design, evaluation and implementation is critical.

With increasing automation and advanced technology, it is important to identify and manage human performance related issues as early as possible. This will result in optimised relationships between people, tasks, technologies and the working environment aiming to ensure safe and efficient human performance (Eurocontrol 2011).

Significant safety errors can occur at all levels of the system. Human errors occur throughout the organisation and the higher up an organisation an individual is, the

more dangerous are his or her errors. Error management techniques need to be applied across the whole system (Aerossurance 2014).

Human factors integration enables designers to understand what end users can and cannot do as compared to the tasks they will be required to undertake once the 'system' is operational (Cullen 2007).

2.8.6 Behaviour

Almost ninety years of research and observation ranging from Heinrich's (Heinrich 1931) early hypothesis in the 1930s to DuPont's successes confirm that unsafe behaviours are involved in almost all accident occurrences. It could also be argued that 'unsafe behaviours' in the boardroom, regarding making inappropriate decisions on safety related issues, could also be the cause of an incident.

Good safety systems on their own do not ensure successful health and safety management, the level of success is determined by how organisations 'live' their systems (Reason 1998a).

The core question remains: Why do employees do what they do, act unsafely, and have accidents? What 'causes' at-risk behaviour (Hansen 2007)? There is evidence that a proportion of accidents are caused by unsafe behaviour. Promoting safe behaviour at work is a critical part of the management of health and safety, because behaviour turns systems and procedures into reality. At-risk behaviour is the critical element, which must be addressed to achieve safety excellence. Behaviour isn't the next level of safety strategy, it is the ultimate level.

Changing unsafe behaviour into safe behaviour is appropriate however, this should not deflect attention from analysing why people behave unsafely. Behaviour modification techniques can be effective in promoting critical health and safety behaviours, provided they are implemented effectively. Focusing on only treating individual behaviour without considering necessary changes to how people are organised, managed motivated, rewarded, their physical work

environment, tools and equipment can result in treating the symptom only, without addressing the root causes of unsafe behaviour (HSE 2002).

Human Error

It is important to focus on human error as shown in Figure 15 so as to reduce vulnerability to human error i.e. prevent accidents, to understand the trade-offs and pressures which people encounter at work, to clarify the value and limitations of human error theory.

The expression ‘human error’ is widely used and generally misused. It has been traditionally associated with the attribution of responsibility and blame. In this context, ‘human error’ is typically a judgement of human performance made after an event has occurred (Massaiu 2005).

Human error and ‘pilot’ error are terms used synonymously and in the aviation industry it is an overly simplistic approach to accident causation as shown in Figure 15. The same applies to the assigning of accidents to ‘operator error’ in other industries. Accidents cannot be attributed to a single cause, or in most instances, even a single individual. Even the identification of a ‘primary’ cause is fraught with problems. Accidents are the end result of a number of causes, only the last of which are the actions (‘unsafe acts’) of the aircrew or the operators (Wiegmann 2000; Wiegmann and Shappell 2003).

Front-line errors are more likely in organisations that are insufficiently concerned about the working conditions known to promote the slips, lapses and mistakes of both teams and individuals. These include such factors as inadequate training, poor communication, bad procedures and problems with the design of the man-machine interface. A poor safety culture will encourage an atmosphere of non-compliance to safe operating practices and is likely to increase the number of defensive weaknesses due to active failures.

Violations are likely to be most common in organisations where the unspoken attitudes and beliefs mean that production and commercial goals are seen to outweigh those relating to safety.

The effect of a poor safety culture is evident in the unwillingness to deal proactively with known deficiencies in the defences. In short, defensive gaps will be worked around and allowed to persist. The history of organisational accidents is rich with examples of management neglecting or postponing the elimination of previously identified defensive weaknesses (Reason 1998b).

‘There is no one best way as different types of human factors problem occur at different levels of the organisation and require different management techniques. Different organisational cultures require different ‘mixing and matching’ of techniques’ (Aerossurance 2014).

An accident is an undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss. casualty. mishap: vehicle accidents. It includes the entire interacting circumstantial framework (chance, pre-existing, or uncontrolled dynamically developing conditions such as commonplace actions, random time and place, participants, etc.) leading up to, including, and resulting from, the accident's immediate occurrence.

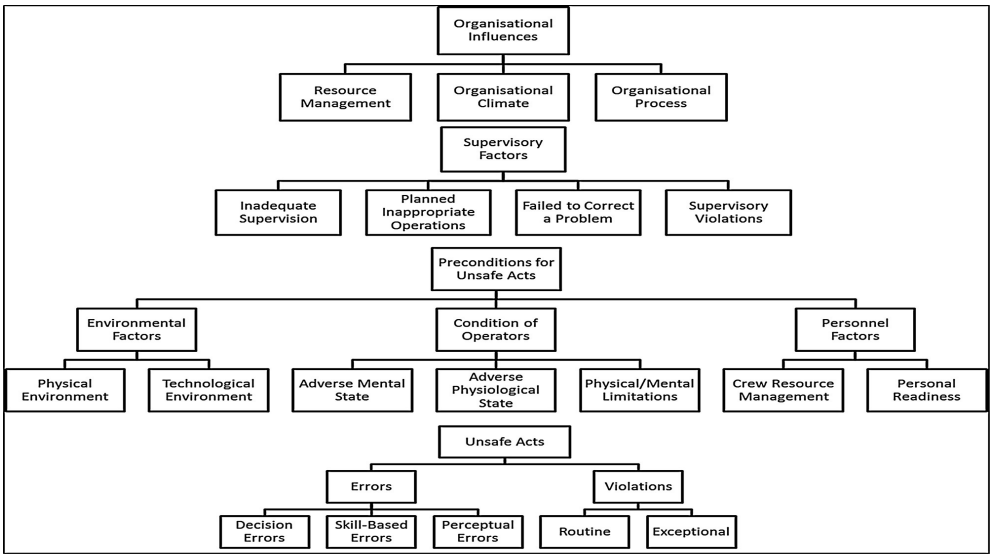


Figure 15 Human Factor Analysis and Classification Framework (Wiegmann and Shappell 2003).

2.8.7 Safety Management Systems

Systems are composed of humans, machines and the environment, which interact in order to achieve a defined goal. The system should have a real purpose which is considered to be parts of larger systems within a set system boundary to operate in a specific environment.

The systems components serve functions such as information receiving, information storage, information processing and decision, and action. The components of a system interact, and the systems, sub-systems and components have inputs and outputs.

A safety management system (SMS) is a set of plans, actions and procedures to systematically manage safety in the workplace that is actively endorsed by a committed employer to achieve a safe and healthy workplace and the prevention/reduction of illness and injury equally for employees and contractors. It should be able to identify workplace hazards, assessment and the control of all risks. The active involvement in health and safety matters by managers, supervisors and employees and their representatives is absolutely necessary. The

system should provide of information and training for employees at all levels so they can work safely.

It is important to put effort into continuous improvement, which is building in ways of periodically checking how you are doing and how to improve your system, using feedback mechanisms, audits and inspections. Developing a structured training strategy, with the ability to meet different language and education needs is a significant factor to attaining success. An effective system is more than a paper chase, it is about making sure that relevant changes occur to improve safety. It is however, good business practice to document what is to be done (Sanders and McCormick 1993).

Why SMS succeed

The SMS should be aimed at managing critical risks and it succeeds when senior managers or owner/operators practice what they preach and make decisions to eliminate or reduce hazards. The system should be commensurate with the risks to be managed and tailored to the organisation's requirements.

A SMS will operate effectively only if it has full management support and commitment. Those who manage and operate the system should have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole. The supervisors and employees should understand their roles in the system and should be closely involved in its development and operation.

The performance of OHS and injury management systems should be continually reviewed, and opportunities identified for improvement. The SMS should able to withstand, and welcomes, robust questioning and review from everyone involved.

Why SMS fail

For an accident to occur it requires the unlikely combination of several different factors to penetrate the many protective layers and to allow hazards to come into damaging contact with plant, personnel and the environment (Reason 1998).

A SMS could fail if the management support is irregular and inconsistent and it is treated as a paper war and follow procedures to keep the managers happy regardless of the effectiveness. If the SMS is established in response to external demands and never really 'owned' or understood by those subject to it and it is imposed without effective participation by those who have to make it work, it could fail.

It is required to build an organisation specific system and not use 'off the shelf' solutions that have little relevance to the culture of the workplace. It is only by applying safe work practices and procedures that 'Zero Harm' can be achieved. It is of no use to have the fully documented system in a folder on the shelf, but never used (HSE 2007).

SMS barriers

There are barriers to the effective implementation of OHS management systems especially if it is not understood by those most affected. Leaders in the organisation should be familiar with the SMS. Another contributing factor is if the system fails to meet necessary conditions by not being customised to the needs of the organisation. The inappropriate use of audit tools where it becomes an end in itself is detrimental to the successful implementation of a safety management system.

The application of a safety management system in a hostile environments is doomed to failure. Cultural and attitudinal change may be necessary to improve performance which could be time consuming (HSE, 2007).

2.8.8 Risk management

Risk is defined as ‘effect of uncertainty on objectives’ (AS/NZS ISO 31000:2009). The purpose of a risk management process is an attempt to proactively and systematically reduce losses. However, the frequency of major unwanted events still exceeds community expectations (MDG 1010).

Unless the hazard, which is defined as ‘a source of potential harm’, is totally removed, and no related hazard put in its place, elimination cannot be achieved. Risk is managed to a level of acceptability or practicality and there is no ‘zero risk’ (MDG 1010).

A controlled work environment using competent people, safe work practices and fit for purpose equipment is necessary in order to ensure safe production, (Bullock 1979). Risk management must be part of a coherent policy and approach to safety management to achieve ‘Zero Harm’. Risk controls to avoid, prevent and reduce risks need to be an accepted part of the approach and attitudes at all levels of the organisation and applied to all its activities.

It should be a priority to remove the risk at the source rather than by adopting secondary measures. If the risk cannot be eliminated then use a different approach, substance or method of work. Measures which protect the whole work force should be given priority and advantage should be taken of technological and technical progress when treating risks.

In the South African mining industry, the risk management approach include baseline, issue based and continuous risk assessments. Risk assessments are scoped in different ways including geographically based assessments such as shafts, haulages, workshops; Functionally based assessments such as trucking and tramming, blasting, winding operations; Hazard or issue-based assessment such as the hanging wall, electricity, machinery; and Discipline based assessments such as engineering, environmental, metallurgical.

The major hazards identified in the assessment are those hazards which, if they are not properly controlled pose serious risks to employees or others who may be affected. It should include a review of the existing safety measures and the extent to which they are effective in controlling the risks. Additionally, those who may be affected by the significant risks or major hazards including those groups and employees who are especially at risk need to be identified. Work should be adapted to the individual rather than expecting the individual to adapt to the work. Employees and those affected need adequate training and supervision to ensure that they understand what must be done to ensure the risk controls work.

Hazard identification tools can be separated into top down and bottom up approaches. The top down approach includes techniques which involves working from a top event downwards to arrive at the underlying causes and also those of potential other events. This approach could involve checklists, accident analysis, Fault Tree Analysis and brain storming as well as task analysis.

The bottom up techniques include breaking the system or problem into small components and then seeing how they or others may fail, building up to a major event. This approach could include hazard and operability studies which may address both hardware and people systems.

Formal risk assessment is a documented process, usually involving a team of relevant site and where necessary, off-site expertise. Companies should use relevant tools to pro-actively reduce risks of major events which could include techniques such as Hazard Analysis; Workplace Risk Assessment and Control; Hazard and Operability Studies; Failure Modes and Effects Criticality Analysis; Logic Tree Analysis; Fault Tree Analysis and Quantitative Risk Assessment.

Once a risk assessment is complete several control barriers can be instituted to ensure that activities are executed within the risk bearing capacity. These control barriers included prevention barriers intended to prevent the energy from getting out of control with adequate reinforcement or backup where barrier failure is probable.

The focus of the Swiss cheese model as shown in Figure 16 is on risk management barriers which include monitoring barriers intended to monitor the status of the energy to identify if it is different from expected and if the barriers are as effective as required; First response control barriers intended to stop an unwanted event in the early stages before any significant consequence can occur; Amelioration barriers intended to minimise the consequences of a major unwanted event which includes Emergency Response activities.

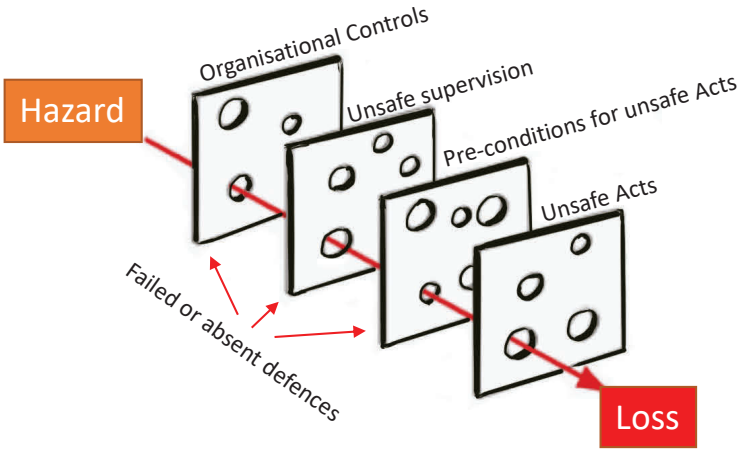


Figure 16 Reason's Swiss cheese model (https://en.wikipedia.org/wiki/Swiss_cheese_model).

Prevention control barriers are intended to prevent a loss or unwanted energy release by minimising the amount of energy to a less damaging level by using engineering controls such as lock out devices, chemical containers, mechanical roof support, gas monitors or by physical barriers such as machine guarding and warning signs.

Administrative controls include isolation procedures and standard operating procedures which is augmented by using personal protective equipment including hard hats, steel toe cap boots, gloves, safety glasses, welding gear. Create awareness of the hazard with warnings and awareness by means of posters, labels, stickers, verbal warnings.

Process monitoring should be used to check the status to identify any variation of change that may indicate that the hazard is out of control and as an indicator of potential problems. Outcome monitoring is used to indicate if the Prevention Barrier is working and if the hazard is different from expected.

First response barriers are intended to identify and address an unwanted event in very early stages and can involve automatic detection and action. In the case of fires, a sprinkler, foam or dust system, triggered by heat or smoke, is intended to extinguish a heat source or fire in its early stages.

Subsequent to an incident, procedures should be in place for emergency action and rescue. Importantly, action should be taken as soon as reasonably practical to prevent a second accident of similar nature to occur (Joy undated).

All sites should also have a procedure and a process for informal risk assessment where all persons should be skilled in identifying and addressing hazards involving unacceptable risks in their jobs. A simple model should be introduced to all personnel which is initiated by pausing before a task is commenced. It is followed by looking for hazards, consider the risks and specific action taken to reduce unacceptable risk or do not proceed with the task. The observations should be reported if any unacceptable risk is observed that needs further action. A process is required which gathers requirements for further action, ensures required action is taken and feeds back action status to the initiator.

Most unwanted events involve some form of human error, most often for understandable and predictable reasons. The consideration of human fallibility in engineering and management decisions is critical, especially for areas where human performance is critical to success. Effective risk assessment should help identify predictable human error. However, it is desirable to ensure that reasonable variations due to human fallibility are considered when personnel performance is critical.

Another way of reviewing inherent risks is to look for a fundamental flaw, or weaknesses, in the purpose and scope of a work process. A design threat is an inherent weakness in the layout of a work process. An activity threat is a flaw, or weaknesses, arising from the manner in which activities are managed and performed. An environment threat is an inherent constraint, weakness, or flaw in the overarching operational environment in which a process is conducted. An event threat is a set of circumstances triggered by an unpredictable occurrence that introduces unexpected change into a process.

Reactive safety management occurs when measures are taken once an accident occurs. The traditional way of safety consequence measurement includes lost time accident rates, serious incidents and fatalities. This way of safety management cannot provide lasting success since it is always after the fact because an undesired event is required to trigger action and improvement.

Organisations are dynamic and there is a constant change within the organisation as well as in the outside world. What has happened in the past can never provide an adequate basis for what will happen in the future. However, accident investigations historically stopped at the unsafe acts and conditions and did not address the real causes which are situated in the management system.

Risk management principles enable a company to prevent undesirable events from occurring. However, it is important to get continuous feedback so as to establish what people really do to prevent accidents. This knowledge and insight into the management system is subject to analysis and it should be where a large part of management's attention is required be instead of being continuously involved with ‘fighting fires’ (Top 1991).

The principles for preventative and protection measures include, avoid a risk altogether, a different approach, substance or method of work. Risks should be combated at source rather than by adopting secondary measures. Risk prevention measures should be part of a coherent policy and approach to safety management.

Work should be adapted to the individual rather than expecting the individual to adapt to the work.

Causation Model

The Causation Model, as shown in Figure 17, depicts a systematic analysis of potential multiple causes of incidents. The model is roughly based on the previous work done by Bird and Heinrich (Heinrich 1931; Bird and Germain 1985).

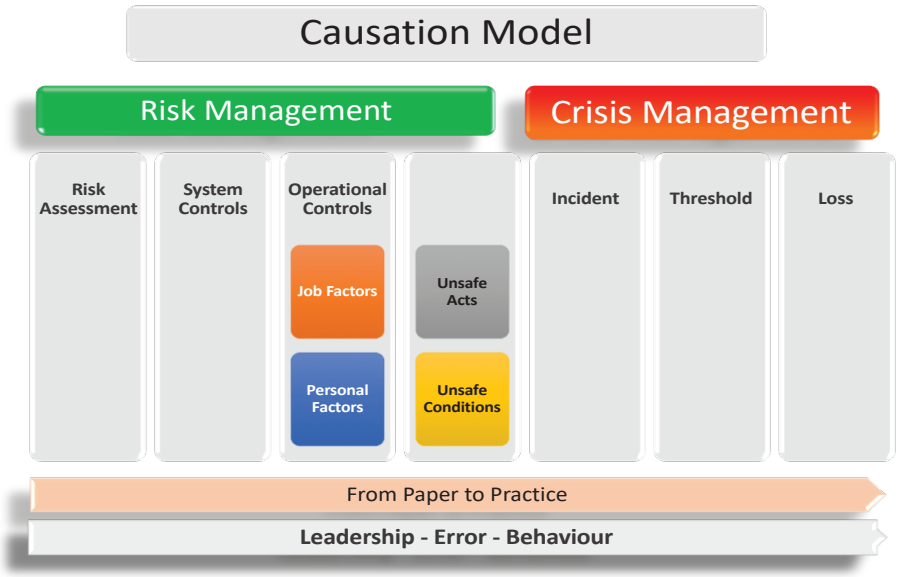


Figure 17 Causation Model (Adapted from Bird and Germain 1985).

In the causation model risk management vs crisis management, pro-active vs reactive, from paper to practice as well as leadership, errors and behaviour is depicted.

The safety strategy in modern companies has moved from a focus on compliance to prevention by planning. The dependence on compliance could be seen as after the fact hazards detection which does not identify organisational errors (FAA 2000).

Resilience engineering

A four-element model of an organisation represented by its design which includes: Environment; Equipment and Technology; Rules and Procedures, and Operator competency is shown in Figure 18.

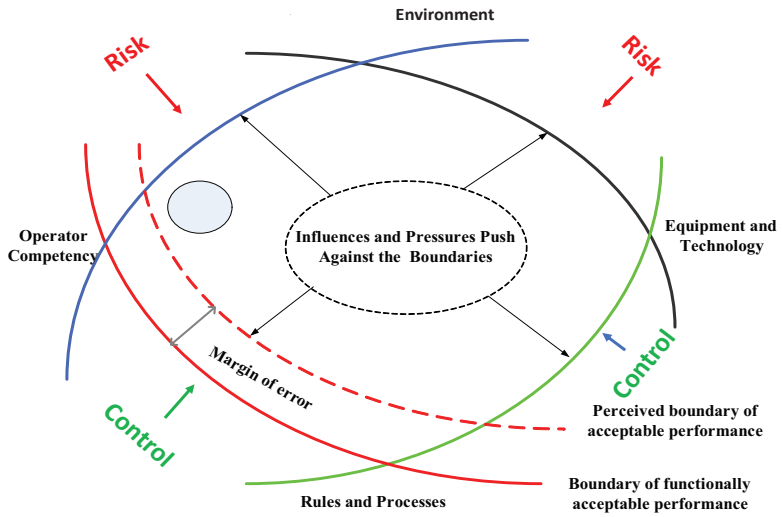


Figure 18 Drift to failure model (Adapted from Cook and Rasmussen 2005).

Under the model, each of the boundaries represents a point of failure. Close the centre of the envelope the risk of failure is minimal, but as an organisation is pushed first towards and then over a marginal boundary the risk of failure increases until failure becomes inevitable (Cook and Rasmussen 2005; Miller and Xiao 2007; Rasmussen 1997). This marginal boundary is also dynamic, shifting inwards and outwards in response to pressures.

Resilience engineering involves monitoring how workers do their normal work around the perceived boundaries of failure. 'Becoming aware that the system's operating point is too close to a boundary, or that risks of operating that close are too high, leads to adaptive responses, which move the system's operating point away from that boundary' (Woods, Schenk and Allen 2009).

Cognitive resilience is involved in developing this awareness, while behavioural resilience enables the adaptive response to be taken. The drift towards failure, according to Dekker (Dekker 2005) can be associated with the ‘normal processes of reconciling differential pressures of efficiency, capacity utilisation and safety against a background of uncertain technology and imperfect knowledge’.

Resilience engineering involves developing an organisation’s behavioural and cognitive capability such that it is able to effectively adjust and continue performing optimally near an it’s safe operating envelop in the presence of everyday threats and environmental stressors at all levels of the organisation.

An important outcome of the above definition is the identification of behavioural and cognitive capability of the various levels of an organisation which enable it to run normal operations (Pillay, Borys, Else and Tuck 2010).

2.8.9 Safety Information System

It is difficult for leaders to make an informed contribution to safety and injury management without an understanding of the relevant regulatory frameworks, individual, responsibilities, or emerging health, safety and injury management risks and issues.

In the absence of frequent bad events, the best way to induce and then sustain a state of intelligent and respectful wariness is to gather the right kinds of data. This means creating a safety information system that collects, analyses and disseminates information from incidents and near misses, as well as from regular proactive checks on the system's vital signs (Reason 1998b).

The criteria for selecting indicators should consider that it should be worth measuring, measured for diverse populations and be understood by people who need to act. The resultant information will galvanise action that can lead to improvement that are known and feasible, and measurement over time will reflect the results of action (Chrvala and Bulger 2010).

Performance and outcome indicators

Using a mix of positive performance or lead indicators and outcome or lag indicators will help organisations achieve targets and improve performance. A supplementary view is to consider process indicators which refer to asset or technical integrity and personal indicators which refer to personal injury (Hopkins 2007).

Positive or lead performance indicators allow an organisation to measure activities undertaken that are designed to positively impact on outcome or lag performance. Leading indicators are predictive requires active monitoring and provides feedback on performance before an accident or incident (HSE 2006).

Outcome or lagging indicators are important measures, but generally reflect the results of past actions. There is often a time lag between action taken by an organisation to improve performance and any measurable change in performance.

Outcome indicators may hide potential risks. For example, a low incidence of injury does not necessarily mean that adequate safety systems and controls are in place. Therefore, relying on lag indicators to gauge a company's safety performance is problematic as it is after the fact and measures failures. Reactive monitoring involves identifying and reporting on incidents to check the controls in place are adequate, to identify weaknesses or gaps in control systems and to learn from mistakes (HSE 2006).

Safety Maturity

The safety maturity journey of a company can be characterized in various ways using safety maturity models. Figure 19 is an example described by Ryder Marsh (Strong 2012).

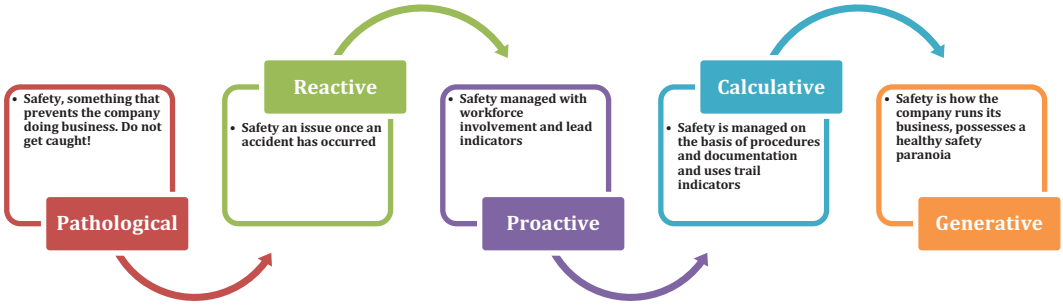


Figure 19 Safety Culture Maturity Model (http://www.rydermarsh.co.uk/safety_culture.html).

The DuPont Bradley Curve as shown in Figure 20 is another way of depicting the shifts in mind-set and actions that need to occur over time to develop a mature safety culture. The safety maturity journey is as follows: a reactive culture is based on natural instincts; a dependent culture is based on supervision; an independent culture is based on self, and a final inter-dependent culture is based on a team approach.

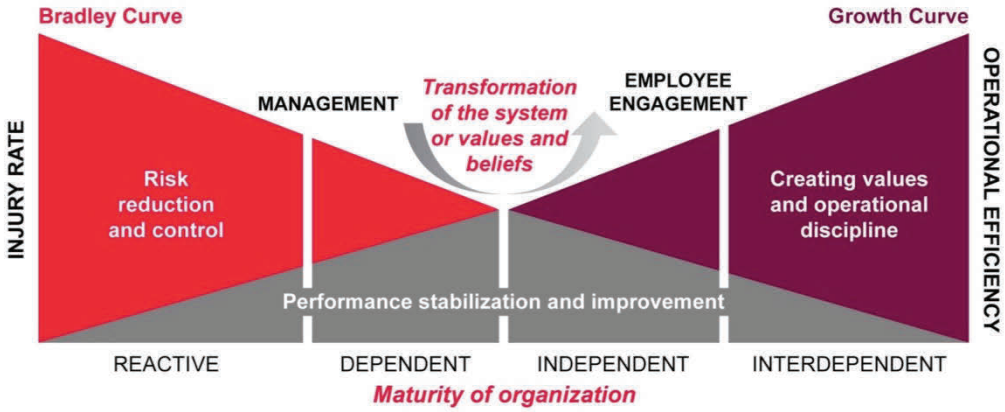


Figure 20 DuPont Bradley Curve (www.pinterest.com.au).

Others safety maturity models include Hudson Ladder Model (Siep 2003) and the Minerals Industry Risk Management Maturity Chart (NSW Mine Safety Operations Branch 2011).

Safety hidden and indirect costs

While workers' compensation costs, typically paid as premiums are a significant component of the cost of workplace injury and disease, there are other hidden and indirect costs. The cost for employers include lost productivity, loss of skills, experience and knowledge; cost of recruitment, replacement and training; increased workload pressure and uncertainty for co-workers; higher risk of injuries to other staff and lowered morale; cost of replacement equipment, and damage to the organisation's reputation and image as an attractive workplace, as well as the cost of investigations reports.

2.9 Sustainable Development

The concept of Sustainable Development (SD) has been bandied about since 1987 as it was seen as a solution to the problems created by environmental degradation as defined in the Brundtland Commission (IISD, 2017). The concept is still evolving is approached differently by the companies researched. It was previously seen as a separate activity, managed by a SD department but has in most cases morphed into a concurrent activity performed by line management.

All the companies researched accept that the long-term expectations of mining performance depend on performance in economic, corporate governance, environmental and social issues. SD is now seen as a core principle of the business approach and the appropriate international best practices would contribute to the attainment of the long-term goal of the sustainability of the business.

The integration of sustainable development considerations into the corporate and operational decision-making processes of the organisation is important in order to achieve the objective of operating in a manner that represented a platform for responsible investment. It is about achieving an appropriate balance between financially performance, achieving world-class standards in environmental management, and the desire and need to ensure broad social benefit.

A sustainable development framework (Appendix D, GF 2010) should consider best practice policies including:

- Occupational health and safety;
- Human rights;
- Ethics and corporate governance;
- Risk management;
- Environment;
- Material stewardship and supply chain management;
- Community and indigenous people, and
- Stakeholder engagement.

2.10 Summary

The historical safety performance in the mining industry has largely improved as external advocacy held the industry accountable and voiced it's expectation for improved safety in mines. This stance has mostly been captured in the significant advancement in enhancing the safety legal requirements put in place by governments in most countries. Examples of the enhanced legal safety legal requirements and improved safety performance include South Africa, United States of America, Canada and Australia.

In 1993, the Leon Commission of Inquiry was launched in South Africa into safety and health in the mining industry with wide terms of reference to inquire into all aspects of the regulation of OHS. The findings built on previous Inquiries done in 1911, 1925, 1960. The Mine Health and Safety Act (MHSA), Act 29 of 1996 was promulgated following the outcomes of the Leon Commission. Subsequently a Presidential Mine Health and Safety Audit was conducted in 2008 as safety deteriorated. (Leon Commission 1995).

The fatalities in the South African mining industry reduced from 219 per annum in 2007 to 73 per annum in 2016 which is a 56% improvement as shown in

Chapter 1-Figure 3. This collective improvement is partly due to the co-operative approach in the South African mining industry in order to reduce fatalities and embracing the MHSC initiatives.

Mining remains one of the high risk industries in the U.S. with injury and fatality rates that exceed the national average. The societal expectation of 'zero accidents' maintains a continuous demand for further improvements (Kohler 2005). The achievements in mineworker safety have been the result of concerted efforts of industry, government agencies, employee organisations, researchers and manufactures.

The Australian mining industry has made significant improvements in health and safety over the last decade, reducing the incidence rates of both fatalities and serious injuries. However, the mining industry still has one of the highest rates of fatalities of any industry in Australia as is shown in Figure 12 (dmp.wa.gov.au).

The evolution of the legislative in Ontario, Canada commenced in 1890 and has been progressively updated. The mining legislative progression has resulted in Ontario being one of the safest mining jurisdictions in the world as shown in Figure 13 (oma.on.ca).

Significant safety related theoretical knowledge is readily available and most of it is used internationally. However, the collective understanding of an integrated safety approach still seems illusive in many companies and countries for that matter. The high level safety related knowledge areas include safety and health leadership, organisational culture with specific reference to safety culture, human factors, safety management systems, risk management and safety information systems.

The success of the combination of mining safety related legal requirements as well as the current state of available safety related knowledge has improved the safety in mining. Unfortunately, to date, zero fatalities in the mining industry have still not been achieved. Zero fatalities has been achieved for extended periods in

mining companies and countries, but the fact that fatalities continue to occur is evident that additional knowledge and extraordinary efforts to implement current knowledge still falls short.

This research is aimed to enhance the integrated understanding of the interdependent solutions required to reduce the number of fatalities and injuries in the mining industry further.

3 LEADERSHIP TAKING HEED OF THE BROADER SOCIETY'S SAFETY EXPECTATION

3.1 Overview

A holistic safety and health approach is necessary for a company to succeed in achieving 'Zero Harm' and it is imperative to understand the interdependencies of various safety aspects in dealing with the achievement of 'Zero Harm'. 'Zero Harm' describes a safety culture that is evolving in the South African mining industry.

The 'Zero Harm' concept can be described as operating a business/workplace without exposing any individual to injury. Businesses can help workers get through their working life without suffering an injury through the implementation of safe work systems. The whole organisation must embrace the concept to achieve a 'Zero Harm' policy (Theberge 2015).

Zero-harm has largely been seen as a goal, and is ultimately measured by lagging indicators such as the number of incidents and injuries. Achieving zero-harm requires sustaining zero injuries over an extended period of time. Safety data in Australia suggests this has proven difficult for many worksites to achieve (Schuback 2016).

Leadership from a safety perspective can become very sophisticated in the minds of some so much so that management can become confused what to do. The engine could become so complex that few people understand the overall safety story line as well as the interdependencies of all the initiatives. However, the essentials of leadership boils down to Plan, Do, Check and Act, which is not a new concept, (Moen 2009).

Safety is not a this or that initiative, but rather a this and that initiative. Safety cannot be synthesised out of leadership, management, supervisory acts or executing work, it remains as an integral part of all these activities. The leadership

of the mining companies researched have been following a multi-tiered approach in order to reduce safety related incidents in mines.

The research findings impacting on the improve safety performance of the mines researched will be discussed in detail in Chapters 3-8. Individual case studies for the mines researched can be found in Volume 2-Annexures B-G.

3.1.1 Research findings summary

A holistic safety and health approach is necessary for a company to succeed in achieving 'Zero Harm' and it is imperative to understand the interdependencies of various safety aspects in dealing with the achievement of 'Zero Harm'. The emerging themes used by the broader South African mining industry to achieve 'Zero Harm' are shown in the 'de Jager Zero Harm model' Figure 21.

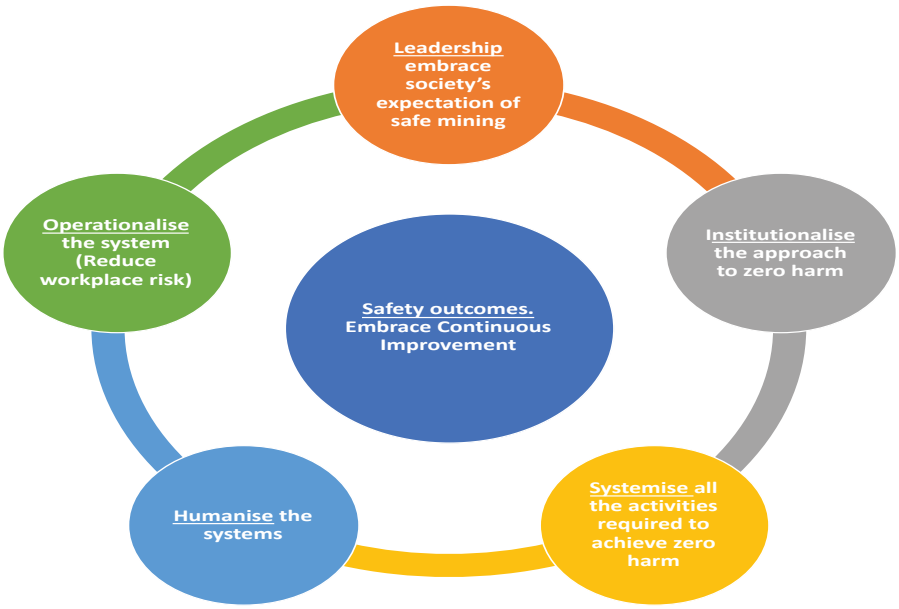


Figure 21 'de Jager Zero Harm model'

It is summarised as follows:

1. The *society norms* and sustainability, including safety expectations and requirements need to be articulated consistently through various means and actions to enable leaders to clearly understand what is expected from them.
2. The country/institutions/company's leadership to *take heed of the broader society's expectation* that mining must take place safely.
3. The country/institutions/company leadership to institutionalise the company's approach to 'Zero Harm' by articulating the strategic intent and to *create an enabling environment* to achieve 'Zero Harm'.
4. *Systemise* all the interdependent activities required to achieve 'Zero Harm'.
5. *Humanise the systems* to transfer relevant knowledge and establish behaviours of all individuals throughout the organisation to enable the achievement of 'Zero Harm'.
6. *Operationalise the safety management system* by removing or reducing the risk to acceptable levels in the workplace.
7. *Monitor* and manage the company safety outcomes.
8. *Embrace continual improvement*.

3.2 Safety leadership

Safety has always been part of mining and it is a very important part of the social license to mine in both the global and the South African mining industry. Although the number of fatalities has decreased significantly in recent times, it still occurs too often to be acceptable by society. What compels a country/company's leadership to take heed of the broader society's expectation that mining must take place safely? The overriding question is what has had to change to achieve this significant improvement? Was the answer in new leadership, technology, processes, systems, legislation or applying what was known before?

An important starting point to improve a company's safety performance is for the company's leadership to take heed of the broader society's expectation that mining must take place safely.

If the company board and leadership have the prerogative to decide that shareholder return is the major focus point and only the absolutely necessary money and effort to be spent on safety, the resultant safety performance will be by chance. If on the other hand, the safety outcome is designed by choice and it is articulated as such, it is a major step in achieving 'Zero Harm'. Where there is a will there is a way.

Safety has long been an integral part of mining, but the levels of performance has been redirected to achieve 'Zero Harm' in the long run. The amount of deaths in the mining industry during the past 100 years exceeds 51 000 between 1917 and 2016. Although the number of deaths has been decreasing substantially during the past 30 years since 1987, it remains unacceptably high at 73 fatalities in 2016 as shown in Chapter 1-Figure 3.

The consequences of a single death are significant for a company, never mind for the individual and his or her family. The workplace is immediately stopped for an extended period by the DMR, followed by a funeral, investigations, enquiries, reviews, audits, reports, remedial work, training and the list goes on. The company's image is tarnished resulting in reputational damage and disinvestments.

It is therefore imperative for a business to operate safely and not harm mine workers. If the risk cannot be engineered out or reduced to an acceptable level, the activity should be stopped. This may hold true for a section of work, a shaft or a mine for that matter.

The broader mining industry got the message a long time ago to ensure that the operations are safe. Some operations have become safer but will probably not ever be completely safe. However, getting the safety message is important in order to

understand that safety as an outcome is not negotiable. The collective approach on how to manage the risks to within the acceptable risk tolerance levels is a combined effort by all stakeholder, but the overall accountability remains with the company board leadership and appointed managers.

The broad outcome of the research was that the global societal expectations and subsequent embracing of these requirements by the mining company leadership and the creations of an enabling environment resulted in the significant improvement of fatalities in the South African mining industry over the past decade.

3.3 Individual, society and company expectations maturity model

The expectations by individuals and the society-at-large from companies matured over time as shown in Figure 22. In the past the majority of individuals that were employed in the mining industry were mostly illiterate and was required to do mostly manual labour underground in challenging conditions. They were largely recruited from remote labour sending areas and neighbouring countries and were housed on the mine in hostels, away from their families. They had an expectation to earn a living wage to support their families and eked out a living. At the same time, they expected to potentially contract phthisis and loose hearing over time due to their exposure to dust and noise. Additionally, they could get injured, get maimed or die as a result of the nature of their work.

As an example, over time, the individual's expectations matured and they expected a a decent wage and benefits, living with their families in houses as well as not to be injured at all or exposed to other occupational diseases. What was acceptable in the past is no longer acceptable currently and will evolve further in future.

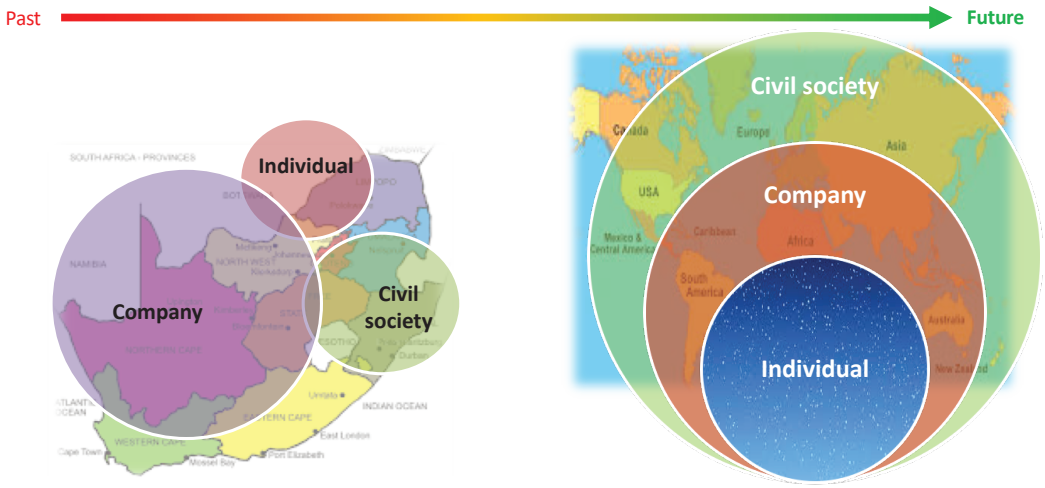


Figure 22 Illustrative expectations maturity (de Jager 2018).

It is within this context that the past safety performance of the South African mining industry should be viewed. What was deemed to be acceptable safety performance in the past is no longer acceptable and much needs still to be done to achieve the vision of 'Zero Harm'.

The company's leadership must engage timeously with the relevant stakeholder to anticipate future expectations as well as the capacity of the organisation to meet the needs as shown in Figure 22. Failing this leads to significant challenges and could put a company out of business.

Stakeholder expectations have increased dramatically over time resulting in increased complexity and effort to have a sustainable business. Making adequate returns on investments is a paramount to ensure business success but it cannot be done at the expense of society norms. Mining companies cannot operate in isolation and society creates an enabling environment if expectations are met and the opposite if it is not met.

Exposure to occupational risks that results in diseases, injuries and fatalities are not acceptable. Many investors have cottoned onto this and are not willing any longer to deal with mining companies that have an unacceptable safety

performance. Times have changed and if there is no adaption, who knows how long a company will still survive?

3.4 National safety advocacy

3.4.1 Mine Health and Safety Council

The Mine Health and Safety Council (MHSC), established in terms of section 41 (1) of the MHSA, 1996 (Act 29 of 1996), was introduced at the first South African tripartite safety summit in 1998. The MHSC was set up to direct safety in the mining industry and to respond to industry safety and health challenges. The council was built on the achievements of decades of fundamental research and was funded by the mining industry. The MHSC comprises a tripartite board represented by the state, employers and organised labour, under the chairmanship of the Chief Inspector of Mines (MHSC 2017).

The mandate of the MHSC is to advise the Minister of Mineral Resources on occupational health and safety legislation and research outcomes focused on improving and promoting occupational health and safety in South African mines. It is also required to oversee the activities of its committees and to promote a culture of health and safety in the mining industry. The MHSC arranges a summit every two years to review the state of occupational health and safety at mines, and liaise with the Mining Qualifications Authority and any other statutory bodies about mining health and safety.

The MHSC has permanent committees to assist in achieving its overall mandate which includes the Mine Regulation Advisory Committee (MRAC); Safety in Mines Research Advisory Committee (SIMRAC); Mining Occupational Health Advisory Committee (MOHAC), and the Mine Health and Safety Policy unit.

3.4.2 MHSC output

The 2 yearly MHSC Occupational Health and Safety Summits held in the past focussed on the following themes:

2003: Occupational Health and Safety Milestones setting.

Industry milestones were set in 2003 which included:

- After December 2013, using present diagnostic techniques, no new cases of silicosis will occur amongst previously unexposed individuals. By December 2008, 95% of all exposure measurement results will be below the occupational exposure limit for respirable crystalline silica of 0.1mg/m3.
- After December 2008, the hearing conservation programme implemented by the industry must ensure that there is no deterioration in hearing greater that 10% amongst occupationally exposed individuals. By December 2013, the total noise emitted by all equipment installed in any workplace must not exceed a sound pressure level of 110dB(A) at any location in that workplace including individual pieces of equipment.
- Zero rate of fatalities and injuries. In the Gold Sector: By 2013, achieve safety performance levels equivalent to at least current international benchmarks for underground metalliferous mines. In the Platinum, Coal and Other Sectors: By 2013, achieve constant and continuous improvement equivalent to at least current international benchmarks. To achieve international benchmarks, an annual reduction milestone of 20% was agreed to by stakeholders.

2005: Working together towards 'Zero Harm'.

The summit programme stressed the human side of death and disease, leadership participation and the shared responsibility of all stakeholders for health and safety.

2008: 'Zero Harm' Through Collaborative Action.

In 2008 the stakeholders identified a need to develop a culture transformation framework. It was concluded after a comprehensive survey that the OHS culture in the South African mining industry was significantly more negative than international comparisons.

A project Changing Minds, Changing Mines initiated to be developed a health and safety culture transformation framework that would allow the South African mining industry to significantly improve its health and safety culture.

2011: 'Zero Harm' Through Action.

The Culture Transformation Framework (CTF), was an initiative that seeked to transform the culture of health and safety in the workplace to control risks. Research showed that an organisation's culture has an impact on safety. The CTF has eleven pillars and the COM was committed to the effective implementation of the following pillars of the CTF by 2020:

- Bonus and performance incentive pillar to prioritise safety ahead of production;
- Risk management pillar aimed at reducing risk at its source and to investigate root causes of incidents;
- Leadership pillar encouraging leaders to lead by example and walk the talk of 'Zero Harm';
- Leading practice pillar provides a unified approach to identifying and facilitating the adoption of leading occupational health and safety practices and research outcomes;
- Diversity management pillar aimed at eliminating racism, genderism and any other forms of discrimination;
- Data management pillar to monitor and evaluate progress of CTF implementation and mine health and safety performance, and

- After December 2020, the remaining pillars of the CTF would be implemented: Integrated mining activity; Technology; Inspectorate; Tripartism; Regulatory framework.

2014: Every mine worker returning from work unharmed every day.

- Striving for 'Zero Harm'. All stakeholders agreed to eliminate fatalities by December 2020, planned 20% reduction in serious injury reduction up to December 2016 and from January 2017, a 20% reduction in lost time injuries;
- Elimination of Occupational Diseases. By December 2024, 95% of exposure measurement should be below the exposure limit of Silica, Coal and Platinum Dust;
- Elimination of Noise Induced Hearing Loss. Quietening of Equipment. By December 2024, the total operational or process noise emitted by any equipment must not exceed a milestone sound pressure level of 107 db. For the Individual. By December 2016, no employee's standard threshold shift (STS) will exceeds 25 db. from the baseline when averaged at 2000, 3000 and 4000 hertz in one or both ears;
- Reduction and Prevention TB. By December 2024, the TB incidence rate should be at or below the National TB incident rate;
- Reduction and Prevention of HIV and AIDS. 100% of employees should be offered HIV Counselling and Testing (HCT) annually with all eligible employees linked to an Antiretroviral Therapy Treatment (ART) Programme as per the National Strategic Plan (NSP);
- Adoption of MHSC OHS leading practices from research through collaborative efforts including mining with nest and bolts to deal with fall of ground, proximity detection systems (PDS) to deal with transportation and mobile machinery and the Trigger Action Response Plan (TARP) to deal with entry examination and making safe., and
- The MHSC launched a campaign entitled 'changing minds, changing mines', with the aim of developing a framework to guide the South

African mining sector into making the necessary changes towards attaining ‘Zero Harm’.

2016: Mining Industry Milestones

At the 2016 Mine Health and Safety Summit the tripartite stakeholders approved a set of declaration of actions as step change initiatives to harness the achievement of 2024 milestones. These actions complement the pillars and minimum standards of the CTF. The COM would facilitate, in conjunction with other stakeholders, the hosting of two annual sessions of stakeholder principals and leaders focusing on tripartite visible-felt leadership and relationship building.

The industry would focus on building a culture of safety. Each mining company committed to hosting an annual health and safety day tailored to their respective needs as part of their overall health and safety campaigns. The objective was to reinforce tripartism, raise the bar on tripartite visible-felt leadership as per the Culture Transformation Framework (CTF) to harness the achievement of the 2024 milestones and to accelerate achievement of the industry goal of ‘Zero Harm’.

Principals and leaders of all stakeholder groups committed to meeting at least on two facilitated sessions on health and safety per annum to facilitate tripartite visible-felt leadership and relationship building. The representation would comprise union presidents and general secretaries, the DMR Minister, Deputy Minister, Director General, Chief Inspector of Mines, Principal Inspectors and mining CEOs.

All stakeholders would address the issue of trust deficit amongst the stakeholders moving from a transactional to a transformative approach. All stakeholder organisations, the MHSC, organised labour, government and employers committed to improving communication across all levels to ensure that the message of ‘Zero Harm’ reaches all mine employees and contractors and, in so doing, support and permeate actions intended to improve OHS throughout the industry.

Stakeholders would collectively and collaboratively empower supervisors, health and safety representatives and employees through extended visible-felt leadership and empowering conversations. This would not only be implemented by employers, but also by other stakeholders from organised labour, government and the MHSC. Tripartite stakeholders would also strive to empower women in mining on safety and security challenges, personal protective equipment and hygiene issues that impact them (MHSC 2017).

3.5 Department of Mineral Resources

The Department of Mineral Resources (DMR) is appointed by the South African Cabinet as the state has the duty and responsibility for effective regulation of health and safety conditions at workplaces.

The DMR has to give effect to the public international law obligations of the Republic that concern health and safety at mines.This is achieved through the enforcement of health and safety measures at mines; effective monitoring of health and safety conditions at mines; investigations and inquiries to improve health and safety at mines; by promoting a culture of health and safety in the mining industry and through training in health and safety in the mining industry

The DMR co-operates and consults on health and safety between the State, employers, employees and their representatives. Employee participation in matters of health and safety is achieved through health and safety representatives and the health and safety committees at mines

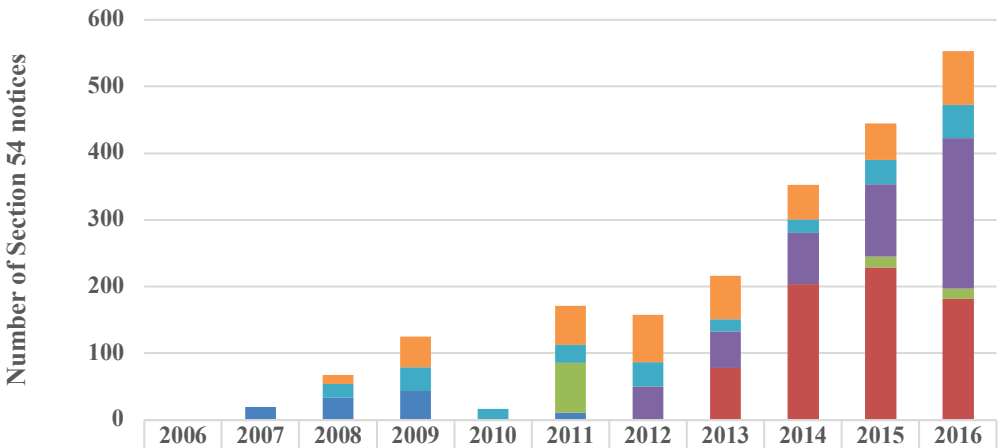
The employers have a duty and responsibility to protect the health and safety of their employees exposed to occupational health and safety hazards and risks. Both employers and employees have to identify hazards and eliminate, control and minimise the risks relating to health and safety at mines. Employees have the right to refuse to work in an environment that may endanger his/her health or safety (DMR 2017).

3.5.1 Section 54 stoppages

The Chief Inspector of Mines is an official appointed by the Minister to implement the Act and administer the Inspectorate. The Chief Inspector of Mines and Inspectors of Mines have wide statutory powers in terms of the MHSA and are empowered to enter any mine at any time, conduct investigations, examine or seize documents, remove any article, substance or machinery. If the Chief Inspector or Inspector is not satisfied with the conditions relating to health and safety at the mines, he or she may order compliance by issuing instructions requiring the employer to improve the working conditions at mine within a specified time. The Inspector may issue an instruction to suspend or halt the operations or part thereof. Issue an administrative fine, and or conduct further investigations or if necessary recommend prosecution (DMR 2017).

Effective regulation needs a clear policy and legislative framework, ability to enforce legislative requirements and adequate sanctions for failing to comply. Good legislation is only good as far as it can be enforced. It was concluded by the Leon Commission that the operators in the gold and platinum sector tended to compromise compliance with health and safety requirements and interactions with the regulator. This stance possibly explained the tough stance taken by the inspectors to stop workplaces where there was no compliance. This regulatory approach was often interruptive and could be very costly but in the absence of any effective sanctions for non-compliance, inspectors used this approach to impress on the minds of mine operators and owners that the high number of injuries, fatalities and exposure to harmful substances was not acceptable (Leon Commission 1995).

The DMR increased its focus on stopping unsafe operations since 2007. The information depicted in Figure 23 is based on disclosures in the respective annual reports by the individual companies. It would, however, be prudent to focus on the emerging trend as opposed to the detail as not all the DMR Sect 54/55 stoppages was disclosed in the publicly available information.



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Implats			14	46		58	71	65	52	55	80
Lonmin			20	35	17	27	37	18	20	36	50
Sibanye							49	55	77	109	226
GF						75				16	15
Harmony							1	78	204	229	182
AGA		20	34	44		11					

Figure 23 Section 54 stoppages (Companies researched - Annual reports 2006-2016).

Since 2006 the government has enhanced the legal requirements and the application thereof by re-organising the Mine Health and Safety Inspectorate. The consequences of the non-adherence to legal requirements has been very visible in recent times by the issuing of Section 54 notices to mine owners to stop operations or parts thereof. This cost the industry millions of Rand and has put some operations at risk due to unintended consequences of these actions. The extended stoppage of workplaces results in the disturbance of the rhythmic mining methods which could result in the deterioration of rock conditions. This in itself creates other risks that have to be dealt with.

The sanction of stopping the operations by the MHSI is legitimate and part of their mandate to ensure that mining takes place safely. However, this approach should be applied consistently, making sure that this remedy is appropriate for the level of transgression by the mining company. Recent experience is that work stoppages by the MHSI has been done indiscriminately and inconstantly which

resulted in the Chamber of Mines and some of the mining companies taking the DMR to court to get a ruling.

It appears that this draconian approach by the DMR have had an impact in that the company boards have realised that in order to avoid these stoppages by the MHSI, operations should be conducted safety and that transgressions of the law has significant consequences.

Although this approach by the MHSI is held in low regard by the industry, it seems to be one of the reasons why the mines are actually applying existing know-how better and are pursuing technology, mechanised and autonomous mining in order to remove people exposed to risk.

The COM response to Section 54 notices

The Chamber of Mines of South Africa (COM) estimated that the DMR Section 54 instructions to stop mines or part thereof, as a consequence of safety related transgressions, cost the industry some R13.6 billion between 2013 to 2015 (Moneyweb 2017).

The COM concerns were particularly around the North West, Rustenburg area, where inappropriate or disproportionate Section 54s were adding to the woes of a significant number of platinum producing shafts that were already loss-making. The primary drivers of this impact were the direct production days lost due to Section 54 stoppages and the indirect losses that result from the slow upliftment process and the subsequent start-ups (COM 2017).

While a number of companies were resorting to costly court action, the Chamber's Platinum Leadership Forum consisting of CEO's of platinum mining companies, developed a practical protocol to guide the appropriate application of Section 54 instructions.

The protocol contained proposals to deal with challenges that make Section 54 applications both ineffective in enhancing health and safety and that render them

value destructive. Some of the proposals included reducing the duration of Section 54 stoppages; Assessing the applicability of Section 55 (an instruction that avoids stoppage of operations) versus Section 54 and/or other instruments; Interacting appropriately with organised labour; Assessing the applicability of training as remedial action, and limiting the impact of small defects and administrative issues.

The practical protocol was shared and discussed with the Acting Chief Inspector of Mines since September 2016 with regular follow ups. During November 2016, this 'disproportionality' was challenged in the Labour Court by a mining company after an its entire mine was closed by an inspector who had found a few relatively minor localised infractions that posed no serious threats to the safety of employees in the small section of the mine, or in the mine as a whole. In finding in favour of the company that the inspector's closure order, as well as the penalty imposed were disproportionate, the Court established important legal principles.

The Court ruled that an inspector may only close an entire mine if he or she has objective reason to believe that occurrences and conditions identified, endangered, or may endanger, the health and safety of any person at an entire mine, and not only of a portion of the mine. It was hoped that this case would lead to greater clarity between mines, the DMR and its inspectorate.

The Chamber tabled the recommendation to the MHSC that Section 54/55 training be extended to other OHS managers, inspectors and organised labour's shop stewards. This would empower tripartite stakeholders to have a common understanding on the interpretation and implementation of Section 54s and 55s, thus building the much-needed trust in this area of mine health and safety (COM 2017).

Preventing Section 54 stoppages

The transgression of legal requirements has significant consequences in South Africa. The most effective way of preventing the stoppages is actually to adhere to

the legal requirements and have safe working conditions augmented by safe working procedures that are executed safely so as to prevent injuries.

Safety has been taken more seriously by some mining companies since the draconian approach by the DMR in that there were real consequences to legal transgressions. It is important for the industry to realise that ultimately it is the South African society's voice that is heard through the actions of the DMR.

Although the approach by the DMR is developing, it is a significant improvement when compared to the outcries from 1960 onwards that the MHSI is understaffed and cannot perform the duties that they were expected to do (Leon Commission 1995). Now in 2015/6 the DMR is doing what they are supposed to have been doing for the past century, there is an outcry by industry. This untenable antagonistic relationship between the DMR, COM and the mining industry at large during the approximately 5 year period leading up to 2017 is not sustainable on should be resolved as a matter of urgency.

3.6 Chamber of Mines of South Africa

The Chamber of Mines of South Africa (COM) is a mining industry employers' organisation that supports and promotes the South African mining industry and serves its members and promotes their interests by providing strategic support and advisory input.

A key role of the organisation is to facilitate interaction among mining employers to examine policy issues and other matters of mutual concern to crystallise and define desirable industry standpoints. Consultation and collaboration are voluntary and never encroach on the autonomy of members. The COM acts as a principal advocate for mining in South Africa in its interactions with government, communicating major policies endorsed by its members. A further vital function of the organisation is to represent some sectors in collective bargaining with organised labour. COM members subscribe and adhere to a Membership Compact, a mandatory code of ethical business conduct.

The COM and its member companies remain committed to the industry's goal of ‘Zero Harm’ of all those working at all operations and continued to be actively involved in a number of initiatives and partnerships aimed at eliminating fatalities and injuries in the mining industry. It was the vision of the COM that the South African Mining Industry would be safe, healthy and productive with risks controlled at their source through collaborative action from all the tripartite stakeholders. The collaborative efforts would strive to ensure that through a learning and participative culture where everybody is treated with care, dignity and respect. At all times, clear standards would be enforced by effective regulator mechanisms through fair sanctions that drive performance improvements focussed on determining the root cause rather than assigning blame.

A significant opportunity to reduce underground accidents was to, as far as possible, to remove the miners from working face dangers and in-stope health hazards. Where this was not always possible, appropriate technology was to be used in order to protect the workers.

The COM is used as a conduit to facilitate the MHSC industry initiatives. In 2009 the COM launched the Mining Industry Occupational Safety and Health (MOSH) Learning Hub to help companies learn from pockets of excellence in the industry which was the largest programme initiated by the COM in the last decade. Through the MOSH system, mines implemented and adopted leading practices to reduce health and safety risks.

The COM’s continued to encourage efforts the mining industry to adopt new technology. These were all incremental improvements, but they add up to making mines far safer places to work. South African mining companies were co-operating with each other and with equipment makers in devising better and safer working methods and technology. Technologies recommended to be the mining industry included the use of nets with bolts to help prevent falls of ground; Proximity detection systems (PDS) to prevent incidents by alerting mine workers to safety risks; Anti-collision technology for underground trackless equipment,

and hydro-powered rock drills and new water-based emulsions that could be electronically detonated (COM 2017).

3.6.1 2024 Milestone co-ordination

The COM plays a facilitative and coordinating role in the implementation of the 2024 milestones on mine health and safety. This is done through engagement with the Chamber's Occupational Health and Safety Policy Committee (OH&SPC), the MOSH Learning Hub and the CEO ‘Zero Harm’ Task Team.

3.6.2 Chief Executive Officer ‘Zero Harm’ task team

Safety is critical to all levels in the companies and the COM would continue to lead by example through effective collaboration with industry stakeholders. In 2012 the Chamber established the CEO ‘Zero Harm’ Task Team to visibly lead by example, to drive health and safety initiatives and to share experiences to help address key challenges in a manner that will enable the industry to achieve the 2024 milestones and accelerate the industry’s journey to ‘Zero Harm’. The team develop a model for industry leadership at CEO level and established working protocols with industry stakeholders and communities, which would be monitored and adjusted to suit specific needs when required.

The first focus area was falls of ground (FOG) which was the greatest single contributor to fatalities at the time. The focus on falls of ground contributed to a 50% reduction in FOG fatalities in the first year.

In 2016 the Chamber’s CEO ‘Zero Harm’ Task Team members agreed to the development and management of critical controls for fatal risks, with an increasing emphasis on controls that are higher up the hierarchy of controls. It was envisaged that a culture transformation in the industry that will change the behaviour of people at all levels to enhance their compliance and agility for change is necessary

3.6.3 Risk Management

In 2016 the COM initiated two projects focusing on the risk management pillar of the Cultural Transformation Framework (CTF). The COM facilitated and coordinated the collation of information from the CEO 'Zero Harm' Task Team member companies on the application of critical controls management on gravity falls of ground and underground transport, both trackless and rail-bound.

The information was then analysed to compile a desktop study report that seeks to encourage companies to share BowTie Risk Assessment (BTA) models on falls of ground and underground transport, trackless and rail-bound, drawing on international experience and formalising lessons learnt including measurement criteria and controls as per the critical control management steps outlined in the ICMM guidance documents.

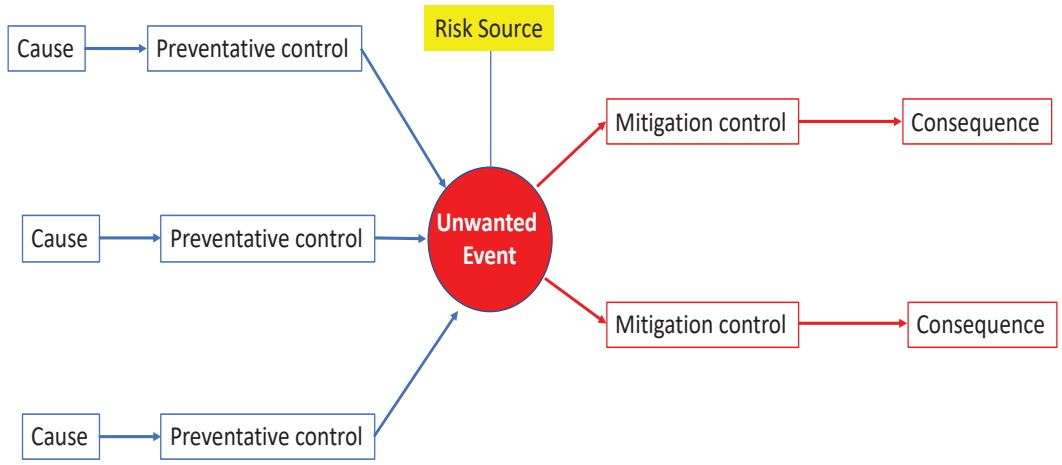


Figure 24 BowTie model

The BTA models as shown in Figure 24 visually portrays threat and consequence pathways to and from a major event in the characteristic shape of a bow-tie. It assists to visualize along each pathway intervening preventative and mitigating controls are depicted. Vulnerabilities, both in layers of control and that control robustness, are quickly identified and addressed (CGE 2017).

The models can link critical controls to management systems through the assignment of tasks, procedures, processes, and accountabilities in a critical control register. Once completed, a BTA risk model reveals vulnerabilities and highlights the importance of having multiple layers of controls, including higher order controls such as engineered controls, and of routinely monitoring control effectiveness.

The COM shared critical controls successes amongst the companies on falls of ground and underground transport in order to determine the benefits of such collated bowties.

Incident investigation methodologies

Another COM initiative sought to understand the current incident investigation methodologies and systems being utilised by companies as well as their consistent application. The conclusions and outcomes of both projects highlighted that there was still some work to be done in developing the maturity of both systems. The OH&SPC subsequently mandated the COM to establish working groups to continue work in these areas.

3.6.4 Leadership and diversity management

The MHSC commissioned two research projects focusing on the Leadership, Diversity Management and Bonus and Performance Incentive Pillars of the CTF. The aim of these research projects is to develop guidance on the leadership and diversity assessment tools and guidance on the incorporation of leading and lagging health and safety indicators in bonus and performance incentive systems (MHSC 2017).

3.6.5 Information system

The COM is exploring various ways in which the MHSC's information reporting system and Chamber's 'Health Source' could be used to collate safety information including lost time injuries and adoption of leading practices.

3.6.6 Mining Industry Occupational Safety and Health Learning Hub

In 2009 the Chamber launched the Mining Industry Occupational Safety and Health (MOSH) Learning Hub to help companies learn from pockets of excellence in the industry and this was the largest programme initiated by the Chamber in the last decade. Through the MOSH system, mines implemented and adopted leading practices to reduce health and safety risks.

The Chamber's continued to encourage efforts by the mining industry to adopt new technology. These were all incremental improvements, but they add up to making our mines far safer places to work. South African mining companies were co-operating with each other and with equipment makers in devising better and safer working methods and technology.

3.6.7 Other Associations by the COM

The COM is associated with the Association of Mine Managers of South Africa; South African Colliery Managers' Association; Organised labour through the Mine Health and Safety Council and International industry bodies through the Chamber's membership of the International Council on Mining and Metals.

3.7 Conflicted mining industry approach

Although the South African mining industry has a common goal of 'Zero Harm', the different approaches and processes by the various stakeholders at times result in some fragmentation and potential conflict with reference to Figure 25.

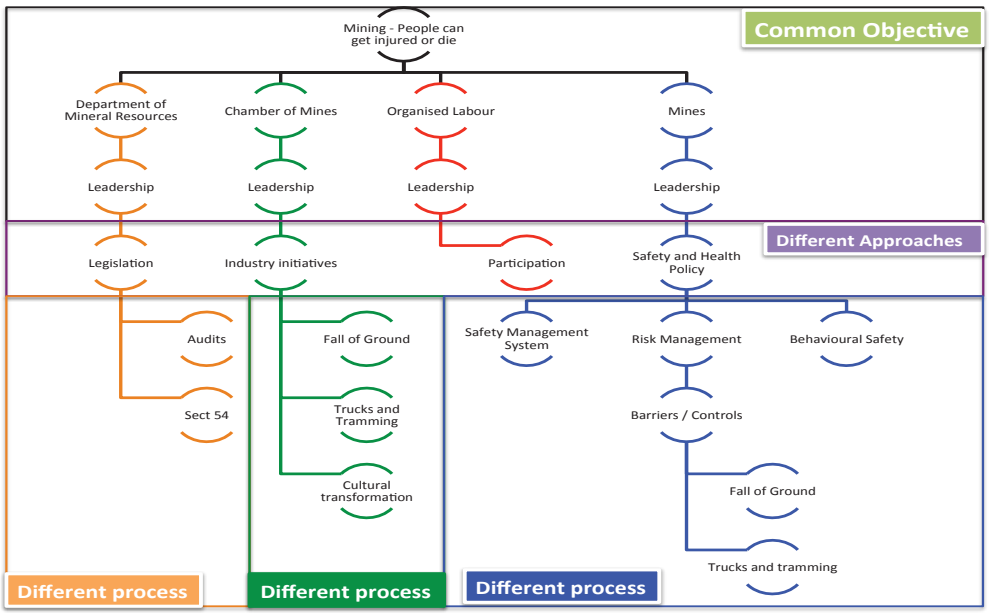


Figure 25 Conflicted mining industry safety approach

There is a saying, 'Whatever interests my 'boss', fascinates me.' In broad terms it means that followers observe what a leader talks about and how he/she behaves. In the South African mining industry 'lead by example' and 'walk the talk' are some of the sayings that are in vogue. These utterances set the tone for what is acceptable or not. In using an analogy of a conductor of a choir, the conductor's overall behaviour sets the 'tone' for the interpretation of the music score. The choir watches the conductor's every move and collectively they follow his/her guidance.

South Africa is still undergoing a transition phase in many respects which will be continuously be evolving. The broader South Africa socio political environment is very dynamic and sets an example of behaviour that is deemed acceptable. This behaviour is permeated to the mining industry at large where the behaviour in public of some captains of the mining industry leaves a lot to be desired.

The original intent of the Leon Commission in 1995 was to have a co-operative tripartite stakeholder approach between the mining industry, labour and

government. The Mine Health and Safety Act of 1996, was promulgated to facilitate this approach. However, over time the intent lost its way.

There are a myriad of factors that probably contributed to this fast deteriorating relationship model. Some contributing factors could include the closure of mines due to a lack of ore reserves and market forces; the challenging political situation in South Africa; the significant dynamics within organised labour including CUSATO, NUM and AMCU and the derecognising of SOLIDARITY at Lonmin; the increased expectations of society in general and mining communities specifically; the transition from singular shareholder expectations in the past to increased global stakeholder advocacy; the selling of largely worked out mines by first tier mining companies to second and third tier mining companies with a different approach to attempt to continue mining in the national interest; the resultant shrinkage of mining jobs and the increased expectations of the South African youth for job opportunities, and some of the major mining companies moving out of South Africa.

The current antagonistic relationship (2016) between several mining industry stakeholders is not sustainable and will have to be normalised at a new level to ensure that most of the expectations by the relevant stakeholders could be met in future.

An unintended consequence of this level of behaviour is that it sets the tone for the citizens of South Africa and the majority of employees in the mining industry. The South African mining industry has adopted behavioural-based safety as a major part of its risk control strategy in its quest towards ‘Zero Harm’. The idiosyncrasy is that it is expected from employees to behave in accordance with set behaviour patterns when working in the mining industry but the behaviour outside the mining environment is quite the opposite. This imbalance of inconsistent behaviour of compliance / non-compliance between the work and social environment is not conducive to achieving consistent conforming of behaviours in the work place.

3.8 International advocacy

3.8.1 International Council on Mining and Metals

The international safety advocacy agencies such as the International Council on Mining and Metals (ICMM) have had a major impact on the behaviour of leaders in order to improve the safety performance globally. In South Africa the Chamber of Mines, as well as several mining companies, are members of the ICMM and the influence was noticeable in the adoption of various ICMM processes.

The ICMM serve as a catalyst for change to enhance mining's contribution to society through a group of Chief Executive Officers of 25 mining and metals companies and over 30 regional and commodities associations and leading mining companies (ICMM 2017).

The association with the ICMM, who's membership are voluntary, is focusing on high level key issues such as principles and methodologies that is embraced by the CEO's of the mining companies as shown in Figure 26. The vision of the ICMM is to strengthen environmental and social performance.

Mines are viewed as complex workplaces covering a range of potentially dangerous activities, as well as hazardous engineering processes. ICMM members are committed to protecting the health and well-being of all their employees.

Safety

The ICMM has a goal of zero fatalities and this requires leadership, investment, and commitment to the ethos that if a company cannot mine safely it should not mine at all. The member companies are working towards a common vision of zero fatalities with the view that with effective risk management, accidents are preventable.

Despite the implementation of comprehensive safety management systems by many companies, fatalities and potential fatalities continue to occur. As an

industrial activity, mining is often hazardous but it can be done safely. Health and safety needs to be central to all operations and processes, with every practical and reasonable measure adopted to eliminate workplace fatalities, injuries and disease from mining and metals activities.

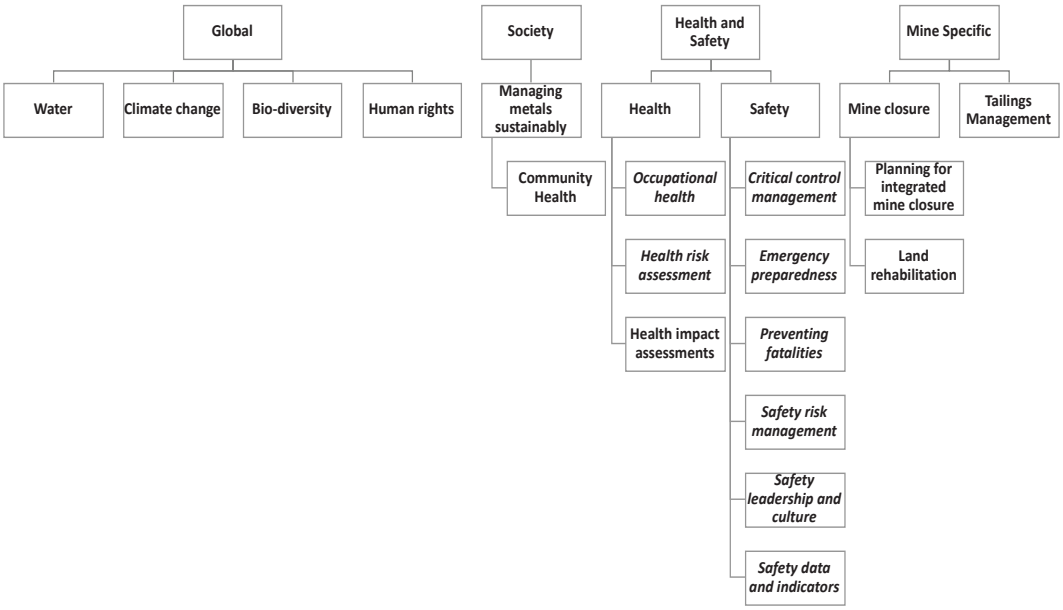


Figure 26 ICMM focus areas (ICMM 2017).

There are a the wide range of risks present in the workplace that can lead to fatalities. The key hazards of particular relevance to mining include: fall of ground/rock falls/seismic activity; explosions; collision of vehicles and catastrophic failure of mine infrastructure.

Mining companies need to use a combination of risk management systems, leadership and establishing a culture of safety to help stop these hazards from causing illness and injury at work and in local communities.

Safety leadership and culture

Mining is an inherently hazardous activity, however, for ICMM member companies health and safety is a core value guiding an unwavering commitment to the well-being of workers, their families, communities and wider society.

Prevention of negative occupational health and safety outcomes is both a key moral imperative and an important business value driver as any harm is unacceptable.

The focus of safety leadership and culture is to have visible commitment to health and safety at all levels of an organisation is centred on proactive actions and behaviours that can be exercised by the mining industry to help eliminate the risk of incidents occurring. Leaders, from chief executives to frontline supervisors, are vital in this regard as they set the tone for others in their organisation to follow.

Safety risk management

Although many mining companies have improved their safety performance in recent years, as measured by lost time, injury frequency rates and similar measures, unwanted events still occur. These include incidents such as underground fires, coal dust explosions, falls of ground and over-exposure to harmful substances. Incidents that can lead to debilitating injuries, fatalities or rarer catastrophic impacts on people and the environment also occur.

Investigations, after the fact, typically show that controls for known risks were not effectively implemented. Often as a result of dense and complex safety management systems and hazard management plans or procedures that prove to be difficult to implement or lack clarity as to which controls are most important

Risk management requires the implementation of agreed controls in order to combat potential harmful events that could result in injuries and illnesses that can result in loss of life.

Ideally, a hazard will be prevented before it occurs by understanding and managing the circumstances that could give rise to it. Leading result indicators give advanced warning that help companies identify whether proactive risk-lowering decisions and actions are being effective and why a desired result has or has not yet been achieved.

Critical control management

While recording actual incidents of harm is important, it's vital that mining companies invest in critical controls to better fulfil their responsibility of protecting the health and safety of workers, their families, communities and society. The critical controls must be clearly defined and understood, with clarity as to who is responsible for implementation in order to prevent fatal and catastrophic events from occurring.

A critical control management approach is an effective way of achieving this, by focusing risk-management on those controls that are most critical for health and safety. The critical control management approach requires clarity on which controls really matter; understanding of what these controls need to do to prevent an undesired event from happening; decisions on what checks are needed to ensure that controls are working as intended; accountability for the implementation of the controls, and reporting on the performance of all critical controls.

Leading indicators can be used to monitor real-time performance and respond accordingly and are an important element of critical control management. These indicators are largely specific to particular, evolving operating environments and can make general comparisons problematic as it's unlikely that a single set of leading indicators can be used in perpetuity within an organisation or appropriately across organisations.

Emergency preparedness

It is essential for mining and metals companies to respond effectively to emergencies and to better protect workers and their families, local communities and wider society from harm.

Safety data and indicators

Health and safety indicators are a key measure of performance and an effective identifier of problem areas. Analysis of this data can stimulate actions and reinforce improvements in behaviour. Historically, the most commonly used indicators for health and safety are those that measure 'after the fact' data. These 'lagging' indicators record data on harm after an incident has occurred.

The monitoring and reporting on occupational health and safety indicators is an important part of driving performance improvement. The ICMM produces an annual mining safety report covering the fatality and injury data of its members which is aimed to encourage information and knowledge-sharing among members, and catalyse learning across the industry (ICMM 2017).

3.8.2 Global Reporting Initiative

The acceptance of the reporting principles of the Global Reporting Initiative (GRI) by many mining companies in South Africa is advantageous in that the broader community has real insight into a company's performance, provided that the reporting company adheres to the GRI requirements.

The GRI is an independent international organisation that has pioneered sustainability reporting since 1997. It helps businesses and governments worldwide to understand and communicate their impact on critical sustainability issues such as climate change, human rights, governance and social well-being. This enables real action to create social, environmental and economic benefits for everyone. The GRI Sustainability Reporting Standards are entrenched in the public interest (GRI 2017).

3.8.3 International Social Security Association

The International Social Security Association (ISSA) is the world's leading international organisation for social security institutions, government departments

and agencies. The ISSA promotes excellence in social security administration through professional guidelines, expert knowledge, services and support to enable its members to develop dynamic social security systems and policy throughout the world. Founded in 1927 under the auspices of the International Labour Organisation, the ISSA counts more than 330 member organisations in over 160 countries.

The ISSA has developed a range of resources to support the Vision Zero Campaign and the seven golden rules of Vision Zero. The vision of 'Zero Harm' is a transformational approach that integrated safety, health and well-being in the workplace. It is believed that accidents are neither predetermined or unavoidable and focus should be on the prevention of accidents that could result in harm.

Safe working conditions are seen as a legal and moral obligation in order to avoid human suffering as well as other positive spinoffs including motivation of employees, quality of work and company reputation (Visionzero 2018). Management should act with awareness, lead consistently, build a climate of trust and open communication as well as:

- Take leadership and demonstrate commitment;
- Identify hazards and control risks;
- Define targets and develop programmes;
- Ensure a safe and healthy system and be well organised;
- Ensure safety and health in machines, equipment and workplaces;
- Improve qualifications and develop competence, and
- Invest in people and motivate by participation.

3.9 Conclusion

Safety is a moral and business imperative that could put a company out of business if not managed within society norms and expectations. It is conceivable that the previously identified issues that were confirmed repeatedly during the

historical inquiries into the mining industry's safety performance is largely being implemented due to increasingly social pressure on the mining companies.

The South African mining industry at large has taken cognisance of the ever-changing society expectations and the International and National advocacy groups principles and processes. The tripartite co-operation between government, mining companies and labour representative organisations are collectively working together to achieve 'Zero Harm' in the mining industry.

The collective research approach facilitated by the Mine Health and Safety Council brings about the necessary focus and synergy. Additionally, the tripartite conferences where the strategic industry safety initiatives are debated and reviewed plays a big role in having a collective industry approach which is measured against agreed milestones. This collaborative industry approach has worked well as the conduit for collective industry initiatives and is facilitated by the COM.

One of the COM initiatives, the Chief Executive Officer's working group, plays a critical role in the collective approach as it creates an enabling environment for initiatives to be implemented by the different mining groups.

The Department of Mineral Resources has played a significant role in enforcing compliance to the relevant legislation. Although the Chief Inspector of Mines has the legal mandate to stop mines for non-compliance under certain conditions, the application thereof was inconsistent and draconian. The consequence of these actions became a major threat for the sustainability of some marginal mines and a political issue for the country.

The COM as well as some of the individual companies took the DMR to court for the inconsistencies in ensuring compliance and the court ruled in favour of the companies. The Minister of Mineral Resources was subsequently relieved of his duties in February 2018. It is hoped that the antagonistic relationship between

some of the tripartite members will be normalised in due course so as to focus on the sustainability of mining in South Africa.

Research finding 1: The company's leadership taking heed of the broader society's expectation that mining must take place safely. It includes:

- International and national safety advocacy.
- International and local society culture and norms.
- Legal requirements, etc., was discussed as depicted in Chapter 3-Figure 21.

The approach to institutionalise the broader society's expectation that mining must take place safely, as the next step, is discussed in Chapter 4.

4 INSTITUTIONALISE THE APPROACH TO 'ZERO HARM'

4.1 Introduction

The safety performance of companies in different countries of the world has been and still is perceived differently by different societies. The overall perception of what is acceptable safety performance by societies in Western Europe, Canada, North America, Australia is very different to that in most African countries, Eastern Europe and the Far East, as examples.

The perception of the South African society on what is acceptable safety performance has developed significantly in recent years while the safety journey to achieve 'Zero Harm' in the mining industry has been evolving slowly over years. Once the industry leadership of the different stakeholders involved in the collective achievement of 'Zero Harm' got the message from international and national stakeholder that enough is enough, and that change is required, the strategic intent needs to be articulated constantly and consistently in the company or institution.

It is amazing what a difference a comment by the leadership, mostly the Chief Executive Officer, can make to create a culture in a company or organisation. An example of this was the words and actions of Cyril Ramaphosa, the newly elected (2018) President of the African National Conference at the 106-year birthday celebrations who said that the proceedings of gatherings will from now on start on time, which is exactly what was done. This is after years of the example of the previous incumbent who was invariably late which became the norm of all meetings and gatherings of the ruling party. The new approach to start meetings on time is set to become the new culture of the organisation.

In the same vein, the words and actions of a company's leadership is a significant driving force of the ensuing organisational culture. However, words alone are not sufficient, as it should be followed up by consistent and persistent actions to create an enabling environment to achieve 'Zero Harm'.

4.2 ‘Zero harm’

‘Zero Harm’ is an elusive outcome that the South African mining industry is relentlessly pursuing. *‘Zero’* in this case means ‘absolutely nothing’ and ‘*harm*’ could include synonyms such as ‘damage, injury and hurt.’ The harsh reality is that ‘Zero Harm’ has not been achieved in the South African mining industry. It is however, more than a slogan as it describes a mindset and culture that is evolving.

When a company embraces the concept of ‘Zero Harm’, it is a good start to a long never-ending journey. The concept needs to be understood by all concerned in that ‘Zero’ means absolutely nothing and harm refers to injury and damage at large. Although the achievement remains elusive in most instances it should remain as the strategic intent.

The strategic intent of ‘Zero Harm’ must be incorporated into the company’s vision, mission and values. Thereafter it must be captured in the policies so that affect can be given to the strategic intent. This creates the attitude that ‘where there is a will there is a way’. This approach then deals with ‘what needs to be done to achieve the strategic outcome’ instead of finding excuses why it cannot be done.

A key to the achievement of success in this regard is accepting ‘Zero Harm’ as a vision. The alignment with all the internal stakeholder is important and ‘Zero Harm’ should ultimately manifest itself in the company’s vision, mission, values and policies. The actions of all involved in the mining operation must have ‘Zero Harm’ in mind when any task at whatever level is executed and the consequences must be anticipated.

The current primary success indicator for ‘Zero Harm’ in the South African context is the reduction in the number of fatalities in the mining industry. Unfortunately, thousands of workers are still injured on an annual basis and if ‘Zero Harm’ is practiced as intended, the success indicators should include the number and severity of injuries.

4.3 Leadership articulating ‘Zero Harm’ intent

To this day, there is no shortage of expressing the intent to be safe in the mining industry by government, company leadership and unions.

- ‘If people are the mine’s best asset, safety cannot be negotiable’ (Appendix B, AGA 2001/2, Page 15);
- The then CEO’s commitment to bring to an end, ‘the ungodly era of people going to work to die’ (Appendix B, AGA 2001/2, Page 15);
- ‘No rock will fall uncontrolled’ (Appendix B, AGA 2001/2, Page 15), and
- ‘We will not mine if we cannot mine safely’ (Appendix D, GF 2008, Page 10).

It is only once the collective stakeholder leadership accepts that mining safely is possible and a business imperative, the message needs to be encapsulated into the company’s vision, mission, values, policies and procedures as a strategic intent.

Words are necessary, but it needs to be turned into real consistent and persistent action to make a difference. The intent must be crystallised through a comprehensive plan, formulated by the necessary stakeholder involvement and buy in to transition the intent into reality. Safety should become a concurrent activity with production to become the norm which ultimately manifests itself in the desired safety culture of the organisation.

Achieving success must be described and the indicators thereof and monitoring processes be established for appropriate feedback to the board. The board in turn should not only watch and critique what happens but ensure that the necessary changes be affected to achieve ‘Zero Harm’.

The board and the company leadership are obliged to give feedback to the society through reports. The indicators used in this instance should conform to the requirements of the GRI to ensure that the disclosure remains relevant, accurate, consistent and auditable. Failures of the systems in the operations that creates

harm or incidents that has the potential to create harm should be reviewed by the board. The necessary action should be taken to keep the strategic intent of 'Zero Harm' on course.

The appropriate governance processes must hold the company leadership accountable to create an enabling environment to achieve 'Zero Harm'.

4.4 Organisational leadership

Most of the mining companies researched had undergone significant amount of changes as a business as well as at board and management level during the period 2007-2016.

4.4.1 Gold Fields

Gold Fields unbundled its mature operations into Sibanye in 2012 and only kept South Deep in South Africa, a mechanised mine with significant challenges in the past and for the foreseeable future. Gold Fields continued to focus on its international operations resulting in the South African operational risk reducing significantly (Appendix D: GF 2013).

4.4.2 Sibanye

The Sibanye mature operations had infrastructure related problems but foresaw upside in the future use of technology to mine previously abandoned ore reserves .Sibanye expanded its operations rapidly by the further acquisition of other mature assets in the platinum sector resulting in the South African operational risk increasing significantly (Appendix E:SIB 2013).

4.4.3 AngloGold Ashanti

AngloGold Ashanti sold its mature operations to Harmony and only kept one operational mine in South Africa (Appendix B: AGA 2016). In addition,

AngloGold Ashanti continued to focus on its international operations resulting in the South African operational risk reducing significantly.

4.4.4 Harmony

Harmony has traditionally been operating mature mining assets as its core business. The asset portfolio was augmented by the acquisition of mature mines from AngloGold Ashanti resulting in the South African operational risk increasing (Appendix C: HAR 2015).

4.4.5 Lonmin

Lonmin has had operational struggles for many years but as a London listed company and having its head office in London at the time, it instilled significant safety management systems in the company (Appendix F: Lon 2007). This was a blessing as it experienced significant turmoil resultant from the underperforming platinum price, high costs, head office move from London to Johannesburg, significant board and management changes.

The local community had been restless for years and had exaggerated expectations from the mining company which ultimately lead to the Marikana massacre in 2012. Lonmin was an accident happening in slow motion and if it was not for its great entrenched safety management systems the fatalities during 2007-2016 could have been a lot worse. In 2018, Sibanye Stillwater planned to purchase Lonmin. Sibanye Stillwater could benefit by using the best of the safety management systems in Lonmin to be used throughout the rest of its operations in order to reduce their risks.

4.4.6 Implats

Implats, somehow was not a member of the Chamber of Mines in South Africa till 2012 when a new CEO, who was passionate about safety, joined the company. Neither were they a member of the ICMM (Appendix G: Imp 2013). However, in

2013 they adopted the principles of the ICMM. The downside of being an internally focussed company was that they lost out on safety initiatives that happened in the rest of South Africa and globally.

Implats started implementing a new safety strategy once the new CEO was appointed in 2012. However, they had a significant backlog of initiatives and risk controls that the mining industry had implemented many years before. Examples of this included, fire retardant belts, self-contained self-rescuers, shaft safety installations, flammable gas monitoring, and enhanced fire detection systems.

To top this, Implats decided to reduce their mechanised mining by replacing most of it with conventional on reef mining. They however, continued with mechanised mining in the development ends which resulted in a hybrid mining concept. The company had infrastructure related issues as well as continuous labour and community challenges. Sadly, this context manifested itself in its overall safety performance.

4.5 Company vision, values and policies

The strategic intent of striving for 'Zero Harm' should be included and expanded upon in the company vision, values and business principles on safety and health (Appendix D, GF 2008). Sustainability was introduced as a specific element in Gold Fields vision as it viewed that a mine's successful operation was intimately linked to:

- The skills and expertise of the people employed;
- The companies with which business was done with;
- The safety of the operations, and
- The nature of the relationships that were built with neighbouring communities and governments.

The safety and health policy of the company should encompass the safety and health expectations and dictate minimum guidelines for the employees in respect

of safety and health (Appendix B, AGA 2004). Some of the principles to be included in the safety and health policy are:

- Committed to complying with all relevant occupational health and safety laws, regulations and standards. In the absence of such standards, leading practice would be adopted;
- Provide a working environment that is conducive to safety and health;
- The management of occupational safety and health is a prime responsibility of line management, from the executive level to the first line supervisory level;
- Employee involvement and consultation with employees or their representatives to gain commitment in the implementation of these principles;
- Provide all necessary resources to enable compliance with these principles;
- The company should not tolerate or condone deliberate breaches in standards and procedures;
- Implement safety and health management systems based on internationally recognised standards;
- Conduct the necessary risk assessments to anticipate, minimise and control occupational hazards;
- Promote initiatives to continuously reduce the safety and health risks;
- Set safety and health objectives based on comprehensive strategic plans and measure performance against these plans;
- Monitor the effects of the company's operational activities on the safety and health of employees and others;
- Provide all necessary personal protective equipment;
- Establish and maintain a system of medical surveillance for employees, and
- Communicate openly on safety and health issues with employees and other stakeholders.

4.6 Governance

Safety did not originally find a comfortable place at board level of Harmony. It ranged from being part of the SHEC committee, the Risk Committee as well as others. Line management was not part of the committee that was responsible for safety, however, this was soon realised and corrected (Appendix C, HAR 2008/1).

The focus of most of the sub-committees of the companies researched was supportive and adequate. Some of the board sub-committees were misguided and did not add value resulting in the company being misdirected for periods (Appendix C, HAR 2006-1).

The company board and relevant sub-committees must be constituted with members that have the appropriate skills and experience so that relevant guidance can be given as well as the interpretation of the relevant trends so as to remain proactive in their approach. It is easy for such a committee to lose its way if not appropriately constituted and focussed. The unintended consequence of an ill constituted sub-committee is that the company could be misguided in its efforts.

The board and sub-committees should create an enabling environment for success and hold management accountable to achieve the desired outcomes. It is imperative that senior line management form part of the sub-committee where safety is addressed so as to ensure the continuous focus on the strategic outcome.

Line management is accountable for safety, however, roles and responsibilities of other role players remained a constant topic of discussion as the company's progress in their safety maturity.

4.7 Safety management approach

The board, management and employee representatives need to participate in determining the company safety management strategy. The strategy should take the company values and policies into consideration in order to achieve 'Zero

Harm'. It is important to appreciate that it will not be business as usual and a long journey if a company strives to entrench the approach of 'Zero Harm'.

A comprehensive interdependent safety strategy is required to enable a sustainable change in the safety culture of an organisation. Some of the overriding principles that could be considered include:

- Establish new and innovative ways to manage safety, support the effective execution of safety strategies, and eliminate inefficiencies;
- Establish a common safety management approach that has a structure and language that helps bring the organisation together with a single and consistent safety framework;
- Ensure that safety is effectively integrated with other business strategies and objectives, in support of a stable operating platform, and
- Engage every employee to create conditions that encourage them to give of their best for their own benefit and that of the company.

4.8 Safety management responsibilities

The Chief Executive Officer is ultimately accountable for safety strategy and management at the operations. The responsibility is delegated to the relevant general and plant managers for implementation and monitoring as each operation has a unique risk profile.

Line management is responsible for ensuring the effective implementation of the health and safety policy objectives through supporting systems and procedures and by continuously creating and maintaining an 'enabling environment' for all workers and for delivering safe systems and places of work.

Managers and supervisors lead by demonstrating their own adherence to safe work practices and required everyone working or visiting their respective areas to follow those agreed operating standards. In principle, all would follow the agreed

safety standards and practices and would not take or allow shortcuts on any safe working practice.

‘Zero Harm’ to the employees and contractors is the core value and the companies concerned are committed to the wellbeing of their employees and contractors and maintaining a culture of safe behaviour. Safety is also the responsibility of each employee and contractor.

All employees should either fix or cause action to be taken immediately to rectify any identified significant hazards before proceeding with any other activity. Management and employees accept joint responsibility for their actions and therefore it was imperative that the working environment empowered people to stop work and withdraw from the mining area when they feel it was unsafe or prevent others from acting in an unsafe way.

Safety representatives and their committees has the necessary responsibility, authority and support to effectively perform their functions, including ensuring compliance with the safety and operating standards.

Safety roles and accountabilities should be clearly defined in job descriptions and used to measure the performance of teams to ensure that all employees understand how they could work safely.

4.9 Safety strategy

It is important to recognise that safety success is not one strategy or another, but one strategy and another as safety excellence is not the result of a singular strategy and there are no universal answers (Hansen, 2007).

It is fundamental to formulate an integrated safety strategy through the involvement and commitment of all stakeholders in order to achieve ‘Zero Harm’. The companies researched all had specific safety strategies that were reviewed on a regular basis for improvement opportunities.

4.9.1 AngloGold Ashanti

Transformation project

AngloGold Ashanti realised that in order to change the safety culture of the company, it would have to have an integrated approach. A safety transformation project was subsequently launched with '*Safety is our first value*' as the imperative. A safety blue print for the business was developed which included the guiding principles representing a global approach to developing a resilient safety culture and systems that created a common business platform and language for safety across the company.

The concept of safety included occupational health and safety, and the wellness of employees, contractors as well as host communities to ensure that no health or safety impact resulting from the operations affected the communities.

The safety transformation project captured the stakeholder perspectives during in the project design. It was undertaken by a series of stakeholder workshops in which government, organised labour, employees and safety experts participated. Stakeholder engagement continued as the project developed and a dedicated stakeholder engagement plan, integral to the project, was compiled. The guiding principles were to:

- Set clear accountabilities for safety;
- Understand and manage hazards and risks, in an ongoing way;
- Engage the workforce in doing this;
- Make the solutions happen by providing resources;
- Have a relentless and broad commitment to safety, within and beyond the workplace, and
- Develop a learning culture to make all of these things happen in reality, not just words.

The global approach was designed taking cognisance of local regulatory requirements, unique cultural differences and site-specific characteristics to achieve four key objectives:

- Establish new and innovative ways to manage safety, support the effective execution of safety strategies, and eliminate inefficiencies;
- Establish a common safety management approach that had a structure and language that helped to bring the organisation together with a single and consistent safety framework;
- Ensure that safety was effectively integrated with other business strategies and objectives, in support of a stable operating platform, and
- Engage every employee to create conditions that encourage them to give of their best for their own benefit and that of the company.

Strategic initiatives to instil a culture of care were effective across the group. It was supported by empowering people to take responsibility for their own safety and health and that of their colleagues, and by recognising safety achievements. A technology-based knowledge management system that encouraged higher levels of collaboration and cooperation across all business units was developed to support the change.

Business change process

A business change process was devised to improve performance levels across all areas of its business operations through consistent management and systems. A framework for change of the organisation was developed and implemented (Appendix B, AGA 2009-2016). It was guided by a steering committee chaired by the CEO and had two major components:

- The System for People (SP), which aimed to have the right person in the right role doing the right work, and

- The Business Process Framework (BPF), with the goal of having the right work done at the right time and in the right way.

Discipline frameworks mapped the detailed design of functional areas of work, for example safety and were integrated into the SP and the BPF. The sustainability strategy that was developed supported and reflected the principles of the project. The objective was to implement each element of the sustainability strategy throughout the project in order to ensure that it was made relevant to the business and became part of the way the company operated by:

Creating the right organisation design:

- A structure where work was undertaken at the correct level, and where the accountability and authority of a particular role clearly contributed towards achieving business objectives, and
- The organisational structure placed priority on operational leadership, with functional roles acting in support of operations through effective cross-functional working relationships;

Ensuring that the right people were in the right roles:

- The continual matching of employee capability to role complexity, which was necessary for meeting immediate and future business needs and in line with employee career development plans.

Developing effective working relationships to:

- Ensure that employees across the organisation worked together effectively, whatever the differences in their internal and external working environments, and
- Effective working relationships were facilitated when employees' behaviour and actions were in accordance with the managerial leadership practices and the company's values.

The approach to the implementation was that it should be:

- Undertaken in a top-down manner;
- Inclusive of, and engaging with all employees as far as this was possible;
- Undertaken within the respective managerial accountability hierarchies and continually reinforced it until it became second nature within the business;
- A delivery framework was developed for the SP that clearly defined corporate and regional roles in the implementation process;
- A corporate team was established to be accountable for the process of designing and developing the SP material to be implemented throughout the company;
- Regional human resources teams were charged with planning, scheduling and resourcing activation of the programme in consultation with line management;
- A global values survey, designed to offer all employees an opportunity to participate in the identification of value-based behaviours and to gauge employee engagement, was completed;
- It was envisaged to review the organisational mission, vision and values at regular intervals and maintain their relevance in a constantly changing environment, and
- The surveys were subsequently analysed for trends and conclusions, and the results, which were integrated with other business processes and communications.

4.9.2 Gold Fields

Safe Production Management

Gold Fields used DuPont to do an assessment of the company. One of the outcomes was the establishment of the Safe Production Management (SPM) project, which commenced with dedicated resources to ensure that the company

had the optimal health and safety culture and performance in future (Appendix D, GF 2009). It included:

- Leadership training programme for all managers and supervisors;
- Regular workplace inspections and general workplace visits;
- Incorporating well developed root cause analysis principles;
- Process prior to purchase and use;
- Accurate analysis of incidents and target areas, and
- Central risk assessment protocol.

The SPM Programme was principally focused on the prevention of serious and fatal accidents, which consisted of two overarching themes, namely:

- 'Engineering out' of safety risks, and
- To advance compliance by winning the hearts and minds of the people by reinforcing positive behaviour.

It was necessary to create an enabling environment to progress from a culture of dependence to one of interdependence. This entailed the requirement to instil the beliefs and values that could create the climate and context required for safe production behaviour by all employees. The successful implementation of the SPM was a pivotal driver for transformation and change in the company. The architecture of the SPM was founded on five pillars.

- Programme for Safe Production;
- Technical, Engineering and Mine Design;
- People driven outcomes including: Cultures, Values and Beliefs;
- Organisational Structuring, and
- Performance Leadership.

Behaviour based safety interventions was an ongoing priority at all the operations (Appendix D, GF 2009).

Safe production rules

Gold Fields developed Safe production rules (SPR) through a comprehensive analysis of historical serious incidences, which aimed to reinforce the Health and Safety Policy and to pursue the objective of 'Zero Harm'.

All employees, business partners and stakeholders had a duty to ensure that the SPR were constantly applied and remained an integral part of work practices and processes. The value statement 'If we cannot mine safely, we will not mine', translated into:

- Responsibility to understand the risks inherent in the task to be performed;
- Responsibility to withdraw from a dangerous situation;
- Required training, resources and personal protective equipment, and
- Required information to enable the employee to mine safely.

The SPR were integrated into the induction processes whereby all employees returning from annual leave, new employees and contractors, were exposed to the SPR, operational safety standards, systems, rules and procedures.

The rules worked hand-in-hand with other initiatives like the 'Stop, Think, Fix, Verify and then Continue' campaign, which had a positive impact on employees' safety behaviour and awareness.

The implementation of the *Safe Production Management Programme* was consolidated into a focus on two critical areas: risk reduction and compliance. This pro-active approach to safety was instrumental in achieving safety performance improvements.

The SPM project assisted to transform the safety mentality of the employees through high quality, two-way engagement. It was vital that the company collectively achieved this transformation, as a significant proportion of serious safety incidents and fatalities continued to result from risky behaviour, non-

compliance with standards or inadequate supervision / leadership rather than factors such as fall of ground.

Safety remained a priority and due to the higher risks posed by the more labour intensive, deep underground operations meant that particular focus was placed on safety management in South Africa. The SPM project was one of the initiatives pursues in the quest for 'Zero Harm' which aimed to achieve a safe mining culture that was in total compliance with the safety standards and procedures, including the Safe Production Rules. A Safety and Health Production Management Task Team monitored safety management and performance (Appendix D, GF 2009).

In 2011 Gold Fields continued to implement a range of activities aimed at cascading the Safe Production philosophy throughout the entire workforce. The SPM project assisted to transform the safety mentality of the employees through high quality, two-way engagement. It was vital that the company collectively achieved this transformation, as a significant proportion of serious safety incidents and fatalities continued to result from risky behaviour, non-compliance with standards or inadequate supervision/ leadership rather than factors such as fall of ground.

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A Safety and Health Production Management Task Team monitored safety management and performance. The committee included two members of the executive committee and was chaired by the Executive Vice President-South Africa region. The Chief Executive Officer also attended the quarterly SPM project meetings (Appendix D, GF 2011).

Gold Fields instituted compliance interventions, which included:

- Implementation of a Priority Safety Disciplinary Case Procedure;
- Increased inspection and audit activity;
- Significant ramp-up in alcohol and drug testing;
- Enhanced Safety Alarm questionnaires to help crews analyse actual safety incidents;
- A Behavioural Safety Programme to encourage safety solidarity between supervisors and crews, and
- A consistent increase in 'Stop and Fix' stoppages by employees which averaged 1 000 per month. It demonstrated the success of the 'Stop, Think, Fix, Verify and Continue' campaign, which was the practical application of the most important value: 'If we cannot mine safely, we will not mine'.

In 2014 Gold Fields remained committed to eradicating residual safety risks by instituting further safety management initiatives. A comprehensive mine-wide review of all safety protocols, procedures and standards was conducted at South Deep in line with the mandate to improve the mechanised mining culture at the project (Appendix D, GF 2014).

4.9.3 Sibanye

In 2012 Sibanye inherited a strong safety culture with good and improving safety performance trends, large high-grade resources, and well-maintained assets from Gold Fields. In combination, these attributes set the scene for a significant turnaround by the focused management team (Appendix E, SIB 2012).

In 2013 safety remained an imperative and Sibanye Gold continued with practices initiated by Gold Fields which included:

- Behaviour based safety initiatives;
- Health and safety agreements with labour;

- Integrated Visible Felt Leadership;
- Mandatory Codes of Practice issued by Department of Mineral Resources (DMR);
- Mine Codes of Practice for rock fall and rock bursts;
- Mine Codes of Practice and standard operating procedures, and
- Safe production rules.

Sibanye's vision was that every employee had the right to a healthy and safe working environment. Its Health and Safety Policy committed Sibanye to conducting activities in a manner that ensured employee health and safety as a priority. The Group's safety strategy required compliance as a minimum, while engineering out safety risks and collaborating with stakeholders, including employee representatives and the DMR, to improve performance (Appendix E, SIB 2013).

In 2014 Sibanye's safety, health and well-being strategy was reviewed and rolled-out across the Group. The company focus was on establishing a safe, production friendly operating environment, through the ongoing implementation of the health and safety strategy and initiatives to reduce risk continues, in the pursuit of 'Zero Harm'.

The company aimed to achieve continuous safety improvement by aligning beliefs and behaviours with the CARE values, including the goal of 'Zero Harm'. Sibanye pursued maximising production responsibly while promoting a safe and healthy operating environment, culture, and upskilling employees at the same time. Managers and employees needed to share goals and engage with teamwork underpinned by motivated and competent teams.

It was Sibanye's objective to have motivated and competent employees so that it could achieve the Group's business and operational goals and make a positive contribution to the quality of life of the employees (Appendix E, SIB 2014). The focus was on:

- Safe, consistent production;
- Eliminating injury;
- Constructive labour relations;
- Attracting, developing and retaining employees;
- Legislative and regulatory compliance, and
- Managing power / electricity.

In 2015 Sibanye believed that the safety and health of employees were essential for an engaged, productive workforce and that healthy employees work safely. In striving for 'Zero Harm' at its operations, Sibanye aimed to eliminate the potential for accidents and injury, and to minimise hazards inherent in the working environment in a practical manner. Sibanye's integrated safety and health strategy included:

- Adherence to operational standards and responsibility;
- Engineering-out risk initiatives;
- Fall-of-ground initiatives and action plans;
- Improvement of employee wellbeing, and
- Application of appropriate technologies, and effective education and training.

Modernisation of mining processes was a means to improve productivity and the safety of employees in the workplace. The development of new technology or innovation would have a substantial impact on Sibanye's ability to create value over time.

Improved mining methods and cycles would allow extraction of maximum value from assets and resources by lowering cut-off grades, decreasing dilution and increasing production rate. The net result would be higher volumes of better-quality product with substantial reductions in injury-frequency rates, facilitated by reduced employee exposure to danger areas.

Sibanye developed partnerships with developers and suppliers as well as memorandums of understanding governing information sharing with counterparts in the mining industry in order to develop fit-for-purpose technology (Appendix E, SIB 2015).

In 2016 an Executive Safety sub-committee was established to ensure that the safety strategy was implemented accordingly and that operations were accountable. The commitment to safety remained firm and the company applied significant resources to improving safety at the operations.

Sibanye management implemented urgent action to address this regression in the safety performance. The executive management, together with senior safety specialists, completely reviewed the Group's safety principles and, following the review, rolled out an extensive safety awareness campaign, elevating safety to a core value in the Group ‘CARES’ values.

A 12-point safety plan was formulated through a series of high-level safety workshops. It included:

Leadership:

- Executive safety leadership;
- Safety leadership structure, and
- Divisional safety structures approved.

Human aspect:

- Safety systems compliance;
- Safety awareness campaigns;
- Training to enhance management capability;
- Focus on safety mind-set and behaviour, and
- Aligned stakeholder approach to enhance safety management.

System:

- Safety risk management regarding ‘A’ hazards, and
- Consolidation of safety systems into combined Sibanye-Stillwater Safety Strategy.

Reactive review:

- CEO review of all fatal accidents, and
- A ‘Zero Harm’ task team was appointed to review serious incidents.

Sibanye continued to strive to achieve the goal of ‘Zero Harm’ in the workplace. The company had a structured, workable plan to achieve this, however, it was essential to create alignment with relevant stakeholders. The safety, health and wellbeing strategy, supported by the CARES values included commitment, accountability, respect, enabling and safety (Appendix E, SIB 2016).

4.9.4 Harmony

The Safety performance was not satisfactory during 2006, which undermined the steady improvements that had been achieved in recent years. Harmony concluded that no immediate trends were identified responsible for this regression. Harmony would continue to aim to improve safety as no accident was acceptable. The Chief Executive Officer gave his personal support to the safety and health programme and would hold managers accountable for safety performance. An immediate high-level response was put in place to address safety and health issues, in particular the behavioural aspects related to safety (Appendix C, HAR 2006).

In 2007 a new safety strategy and philosophy was communicated and implemented and in future focus was a continued emphasis on safety, with the aim of achieving ‘Zero Harm’. The ‘back to basics’ approach and focus on disciplined mining should have management and the workforce concentrating on reversing the downward trend in the production and the upward trend in costs.

Harmony was aware that good management and intensive cost controls would enhance the company's prospects. Productivity improvements were expected from each and every employee throughout the company. It was important to align the company objectives with those of the employees, particularly middle management.

Harmony embarked upon a three-phase, three-component strategy to run to 2012 and beyond. The first phase of the strategy aimed to stabilise the company and its operations. The stabilisation phase was implemented over a five-month period which included the focused implementation of the first component 'Back-to-Basics'. It continued into the early months of the second 18-month Recovery Phase.

The Back-to-Basics component of Harmony's strategy was designed to stabilise and kick-start recovery, comprised four primary objectives, which included disciplined mining, cost control, ore reserve management and efficiency. The drivers of back-to-basics included:

- Non-negotiable safety;
- Operation-specific, target-directed plans, 'owned' by focused management teams;
- Accurate ore reserve management;
- Accelerated development;
- Operational consistency;
- Cost control;
- Increased productivity, and
- Proactive maintenance.

The commitment to 'Zero Harm' initiated at top management, filtering to every level through a deliberate and programmed effort. The company embarked on comprehensive safety auditing. Agreement was reached on key non-negotiable principles, which included:

- Management leading by example;
- Continuous verbal communication with all team members;
- Visible creation of awareness of safety-related issues;
- Recognition of and rewarding for safety achievements, and
- Involving all stakeholders.

Management focused on improving the underground conditions, in particular in areas deemed to be of the highest potential risk such as the shaft infrastructure and the underground workplaces. Management teams were empowered and established small, multi-disciplinary, focused teams for planning and implementing improvements at the operations.

Each management team developed an operational plan to attain the set goals. The Executive Committee did regular reviews of results focused on maximising productivity by structuring of operations so that 60% of the workforce was directly engaged in production mining.

The Back-to-Basics component, which lasted until the end of 2009, became a guiding philosophy for the overall strategy. As Back-to-Basics was bedded down and began to deliver the desired results, the second component of the strategy, known as Organic Growth, was launched.

A +36-month Growth Phase commenced which was planned to extend to June 2012 and beyond. Harmony's organic growth strategy focuses on extracting high-quality ounces and developing and operating the company's long-life mines. As the Organic Growth component of the strategy bedded down and delivered results, the third and final Organic/Acquisition component was initiated (Appendix C, HAR 2007).

In 2008 the company reflected extensively on the Elandsrand incident, which occurred on 3 October 2007 when more than 3 000 people were stranded underground following the fall of a compressed air column into the shaft. Not a

single person was hurt in this incident. There was an unprecedented level of co-operation amongst management, employees, unions and government in getting people out of the mine as quickly and safely as possible and subsequently, much attention was paid to analysing the cause of the incident. The incident's focus on safety was seen as significant by the mining industry, government, unions and others.

Safety enjoyed priority status and there was no room for complacency. Not a single safety accident was acceptable to Harmony. The provision of safe and healthy workplaces as well as the elimination of all workplace injuries remained a key priority for Harmony. There had been a significant amount of attention dedicated to safety initiatives at Harmony during the year. These initiatives were a key part of the company's restructuring and refocusing initiative, and also part of the broader transformation of the workplace.

The emphasis placed on productivity was inclusive of good safety performance and not an add-on. The commitment to zero fatalities reached to every level of the company with a persistent, deliberate and consistent safety awareness effort. Safety was a priority, every day. It was not something considered only after an incident. It was important to celebrate and learn from all of those days, weeks and months that no incidents were experienced.

A significant amount of attention was directed towards safety management, with some positive outcomes being delivered and there was more effective management and control of the operations (Appendix C, HAR 2008).

In 2009 the number of fatalities was of great concern and the company continued its focus to improve safety. There was an improvement in other safety leading indicators. It was believed that the resultant introspection at the operations, together with the continued application of campaigns, particularly in the area of behavioural change, would deliver further improvements in safety in future.

Employee safety and eliminating fatal accidents was a priority for all senior and operational management. Harmony was confident that mining safely without accidents was possible was committed to achieving this. The commitment to zero fatalities was communicated to employees on a regular basis, at every level of the company, with a persistent, deliberate and consistent safety awareness effort.

Substantial progress were made in continuing to boost the depth of management at the operations, particularly in the technical and engineering disciplines. The management team was restructured to have a formidable executive and management team who was experienced, empowered, motivated, focused and cohesive. Several leadership appointments were made that included:

- Executive: Risk Management and Engineering;
- Executive: Legal and Compliance;
- Executive: Environmental Management, and
- Four new General Managers.

The leadership team was personally involved in driving the programme to eliminate accidents in the workplaces, through the adoption of and adherence to standards and changing of a mindset at all levels that accidents in deep level underground mining were inevitable. Overcoming these issues required the partnership and co-operation of management, employees and the regulators.

The safety non-negotiable principles were identified and communicated to management and employees alike. The Chief Executive Officer and operational executives played a significant role in setting safety objectives and in developing safety strategies that continue to focus on:

- Management to lead by example;
- Continuous verbal communication with all team members;
- Reward and recognition of safety achievements;
- Involvement of all stakeholders;
- Compliance with standards and the auditing thereof;

- Behaviour-based campaigns and initiatives, and
- In-situ training, particularly in hazard identification and risk assessment.

Harmony started to reap the rewards of the first, 'back-to-basics' component of the strategy. Internal and external benchmarking were bedded down and was starting to deliver on expectations.

The three-phase, three-component strategy served Harmony in good stead. This was particularly encouraging, considering the changes beyond the company's influence that continued to take place in the South African mining sector and the national and global economies (Appendix C, HAR 2009).

In 2010 every fatality was one fatality too many. Harmony remained determined in their efforts to continuously improve safety standards and records, and the target of zero fatalities remained steadfast. Every effort was made to ensure that stringent safety procedures were implemented at all operations and that adherence to these procedures was so ingrained as to become second nature to every employee. Despite the fatalities experienced, there was a glimmer of hope in that many of the leading safety indicators were moving in the right direction.

Harmony was committed to working safely. Ensuring the safety, health and well-being of the employees was a primary area of focus for Harmony and continued to strive for zero fatalities. Active steps were taken to ensure that the only acceptable production was safe production.

In August 2010 the New Harmony strategy was unveiled. Harmony's plans were clear and had confidence that targets would be achieved regarding:

- Improving productivity;
- Commissioning projects;
- Increasing production, and
- Undertaking successful exploration.

Each shaft had its own business plan in place, designed in accordance with its own specific requirements. Together they provided a firm handle on the business, with the ability to address and pro-actively overcome challenges that may arise.

The Harmony Executives and management teams held a Health and Safety Strategic workshop with employee participation. Various safety aspects were identified which were to be implemented in 2011 which included:

- Fall of ground prevention;
- Trucks and tramming;
- Occupational health and hygiene;
- Metallurgical plants, and
- Environmental management/occupational health and safety management systems.

Safety management and performance targets were set in compliance with Harmony's 2013 safety milestones and were included in the performance parameters at each operation (Appendix C, HAR 2010).

In 2011 the South African mining industry continued to improve its safety performance as evidenced by a further decline in the industry number of fatalities. In the past decade, fatalities declined by almost 40% despite working at greater operational depths. This commendable progress reflected the commitment of all stakeholders to mine safely. There was a long way to go before reaching the stated goal of an injury-free workplace.

Safety was the main priority no matter what the circumstances were. The ultimate target was to have zero fatalities and to significantly reduce injuries. The safety and health of all employees remained Harmony's foremost priority and the target was an injury-free workplace. Harmony would not rest until it reached the goal of zero fatalities. Each death was one too many. Safe behaviour was required in everything that was done. 'Zero Harm, zero accidents, zero fatalities.'

Given the high-risk nature of many of the deep level operations, the safety, health and well-being of the employees was the foremost priority. Safety was a key performance indicator for management and a key component of performance reward for the employees. The workforce comprised the people whose skills underpinned the success of every operation and the sustainability as an industry. The sustainability of the company and the mining sector as a whole depended on the skills and expertise of the workforce.

An experienced Executive was appointed to spearhead the safety strategy, using an analytical approach to address critical issues. The company continued with the identified specific safety aspects for implementation and aimed for systemic improvement that would blend behaviour-based metrics with operational controls. The elimination of accidents could be achieved by managing risk and ensuring appropriate structures, systems and training were in place. Lessons learned were shared throughout the company.

The approach to safety was comprehensive and included training, auditing, communication, specific management interventions and programmes, and ongoing campaigns. Harmony perceived that implementing world-class safety systems/standards was a straightforward task and that safety was more about attitude than equipment.

It was the company's view that investigations proved the impact of a casual error on the most sophisticated systems. Managers were required to remain responsible for minimising human error by ensuring people were well trained, in good health and working in environments conducive to safe practices.

Harmony focused on transforming the values-based safety approach from being reactive to proactive. A leading global risk management solutions provider on safety, health, environment and quality conducted a number of audits to establish the reasons behind the notable safety improvements made recently and the increased focus on safety. A project plan was developed to rectify identified shortcomings and move Harmony from a reactive to a proactive approach.

Harmony believed that safety in the workplace could be addressed only through a cooperative approach that ensured the right infrastructure was in place. Safety was about attitudes and mindsets. Harmony renewed the focus on implementing, communicating and reinforcing safety in the workplace (Appendix C, HAR 2011).

In 2012 the 'New Harmony' values and would guide the performance in future and the company was well-positioned to deliver on its strategy of creating a global gold mining and exploration company. This included:

- Leading in safety, health and environmental responsibilities;
- Making a meaningful contribution to a sustainable society;
- Operational excellence;
- Committed workforce;
- Investing in people through education, training and community upliftment;
- Living the values.;
- Company-changing exploration;
- Building world-class mines;
- Growing relationships, leadership, gold production, reserves and profits, and
- Committed to measure up and deliver.

Harmony concentrated on embedding sustainable development practices in the business strategy, understanding that Corporate citizenship was both a moral responsibility and a condition of mining licenses. This duty rested on the link between profitability and sustainability.

Sustainable development was integrated into organisational business processes and practices as part of the way business was conducted. The Harmony leadership approach embedded the culture and values through management systems, which included group standards for safety, standardized processes and definitions.

The cornerstone of Harmony's global expansion was integrating sustainable development into the business strategy, and good practice into the operating standards. The marketplace measured Harmony against robust world-class standards.

Harmony has recorded notable successes in recent years in realising the vision of 'Zero Harm' to people and the environment while enabling and empowering the societies within which operations were conducted. The aforementioned was guided by the sustainable development vision.

The safety strategic approach was that production lost would not be recovered at the expense of safety. The eliminating of accidents by managing risk and ensuring the appropriate structures, systems and training are in place. It was a priority for Harmony to provide safe and healthy workplaces, and to focus on the elimination of workplace injuries and work-related ill health. The objective was to eliminate all work-related injuries and illness.

The safety strategy included behavioural aspects, competency training and development as well as research and new technologies. It was believed that safety in the workplace could only be addressed through a cooperative approach that ensured that the right infrastructure was in place, systems and planning as well as communication and training.

Management and employees accepted joint responsibility for their actions. It was therefore imperative that the working environment empowered people, management, supervisors, workers and union representatives to stop work and withdraw from the mining area when they feel it is unsafe or prevent others from acting in an unsafe way.

Each operation was monitored monthly using a formal review system, while major safety issues were reviewed annually during the health and safety workshop. Harmony adopted a journey model as part of the long-term strategy to achieve 'Zero Harm'. The objective was to improve Harmony's health and safety

management systems to a fully proactive level of maturity through the revised approach to safety.

The company ensured that management led by example and created the enabling environment for driving continuous improvement. High safety exposures were managed through focused strategies, including fall-of-ground, and trucks and tramming activities. A behavioural shift was affected to make safety foremost among the people, both on and off the job (Appendix C, HAR 2012).

In 2013 Harmony revised the occupational health and safety strategy to focus on ensuring the foundation for a healthy and safe environment was in place. It recognised the importance of leadership and employee attitudes towards health and safety. The strategy and focus areas to achieve a culture where health and safety was the first priority and 'Zero Harm' the goal. The foundation of the strategy was the basics and stemmed from an in-depth understanding of the operational health and safety risks at every Harmony site. Risks were controlled through:

- Mine design and planning processes;
- Implementing standards, codes of practice and procedures;
- Ensure standards were effectively implemented, employees undergone skills training and workplace competency assessments, and
- Underground supervision and audits ensured these standards were firmly in place.

Harmony instituted a focused and multifaceted drive to catapult Harmony from a reactive to proactive approach by improving the safety culture across all operations. Elements of this approach included:

- High-level internal health and safety reviews;
- Adopting leading health and safety practices;
- Improving the Harmony safety risk management system;

- Integrating proactive key performance measures in incentive schemes;
- Continuously improving standards and procedures;
- Implementation of e-learning to improve safety-related training;
- Harmony culture alignment programme was implemented, and
- Integrating safety management standards and safety culture initiatives to function as a single strategy.

The results of a significant change in this approach towards safety were evident however, there was still some way to go in closing the gap between the safety performance, the 2013 industry milestones and the goal of 'Zero Harm'.

Harmony's improved safety performance reflected both the effectiveness of the revised approach and commitment to achieving the safety goals. It was believed that focusing on leading indicators would result in a better safety environment supporting the policy of 'Zero Harm'. Safety was about attitudes and mindsets and the focus was on implementing, communicating and reinforcing safety in the workplace (Appendix C, HAR 2013).

In 2014 Harmony lived its values and it guided actions to ensure the achievements of the strategic goals. The values were ingrained in training initiatives and decision-making processes, ensuring that they were at the forefront of employees' minds and actions.

The values extended beyond Harmony's gates as it guided interaction with external stakeholders, from shareholders and the media to local communities and those from which the employees were drawn. It was expected that through a commitment to the values Harmony could be a company which people wanted to be associated with and would generate shared values into the future.

Harmony understood that long-term value was about more than the gold produced and the profits made. These were fundamental to the ability to create value in the

broadest sense, but the value was better reflected in the impact that was made on the lives of people, then and in the future.

Safety was viewed as an opportunity to engage with many key stakeholders, particularly the employees and to entrench values. It was integral to the sustainability of the business and featured in Harmony's values, material issues and the strategy. Additionally, it helped foster relationship with employees, maintain stable production and retain the licence to operate.

It was appreciated that deep level mining brought with it inherent safety risks and therefore safety was prioritised primarily to protect the people, who were at the centre of all that was done at Harmony.

Safety had an effect on the employees' mindsets, productivity and it also had the potential to impact the reputation, stop production, lead to litigation and decrease the overall value of Harmony.

Harmony has made great strides in safety over the last few years but there was always more to do. A number of 'daily' adjustments were made to improve safety performance at the mines. These included:

- Regular underground visits by the executive management;
- Clearly defining leading safety practices at all operations;
- Holding regular safety meetings at all levels;
- Increasing safety messaging and training, and
- Doing a baseline risk assessment.

The people were the cornerstone of the business, making their safety central to what was done, was one of the company values working towards 'Zero Harm' was to be continued. Harmony was seeking the most effective ways of keeping the employees safe at work and was in the process of embedding proactive management with a particular focus on empowering the leaders to speak of safety as the first priority at Harmony.

External professionals reviewed the Harmony Health and Safety strategy to ensure it was on the right track. Harmony's strategy was to be a globally competitive gold mining company that delivered true long-term benefits to a broad range of stakeholders. A continuous improvement in safety and health was a primary overriding imperative, and crucial to the ability to care for people and optimise the operations. It was important for the company to have experienced, skilled teams who lived the values and maintained stakeholder relationships in order to achieve and maintain a sustainable company.

The internal environment was shaped largely by factors which had an impact on the employees or on which the employees had an impact. These included the environment, processes of mining, and the behaviour of people. These brought with them certain risks to the employees, which was to be avoided, mitigated or managed.

Although Harmony achieved significant safety improvements the company remained committed to further improvement in keeping the employees safe and healthy. Emphasis on open communication allowed Harmony to understand any emerging issues and to deal with it before it escalated (Appendix C, HAR 2014).

In 2015 Sustainable Development was woven into the way business was done at Harmony. The company worked to leave lasting legacies, tangible impacts that extend beyond the lives of the mines and that were aligned with the legitimate expectations of the stakeholders.

Harmony lived its values, which were safety, being accountable, achievement and being connected and honest. These were the compass points for actions, ensuring that, in addition to achieving the strategic goals, Harmony aimed to make the right decisions and support the members of the teams in doing so.

These values were ingrained in the training initiatives and decision-making processes, ensuring that it was at the front of employees' minds and actions. The values extend beyond the operation's gates.

The safety strategy was divided into short, medium and long-term components. The short-term strategy comprised visible felt leadership, communication and report reviews. The medium-term strategy involved the implementation of the fatal risk management system, whereas the long-term strategy focused on industry leading practices, which included:

- Separating the employee from the risk or hazard through more extensive barrier controls;
- Focusing on embedding a safety-conscious culture;
- Ensuring that people are committed to the values, and
- Sharing of information and the adoption of best proven pro-active safety measures (Appendix C, HAR 2015).

In 2016 Harmony intensified the focus on safety through the appointment of a Chief Operations Officer, a former Regional General Manager, with specific responsibility for, among other aspects, safety who would:

- Refine the safety strategy to institutionalise risk management;
- Promote a culture of continuous improvement;
- Create genuine care for safety whilst providing safety leadership;
- Visit different mining houses and companies to investigate best practice in safety and health strategies and structures, and
- Be responsible for adopting and implementing world best practice in safety and health strategies.

Senior engineering capacity and safety management were enhanced in order to combat and prevent infrastructure and equipment failures (Appendix C, HAR 2016).

4.9.5 Lonmin

In 2010 Lonmin developed a new Integrated Safety Strategy reflecting a shift to a more proactive approach. The strategy focused on lead-indicators and emphasised

proactive behaviour. It replaced the Business Area Safety Strategies that was in place up to then. The new strategy was built on a foundation of effective systems, enablers, strong values and a clear understanding of the business risks. The strategy had three safety pillars, which were fatality prevention, injury prevention and a safety culture change.

The new strategy development process examined the level of compliance to the existing policies, standards and protocols at different areas within the company. This was followed by an assessment of the maturity for specific areas. the capacity to mitigate safety risks and compliance with regulations for the respective area.

The implementation was based on the outcomes of this assessment, which changed appropriately for the identified gaps in maturity. The new approach was characterised by more robust data collection and risk identification, greater integration and a stronger level of buy-in across the Lonmin.

There was increased focus to improved safety in six areas and tactical measures for each area were rolled out across the business and the individual elements were driven down through the organisation. The focus areas included mindset, culture, safety leadership, governance, risk assessment management, and compliance.

The integration of the Safety Strategy, objectives and targets was implemented throughout the organisation. The company improved the procedures for compiling safety data (Appendix F, LON 2010).

In 2011 the company reviewed and refocused the safety strategy. One of the initiatives was that the Chief Executive Officer and a number of managers spent time with DuPont, a company world renowned for being at the leading edge of sustainability good practice, to inculcate safety into the core values of the Lonmin's management team.

Lonmin held a Safety Summit leading up to the company's participation in the National Safety Summit in July 2011, which was supported by the Department of Mineral Resources as well as many trade unions. At the summit the Chief Executive Officer recommitted Lonmin to zero tolerance towards fatalities and the value of 'Zero Harm' to employees.

An outcome of the summit was to establish representative task teams with a primary focus to address different safety issues and enhance the effective implementation of the strategy. Regular feedback was to be given to the Summit Controlling Committee (Appendix F, LON 2011).

In 2012 the hierarchy of safety management included:

- The Lonmin Charter, which outlined the vision and values of the company and governed safety management at a high level;
- Training of Line Management on core principles and development of their safety knowledge;
- The company wide Integrated Safety Strategy with three Pillars: fatality prevention, injury prevention and safety production culture, with four enablers: leadership, simple systems, enabling environment and a culture of safety;
- The Safety and Sustainable Development Policy, which outlined the policy commitments to the health and safety values;
- Fifteen Lonmin Sustainable Development Standards supported by protocols and Fatal Risk Control Protocols, which provided a risk-based management framework, continual improvement and alignment with best practice;
- Auditing of the implementation of the Safety Strategy by the Group Safety Department;
- Safety structures and staffing to conduct legal compliance inspections and audits, and

- Implementation of the industry tripartite action plan on health and safety, including the roll out of the National Safety's Summit commitments.

Tactical teams were established for Leadership, Simple Systems, Enabling Environment and Safe Production Culture, to facilitate and manage certain projects and initiatives to generate and maintain momentum within the safety programme. The projects and initiatives from these teams were intertwined within the 15 Lonmin sustainable development standards (Appendix F, LON 2012).

In 2013 improvements in safety became more and more difficult. The company approach was that initially systems, protective equipment and working practices were evaluated whereafter a culture of safe working was designed and implemented. However, safety increasingly rested on the behaviours and mindsets of individuals, which was a much harder thing to change.

The company believed that keeping people safe was a team effort and that good working relationships led to good working practices. The continual empowerment of employees to exercise their right to withdraw from unsafe work areas was encouraged. These incidents were reported and analysed weekly to address shortcomings and drive improvement.

Safety for Lonmin did not end at the gate to a mine. The company continued to work with employees, Non-Governmental Organisations and authorities to address concerns about crime, stress and substance abuse away from work.

Five major projects were explored with the employee, union and community partners and other key stakeholders, seeking to find fundamentally new and more sustainable ways of working. The initiatives included:

- Employee relations and engagement;
- Empowerment and equity participation;
- Exploring alternatives to migrant labour and improved working arrangements;

- Better use of existing invested capital and infrastructure, and
- Living conditions including sustainable housing and human settlements.

The safety strategy rested on three pillars: fatality prevention, injury prevention, and safe production. Within each of these pillars the strategy focused on leadership, simplifying systems, creating an enabling environment and creating a safety-conscious culture.

It was believed that a leader makes safety personal and the company strengthened the leaders so as to help them better relate to their teams, and to build stronger relationships between team members.

Lonmin educated and empowered employees regarding the importance of knowing their right to withdraw from an unsafe working area. Internal stoppages regarding assessing the safety of an area were mainly focused on the Life Rules:

- Early entry examinations;
- Support installation and geological features;
- Explosives control;
- Winches and rigging, and
- Trucks and tramming.

The company invested in specific initiatives that aimed to provide leaders and teams with the necessary skills to improve levels of quality, operations, cost, people, and safety by translating the business strategy into measurable targets for each team.

It was driven through an ongoing approach called Line of Sight. This programme created an environment in which objectives were visually presented on charts in various work areas or waiting places. It promoted continuous improvement as well as the establishment a culture of teamwork, participation and recognition.

The safety initiatives were guided by the Safety and Sustainable Development Policy, Fatal Risk Control Protocols and the Lonmin Sustainable Development Standards. These Standards provided a risk-based management framework for company-wide safety management, in line with the strategy of working towards improving safety and striving for best practice (Appendix F, LON 2013).

In 2014 Lonmin embarked on a campaign of renewal to unite the internal forces by aligning individual employee success through a shared value structure with that of the company. It was driven by the Chief Executive Officer under the banner ‘We dig to improve lives’.

The Lonmin 2009 safety strategy was strengthened in 2013 incorporating the overarching slogan and vision: ‘Zero Harm to everyone, everywhere, every day.’ The company reviewed the safety strategy on an annual basis in line with the overall business strategy to identify strengths, risks and opportunities to improve. The overarching frameworks under which the company operated were the Safety and Sustainable Development Policy, Sustainable Development Standards and the Fatal Risk Control Protocols.

A transformed culture was embarked upon to reach a high level of safety awareness driven by the employees to entrench safe behaviour in the operational DNA. A significant challenge is that the workforce was at different stages of safety awareness and independence. The safety plans needed to be appropriate for these audiences. To transform and empower the workforce the company would continue with safety training and create awareness that any employee or contractor had the right to withdraw from any unsafe work area. This had, and would, reinforce the belief that the underlying enabler was a transformed culture, which would drive Lonmin towards ‘Zero Harm’. Focus was placed on leadership in order to develop strong leaders supported by safety professionals to lead the workforce in the right decision making and behaviour.

Safety training formed part of the employee and contractor induction. Lonmin's objective was that every individual in the business had a personal understanding

of and respect for the importance of safety in the workplace. Entrenching safety principles in the organisation and increasing visibility on safety matters achieved this.

Lonmin aimed to empower its managers, supervisors and team leaders to play a direct and integral role in the functioning of the workforce through the promotion of Visible Felt Leadership. This approach positioned the leader as an agent of change who led by example and not by power, and who had a personal commitment with each member of the team to collectively enable a safe and transformed environment in the workplace. Simple fit for purpose systems were invested in that would record real-time information for trend analysis and incident prevention.

Lonmin had an internal audit programme in place for the 15 Lonmin Sustainable Development Standards to improve the safety governance practices. The audit programme continued and the operations completed self-assessments to evaluate their compliance and implementation of the standards. Externally, Lonmin obtained OHSAS 18001 certification at all processing plants. An enabling environment was created to understand risks and optimise control and management, moving beyond compliance to an environment of excellence (Appendix F, LON 2014).

In 2015 the company developed an updated and focused safety improvement plan to curb the increase in Lost Time Injuries and high-potential incidents. The day-to-day safety was complemented by 90-day safety turnaround action plans that were introduced this year to address the increase in injuries at the operations. Progress on these was reported to the Chief Executive Officer on a monthly basis and these plans were continuously adapted to new hazards or emerging trends.

The company introduced incident review meetings and recall meetings, chaired by the Chief Operating Officer, to discuss and learn from potentially severe incidents and to discuss the lessons learnt from incidents that have occurred. The

implementation of these learnings was tracked and reported monthly (Appendix F, LON 2015).

In 2016 the company was determined to better the overall safety performance and further enhanced the focus on safety improvements. It was believed that ‘Zero Harm’ was realistic and achievable.

A collaborative Tripartite Safety Day was held in July 2016, incorporating the key stakeholders including the DMR and AMCU in continued efforts to prioritise the improving of the safety performance. The Chief Executive Officer, supported by the President of AMCU and the Principal Inspector of Mines for the Rustenburg region, reiterated the focus on safety to employees.

Lonmin aimed to provide a safe working environment for all employees, contractors and the communities the company operated in. The company was determined to continuously improve the overall safety performance. The safety strategy was centred on the belief that ‘Zero Harm’ was possible.

The goal was for every person in the business to have a personal understanding of, and respect for the importance of safety in the workplace through entrenching safety principles, increasing visibility on fatality and injury prevention and encouraging a safe high-performance culture.

‘Zero Harm’ could be achieved if the risks that led to serious or fatal accidents were managed consistently. This was done through sustaining operational excellence, caring for people and demonstrating good corporate citizenship. Lonmin viewed safety as a proxy for good performance.

The company needed to reach production targets to sustain the company and families, but safety always came first. The company ensured that the necessary controls and procedures were in place to support the safety and health of the workforce as it was a critical element of the business strategy.

Safety Improvement Plans were implemented with an enhanced focus on accident analysis and pro-active preventive measures. Visible Felt Leadership (VFL) as a pro-active measure was accelerated. VFL was senior management being visible in the operational areas confirming that safety was a core belief and showed passion to work safely.

Achieving safety goals was an integral aspect of demonstrating operational excellence and the safety strategy was built around the belief that company can operate without accidents. The safety strategy focused on proactive safety management to entrench a culture that influenced safe behaviour (Appendix F, LON 2016).

4.9.6 Implats

In 2006 a safety leadership summit was held at which there was group-wide commitment to a policy of 'Zero Harm'. A new safety target was set of a Lost Time Injury Frequency Rate of zero at Impala within five years.

It was envisaged that the plateau reached in terms of constant improvements would be breached and that the renewed efforts would continue to drive the company towards the long-term goal of zero injuries. The need for ever-increasing vigilance regarding safety became paramount as mining operations at Impala deepen with the move to third generation shafts where more difficult ground conditions were being encountered.

Implats improved the understanding of rock engineering and support systems in order to reduce injuries caused by falls of ground. The company increased emphasis on behaviour-based safety training and the setting of more stringent targets (Appendix G, IMP 2006).

In 2007 it was of particular concern to the group that the significant progress made in recent years in improving safety performance was not maintained and the specific targets set were not met. Intensive efforts were made to address safety

performance, and these included the re-introduction of a strata control course to improve employees' knowledge of geological features (Appendix G, IMP 2007).

In 2009 Implats changed the group's management structure to focus on four strategic imperatives of the business, namely:

- Operations, which included all existing mining, processing and refining operations of the group, as well as including the management of safety, health and the environment;
- Growth, which included marketing, new business and projects, exploration, mineral resource management, commercial ventures and business opportunities, and technical services;
- People, which included talent and reward management, employee relations, stakeholder engagements and sustainable development, and
- Finance, which included financial management, services, legal and secretarial.

This approach was developed so as to ensure that the appropriate level of focus and resources was targeted and available to ensure the achievement of distinct goals, and to enable the group to react swiftly and decisively to any changes in the external environment that may have an impact on the company (Appendix G, IMP 2009).

In 2010 the safety strategy was refined as it was identified as one of the sustainable development issues as most material in ensuring the sustainability of the business. It was to ensure a world-class safety environment in order to realise the vision of becoming the world's best platinum-producing company. The safety performance had a direct impact on production performance and the overall business.

The DuPont safety review reflected that the Group needed to adjust its approach to safety, so as to recognise that it operated in a 'dependency' culture and a more active and direct enforcement of adherence to the important platinum safety rules

was needed. The safety culture of all employees needed to change for Implats to achieve its safety goal (Appendix G, IMP 2010).

In 2011 safety was the number one priority for the Group and remained committed to achieving 'Zero Harm' in the workplace. Implats was committed to the vision of 'Zero Harm' within the work environment. Ensuring the safety and health of the employees and promoting their overall wellbeing was a key strategic objective for the Group. It was believed that it was possible to mine safely, and this philosophy of 'Zero Harm' underpinned the approach.

There were significant improvements in safety over the years, but safety would remain a key challenge for the mining industry. The industry as a whole had to do more in order to attain world-class standards and performance and better co-operation between industry, the unions and government would go a long way in achieving this. It was believed that this tripartite alliance would play a pivotal role in improving safety performance across the industry.

Several initiatives were undertaken during the year that resulted in a refocus of the safety strategy. The safety strategy continued to focus on leadership development with the aim of creating a culture of compliance and a belief that it was possible to mine without fatalities.

The company continued to change the behaviour of employees by using the monitoring and measuring of lead indicators to enforce full compliance with rules and fostering a culture of zero tolerance for unsafe behaviour.

An integral part of the Group strategy to ensure long-term business sustainability involved a productive workforce. This was done by:

- Understanding the business requirements and strategic challenges;
- Have an effective attraction and skills retention mechanism, particularly of critical skills;
- Manage employee health effectively;

- Provide training and development at all levels particularly at leadership and critical skills level;
- Ensure that the reward and remuneration system was in line with market-related trends, and
- Provide career progression opportunities to employees.

The People strategy focused on:

- Improving employee wellness and technical core skills;
- Increasing expenditure on skills development;
- Improving employee literacy and education, and
- Retaining and developing high performers.

Following on the DuPont assessment, the strategy was aimed at changing the safety culture and ensuring that the appropriate supervisory structures and skills were in place to encourage and support this objective of closing the supervisory gap (Appendix G, IMP 2011).

In 2012 Implats joined the Chamber of Mines as a member. The Group remained focused on a strategy to develop safe and effective people. It was to be achieved by:

- Promoting employee safety and health;
- Creating and sustaining mutually beneficial relations with employees, and
- Attracting, retaining and developing talent and skills.

Policies and procedures on people management issues were established at corporate level and apply at the operations. This was done in order to ensure the continuous development of the employees, in line with business demands, while at the same time offering career progression opportunities with particular emphasis on the historically disadvantaged.

Each operation had a Transformation Committee made up of representatives drawn from management, employee unions, women and people with disabilities, as well as other stakeholder groupings that was engaged with to advance transformation at each operation. Future commitments for achieving safe and effective people included strong focus on cultural transformation for safety and closing the supervision gap.

A commitment to a culture of health and safety was the single most important factor and was central to the future of mine health and safety within the Group. A number of very significant, potentially very beneficial, new safety initiatives were implemented at a sector level and within Implats. It included the introduction of new policies and the development and implementation of a new cultural transformation framework.

The company strived to implement the outcomes of the 2011 DuPont safety intervention and foster an enhanced culture of safety, however, the performance showed that much work remained. A zero-harm working environment could only be achieved if all parties involved in the production processes, including suppliers and contractors as well as the employees and management, buy into a shared safety culture and live that culture every day.

Several safety initiatives were embarked upon during 2013 (Appendix G, IMP 2012) which included:

- Planned to equip all underground employees with self-contained self-rescuers, which were purchased, for a full roll-out during 2014;
- The entire centralised blasting system was to be replaced over a two-year period as it offered much-improved levels of safety and reliability over the current blasting operations;
- The replacement of all of its conveyor belts with retardant conveyor belts was to be implemented in 2014, and

- A revised methane management plan and associated initiatives was developed to cater for increased flammable gas intersections being encountered on some of the deeper shafts at Impala.

In 2014 Implats aimed to improve workplace safety by building on changing the culture of the organisation, improving the supervision, and adopting and implementing various technical initiatives. The company prioritised several strategic objectives and focus areas. Implats would further develop leading indicators.

A three-day safety summit was held in December 2014 for all Impala's mining and processing safety representatives. The summit was called following the five fatal accidents that occurred shortly after the commencement of work following the five-month strike. Over 600 safety representatives attended the three-day summit, during which good progress was made on the following issues:

- Identified the critical safe behaviours for the top critical mining and processing risk occupations;
- Agreed to develop a system to formalise the 'Section 23' withdrawals by safety representatives;
- Introduced a 'Buddy Barring' system, involving the second-person observation of the barring process, and
- Highlighted the concern that safety representatives were not being adequately recognised or rewarded for their duties and responsibilities.

These four groupings of issues were further reviewed and included within a subsequent implementation plan (Appendix G, IMP 2014).

In 2015 while encouraged by some of the significant improvements in the safety performance, the loss of life remained unacceptable. The improvements in safety performance was underpinned by the effective implementation of the safety recognition agreement with AMCU at Impala Rustenburg and Marula, which laid

out the agreed responsibilities for management and union representatives on safety issues.

The CEO was determined to see a further step change in the safety performance and was fully committed to achieving the goal of zero fatalities. The safety strategy was built on changing the culture of the organisation, improving supervision, and adopting and implementing various technical initiatives to improve workplace safety.

Implats continued to prioritise several strategic objectives and focus areas for safety (Appendix G, IMP 2015), which included:

- The company would continue to pursue interactions with senior union leadership to gain commitment for safety initiatives in order to normalise employee relations;
- It would promote the enhanced safety culture through leadership, using the Chamber of Mines Five Pillar Cultural Transformation Framework (CTF);
- Use opportunities presented through the revised health and safety agreement with all employee representative groups, to engage more effectively with employees in promoting the right safety culture, and
- Focus to increase supervision and leadership skills and implement best practice technical initiatives in order to mitigate safety risks in the workplace.

The safety targets were:

- The target was zero fatalities across all of the operations;
- In striving for zero fatalities and ‘Zero Harm’, Implats would continue to focus on ensuring that all operations had behaviour-based safety programmes in place;
- Each operation was expected to achieve at least a 20% improvement in their LTIFR performance in support of the MHSC safety milestones, and

- Strived to achieve 100% compliance with road behaviour, platinum rules and disciplinary action for non-compliance, to these rules.

In 2016 the strategy was informed by external and internal reviews of the safety systems and culture and by a continual analysis of the root causes of all fatal, reportable and lost-time incidents. The safety strategy strived to foster a culture of safety and achieve the vision of 'Zero Harm'. It was about ensuring that the company had the right skills, teamwork, intelligence, knowledge, motivation, attitudes and abilities to achieve 'Zero Harm' (Appendix G, IMP 2016).

In 2017, Implats safety strategy was focused to promote a culture shift and mitigate safety risks in the workplace. The following key interventions were planned for 2017:

- Conduct a further 360-degree safety survey of all E level managers and further ZIP safety leadership self-assessments among D and E level leaders every six months;
- Enhance the Section 22/23 withdrawals process with formalised and systematic recording and reporting;
- Include in all injury investigations an analysis to determine whether any human failure factors were unintentional or intentional. where applicable, enforce disciplinary action as required by the human failure guide;
- Continue to analyse data sets to identify employees at high risk of having a safety incident, monitor and seek to mitigate the level of risk;
- Enhance the knowledge and competence of the employees, including providing special training for users of new equipment and communicating and providing training on a revised set of safe production rules;
- Entrench the critical safe behaviours that were rolled out to the five critical occupations, through safety representative and supervisory monitoring interventions;

- Develop critical controls to prevent any of the following unwanted events: conveyor fires, major fall-of-ground collapses, a tailings dam run out, methane explosion, and rolling stock falling down a shaft;
- Continue to implement best practice technical initiatives and assess new technological advances to determine their appropriateness, and
- Continue to pursue interactions with senior union leadership to gain commitment for safety initiatives.

The target was zero fatalities across all operations. Each operation was expected to achieve at least a 20% year-on-year improvement in their LTIFR performance in support of the MHSC safety milestones. The company aimed to certify all operations to the OHSAS 18001(ISO 45 001) standard by 2018 (Appendix G, IMP 2016).

4.10 Conclusion

To mine or not to mine is the question when ‘Zero Harm’ is not negotiable? Is mining like a painting that is not quite finished or is it like a puzzle that has got a piece missing? Whatever the view, it is business in progress as the work is not quite done yet. The South African mining industry at large has been trying to resolve this illusive solution since the promulgation of the Mine Health and Safety Act in 1996. It has never been acceptable to kill somebody in the course of their work. Society’s expectations and the mining industry’s response has got closer over time but the mutual vision of ‘Zero Harm’ has still not been reached as yet.

Will ‘Zero Harm’ ultimately be achieved? Probably not as mining is inherently dangerous, and people make mistakes. The focus of the mining industry is to make mining safer and for people to make less mistakes. The decision to mine at all brings about a context that needs to be dealt with. How to mine, in the broader sense, dictates largely the potential outcome. This outcome is fine-tuned by the interface between humans, machinery and the environment created.

In the South African mining industry, there are a significant number of elements that creates the context within which miners are expected to operate. The safest mining is no mining at all, but it is not an option for a developing country like South Africa. There is a direct relationship between energy used and the potential consequences of it used in a positive or negative manner. In mining the amount of energy used is invariably significant to turn locked in ore reserves ultimately into money.

Mining is not a steady state operation and is very dynamic as the layout and environmental conditions constantly change. It is therefore an abnormal normal. When risk controls are formulated for a broad range of possible eventualities it is perceived that the residual risk will be within the risk tolerances. It is possible that an individual could find him or herself in a situation where there is no ready-made solution available and that an on the spot solution needs to be made to deal adequately with the risk at hand.

Danger is real, but it is the individual's interpretation of the perceived future residual risk that will determine his or her actions. If the outcome is misinterpreted and the risk mitigation is inappropriate, the incident can result in harm. It is for this reason that a significant amount of technical training is imparted to the individual as an enabler to envisage potential solutions. This training is augmented by behavioural safety training to equip the individual with the necessary emotional intelligence to make informed decisions to avoid harm.

Fatalities will not occur if the risk controls are in place, were adequate and actually applied as intended. However, having Zero Fatalities is possible for a limited period in a specific environment. So, if one considers the 73 fatalities that occurred in the South African mining industry during 2016, how many of the fatalities are due to inadequate controls in place? If some of the generalities that was bandied about by the individual companies are used then 70-80% of accidents were due to human behaviour, it refers to the behaviour of the individual that are

injured. It means that the risk controls were in place but not adequately applied which resulted in harm.

The converse must then be true that 20-30% of incidents have inadequate risk controls in place, designed by the company leadership. That being the case, is this oversight due to mistake or is it a violation? Ignorance is bliss, but unacceptable in mining. If mining takes place in seismic areas, as an example, and the industry acknowledges that further research is necessary to manage the risks better, it means that inadequate knowledge is currently available. If mining in seismic areas is continued with in the meantime, it is done knowingly that the controls in place are probably not adequate. This in turn becomes a moral debate and no longer a technical debate. If mining with inadequate controls is continued with it is a management behavioural violation as they know that they don't know.

When risk controls are devised it is envisaged that when it is perfectly applied, the residual risk will be acceptable. The tolerance for non-adherence of the control requirements is minimal in the instances where potential energy to which individual is exposed is beyond human tolerance. The unintended release of energy where an individual could potentially be exposed to invariably does not fail to safe, as would normally be the case with electricity that has a trip switch. The unintended release of energy such as a fall of rock, blasting, fall from height, in the way of equipment, misuse of energy normally exceeds human tolerance and results in harm.

The mining method, taking into consideration the inherent characteristics of the orebody, is the singular most important predictor of the safety outcomes as everybody working in the resultant environment will be exposed to the risks created by design. The residual risk is the interface by the individual to this environment by a prescribed working methodology using prescribed equipment. The onus of ensuring that this interface can conceptually be safe rests with the company's leadership to determine policies that will create an enabling environment to achieve the lowest possible anticipated residual risk. It is only by

the perfect application of this strategic intent that the real residual risk will equate to the planned residual risk.

The company leadership invariably will cater for the eventuality that the strategic intent will not always be executed perfectly. This resultant gap is where incidents occur that can cause harm. Paper solutions are patient, but the reality is that the mining environment is dynamic, and conditions changes continuously. People are exposed to the real environment and will have to take these dynamics into consideration to make informed decisions on the spot. The result of these decisions will determine whether 'Zero Harm' is achieved, or not. The perfect human being has not been found as yet and the rest of society is still fallible and has the potential to make mistakes.

There is no single answer to achieve 'Zero Harm' as the overall efforts necessary to ensure that the residual risks created by deep level, hard rock mining is enormous and complicated. Continuous improvement is required in order to move closer to achieving 'Zero Harm'.

The South African mining companies have introduced significant efforts to reduce the residual risks. The concept of 'Zero Harm' is demanded by the society and are shared by the mining industry. The mining industry has renewed their efforts to apply known solutions better in the prevailing circumstances. They have also stopped certain practices and introduced new ones. This has resulted in improved safety results. However, more of the same can only do so much and something new is required to create the step change in safety performance.

The conceptual level of the focus of the South African mining industry is to remove people from risk by changing mining methods and by introducing new technology. This eventuality has had some success, but its full potential is still to be achieved in the future as the current mines operate mainly using conventional methods which continue to expose people to risk.

Research Finding 2: Institutionalise the company's approach to 'Zero Harm' by creating an enabling environment to achieve 'Zero Harm'.

- The company leadership to articulate the strategic intent to achieve 'Zero Harm';
- The Board and company leadership to accept that 'Zero Harm' is not negotiable and making it part of the company's value system;
- Sustainable development is a line management function and a concurrent activity to the core business of responsible mining;
- Appropriate Safety and Health Policies to be developed, and
- Relevant governance mechanisms to be put in place to ensure focus on 'Zero Harm', etc.

The approach to systemise the activities to achieve 'Zero Harm', as the next step, is shown in the 'de Jager Zero Harm model' Chapter 3-Figure 21, and is discussed in Chapter 5.

5 SYSTEMISE THE ACTIVITIES TO ACHIEVE ‘ZERO HARM’

5.1 Introduction

In order to prevent accidents from happening, it is important to design the entire interacting framework to ensure that the pre-existing environment, or uncontrolled dynamically developing conditions such as commonplace actions, random time and place, participants and chance is taken into consideration. The associated complexity of safe mining needs be systemised to encapsulate the company intellectual capital and know-how.

Safety is a concurrent activity, aligned with the core company process, and should therefore be integrated into the overall management systems and not be dealt with as a stand-alone system.

Systems are based on the company vision, mission, values and policies and has long term consequences for the company. Standards, procedures and processes are defined by the overall game plan of the company. The system design caters for a limited number of scenarios, but it is applicable to the company as a whole. It is captured in print, but it is only through people’s action that it becomes alive.

A system is necessary to ensure that the components’ interdependencies are recognised in order to have consistent repeatable outcomes in order to achieve ‘Zero Harm’. Paperwork is required for any system, but the actual application of the processes and procedures to avoid harm are crucial in order to achieve the strategic outcome. It is of no use to have a perfect system, yet the safety performance of the company is unacceptable. It was for this reason that safety systems fell out of favour in some companies post the 1993 Leon Commission of Inquiry into the South African safety performance (Leon 1995).

The international aspirations of some mining companies encouraged the adherence of safety management systems to internationally accepted terms of reference allowing for consistency across companies. The adoption of the

international standards such as OHSAS 18001, ISO 45001, ISO 31000, ISO 14001, ISO 9001 has become common and most mining companies have been certified. Although there are commonalities between the international systems and it is possible to have a common audit protocol, some of the processes required to achieve ‘Zero Harm’ can get lost if it becomes too generalised.

There has been a steady move away from stand-alone systems for safety, community, sustainability, risk management and others. It has been recognised that management systems should be integrated to ensure that the commonalities are recognised, and the specifics are highlighted. The integration of systems is imperative to avoid duplication and yet ensure that the focus areas receives the necessary attention to achieve the envisaged outcomes.

5.2 Risk Management

5.2.1 Risk Exposure

An accident is an undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss, casualty or mishap. It includes the entire interacting circumstantial framework leading up to, including, and resulting from, the accident's immediate occurrence.

Identifying the risk present in a mine through baseline, issue based and continuous risk assessments are fundamental in ensuring that the mine and associated processes are systemised and designed with a safe outcome in mind. The complexity of mining and its related processes should ideally be dealt with during planning and taken care of in the design of the overall safe production system. The mineworker has a moral and legal right to expect to work in a safe environment and have been trained sufficiently to be safe while executing safe processes and procedures.

All hazards that mine workers are exposed to will not all be able to be eliminated and therefore safe operating procedures needs to be designed and the necessary

equipment and training be provided to ensure a safe outcome. Danger is real and the individual's perception of the future outcome of the exposure to risk will dictate his or her behaviour. In this instance the full application of procedures and work methodologies should result in a safe outcome.

Demming's red bead experiment

Deming's red bead experiment demonstrates that whenever there are risks present in a mine, incidents will occur that could cause harm. It is therefore an essential to eliminate and reduce the risks that employees will be exposed to in the course of their work. The red bead experiment message proves the misconception that workers can be meaningfully ranked is based on two faulty assumptions.

The first assumption is that each worker can control his or her performance. Deming estimated that 94 percent of the variation in any system is attributable to the system, not to the people working in the system (Deming, 1986).

The second assumption is that any system variation will be equally distributed across workers. Deming taught that there is no basis for this assumption in real life experiences. The source of the confusion comes from statistical probability theory where random numbers are used to obtain samples from a known population. When random numbers are used in an experiment, there is only one source of variation, so the randomness tends to be equally distributed. This is because samples based on random numbers are not influenced by such things as the characteristics of the inputs and tools (e.g., size of the beads and depressions in the paddles) and other real world phenomena. However, in real life experiences, there are many identifiable causes of variation, as well as a great many others that are unknown. The interaction of these forces will produce large differences between people and there is no logical basis for assuming that these differences will be equally distributed (Martin, undated).

Unless hazards are removed (red beads) from mining operations employees will always be exposed to risks. Hazard identification and risk management are

cornerstones in the mining industry to enable mining to take place as safe as possible. Danger is real. It is the individual perception of the future outcome that will dictate his or her behaviour. If the risk exposure is perceived to be safe and in reality it is safe, the individual will be safe. However, of the individual perceive the risk exposure to be safe and it is actually dangerous, danger is real and the potential consequences will become real.

5.2.2 Enterprise Risk Management

Risk management has been part of the South African mining industry for decades and it is still evolving. It forms part of the business process of most companies and the governance thereof is at company board level. The process is cascaded through the organisation with the usual baseline, issue based and continuous risk assessments.

Most of the mines researched adopted an Enterprise Risk Management (ERM) process which comprised of operational risk management and strategic risk management which was aligned with ISO 31000 as well as with the risk management requirements of South Africa's King III Code. It covers operational, business, environmental, social, health and safety risks and it is perceived that effective and integrated risk management was at the heart of true business sustainability (Appendix B, AGA 2004; Appendix C, HAR 2005; Appendix D, GF 2012; Appendix E, SIB 2013).

Risk assessments are conducted at both group and operational level, from the risks relating to the group as a whole to risks associated with specific working places, with the aim of understanding the potential safety and health risks that existed so that they may be eliminated or reduced to tolerable levels.

Risk management has both a bottom-up and top-down approach with the objective to have employees actively involved in the management of risks to the business and in the work place. The top-down approach involves senior executives of the

business reviewing strategic risks facing the business and the ability to meet the strategic objectives. The bottom-up approach involves management within the business units reviewing risks that may prevent achievement of the business specific objectives.

Key controls are established that focus on critical risk areas identified by line management, facilitated by risk management and assessed and evaluated by the internal auditors. The controls are designed to provide a cost-effective assurance that assets are safeguarded and that liabilities and working capital are efficiently managed.

The established organisational policies, procedures, standards, guidelines, structures and delegation frameworks clearly defines and provides appropriate levels of direction, accountability and segregation of responsibility, which facilitates self-checking and monitoring mechanisms.

Reviews are conducted annually and on an ad hoc basis as business changed or the risks change so as to support business decisions. Progress on management plans are tracked and internal audits undertaken on a frequent basis.

The risk management system is generally incorporated into the strategic planning process to avoid possible gaps between the two processes and to ensure integration. This consolidated risk management system is a management decision making rather than an administrative tool (Appendix F, Lon 2007).

The compiling of risk registers is used to strengthen the role of risk management within broader operational management and to achieve an informed, pro-active way of risk management and mitigation. Risks are controlled and mitigated within the accepted and approved risk-tolerance levels and appropriate risk-financing programmes, based on the risk profiles (Appendix F, Lon 2010).

Risk management principles are applied through a focus on major hazard management and to ensure that the words were backed by actions. These focus areas include:

- Major hazard management;
- Identifying and monitoring critical controls;
- Instituting measures to reduce control deviation, and
- Continue to build organisational safety capability and capacity.

The guiding principles includes the application of risk management principles in order to understand the risk pathways, which gave rise to safety incidents as well as to prevent occurrence (Appendix B, AGA 2014).

The objective of ERM is to provide enduring management of internal and external risks that threaten achievement of an organisation's mission.

5.2.3 Risk Management

Mining is dangerous and adequate reliable risk controls need to be in place and used to enable the workforce to be safe. Mining is not a steady state operation resulting in a significant amount of ever changing risks that need to be controlled.

From a safety perspective risk management is key to the success of achieving the strategic intent. However, what is most crucial is to firstly recognise the risk and subsequently to understand the potential consequences of the risk. The aforementioned will enable the formulation of controls. It could include controls such as removal of the risk completely, reducing the risk by engineering or administrative controls, the adherence to operational procedure and the supply of personal protective equipment for persons exposed to the residual risk.

Key to the risk management concept is the actual application of the envisaged controls. The formulation of controls reduces the residual risk on paper only. However, the strict application of the risk controls will determine the real residual

risk. The reality is that if there is a gap between the envisaged residual risk and the actual application thereof, incidents will occur.

Risk management forms a significant part of the overall systems as various forms of energy are used during the mining process which involves the removal of bulk material, moving the mined material horisontally and or vertically to a process plant. The material is upgraded in the plant and the waste material is moved using energy.

The energy, in its various forms used in mining is significant and the inability to harness the usefulness of the energy, can result with disastrous consequences. Risk controls are used to eliminate, reduce, divert and replace the various forms of energy so that the exposure by humans is insignificant.

Unfortunately, the nature of the energy sources is not only what is put into the process but what could potentially be reciprocated by the environment if it goes wrong. This includes seismicity, fires, flooding, noise, dust, gases, explosions, etc.

In the ideal world, the risk assessments undertaken are adequately understood and the suite of controls in place will adequate address it so that the residual risk is within the company's risk bearing capacity. Consideration should be given to the underestimation of the risk assessment which could render the controls put in place also inadequate. In the instance where individuals are exposed to a risk that depends on their individual actions to bring it within the risk bearing capacity, in many instances it will fail as humans do err for whatever reason.

The South African mining industry should put more effort into reducing the impact of the assessed risk through engineering controls. There is an over reliance on behavioural safety as the last control before an incident. The reason being that the energy releases that the individual could be exposed to are outside the human tolerance levels. If this cannot be achieved, some of the mining activities should be curtailed until sufficient controls are available to be less dependent of human intervention at the last moment.

BowTie risk model.

The risk management processes introduced in the South African mining industry during the 1980's has become more sophisticated using the same principles as are described in this chapter. It still includes the baseline, issue based and continuous risk management processes and has significant traction in the industry.

More recently the BowTie (BTA) risk assessment process, has been finding favour in the South African mining industry in order to understand better how and why such incidents occurred. BTA is a simple and effective tool for communicating risk assessment results to employees at all levels as shown in Chapter 3-Figure 24 (Appendix B, AGA 2012).

Continuous risk assessments

There are various continuous risk assessment processes used by the mines researched to create awareness in individuals of what had to be done before starting a task and encouraged a culture of risk awareness.

Some examples include the SLAM continuous risk assessment process consists of Stop and think; Look; Assess the situation; Manage the hazard and the Stop; Think; Fix; Verify and Continue process which include:

- Individuals or teams to stop work;
- To withdraw to a place of safety;
- To assess the risk in collaboration with the appropriate supervisory level or discipline specialist;
- To rectify the situation in terms of mine requirements, and
- To continue activities only once the required remedial action has been verified should a risk be identified (Annexure B, AGA 2016).

Objective based risk assessments

One of the companies identified a set of objective-based risk assessments that covered approximately 80 of the most important aspects of the business. Each identified risk and its associated controls, had a clearly defined line management owner. This process was repeated and reviewed regularly, ensuring that the information remained relevant.

All information was captured into the company risk repository system that informed the risk profile. The risk profile was presented on a monthly basis to the Exco and quarterly to the board risk committee, which was separate from the audit committee (Appendix G, IMP 2011-2012).

Risk governance

At all the companies researched, the board had ultimate responsibility for establishing a framework for internal controls designed to effectively provide reasonable assurance against material loss, including appropriate risk management and good corporate governance frameworks and systems.

It reviewed and approved the risk strategy and policies that were formulated by the executive directors and senior management. Management was accountable to the board and had established a group-wide system of internal control to manage significant group risk. The risk management policies were communicated to all relevant employees.

A review of the risk, control and disclosure processes is undertaken annually to ensure that all additional requirements are incorporated into the risk management system. In conducting the annual review of the effectiveness of risk management, the board considers the key findings from the ongoing monitoring and reporting process, management assertions and independent assurance.

5.3 Safety management system

Safety risks in a complex organisation is co-ordinated and managed by using a Safety Management System (SMS). A SMS is a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures together to enable mine personnel to follow a systematic approach to achieving and monitoring an effective level of health and safety. A SMS ties all the elements together into an integrated system to effectively manage the risks to the health and safety of all workers. It ensures there are no gaps and that all the elements work in a coordinated way.

There are numerous ‘safety management systems’ available but it is imperative to incorporate it into the management system so as to ensure that it is a concurrent activity. The complexity of underground mining, normally in a significantly spread out area with hundreds if not thousands of people on shift executing a multiplicity of tasks requires a robust safety management system. A safety management system should continually strive to eliminate fatalities, reduce injuries and near miss incidents, encouraged positive behaviour and enhance the training and awareness programmes.

It is imperative that leaders involved in safety and health holistically understand the interdependencies of various safety aspects in dealing with the concept of ‘Zero Harm’ and how to achieve it. It has been experienced that in large organisations, very few individuals actually understood the interdependencies of the overall safety management ‘system’ as a whole.

The systems approach is certainly not new for the mining industry as SMS have been used in the South Africa mining industry since the early 1970’s. Examples of Safety Management Systems used at the time was the International Mine Safety Rating System (IMSRS), The NOSA 5-star safety rating system and the Chamber of Mines 5-star safety rating system. Although these SMS consisted of mostly

appropriate elements, the application of the system left much to be desired as it lost its primary purpose of improving safety at the time.

The overriding disabler of this fairly good SMS, was that it was marketed as a Loss Control Program. The net result was that it required a significant amount of paper trails and focussed on the company achieving stars, instead of focussing on improving safety. It was partly due to the detail requirements of some of the elements in that the option to assign responsibly for safety to others instead of the CEO was misaligned with the legal requirements applicable at the time. It was also seen as a separate system instead of it being integrated with the management system.

The then prevailing command and control management style inhibited the participation of all stakeholders in achieving safe production. Therefore the SMS approach was actually doomed from inception and it fell out of favour primarily due to some mines having a 5-star rating yet with unacceptable safety performance. It certainly was compromised even further in the Leon Commission of Inquiry who came to the same conclusions in 1993. The use of safety management systems decreased over time which was actually unfortunate as it had its merits.

The management control of activities in the 1970's included the identification of the work required to achieve the desired objectives, establish standards for the work performance, measuring the performance of the degree of compliance and take corrective action. Despite the fact that the principles since the 1970's have not markedly changed, the context has changed dramatically in South Africa since participative management of all stakeholders has been legislated and practiced. It is a conducive environment where the application of a safety management system is expected by the stakeholders.

Most of the mines scheduled surveillance audits to ensure that continual improvement measures were implemented and maintained. Regular internal audits were conducted at all operations to consider the day-to-day effectiveness of health

and safety management systems. The SMS was regularly revised and took into consideration lessons learnt from the investigations and the outcomes of audits conducted.

In some instances, DuPont was used to assess the existing health and safety management systems and benchmark them against the international best practices. The audits covered all aspects of the health and safety management systems, strategies and plans, and also included a perception study of employees across all levels of the organisation. The behaviours, attitudes, practices and procedures were analysed, and a gap analysis conducted which focused on leadership, the organisation, operations and risk assessment.

5.3.1 Safety and Health Management System Standard

Occupational Health and Safety Assessment Series, OHSAS 18001

In 1999, a unified approach in the Occupational Health and Safety Assessment Series (OHSAS 18001) was published in recognition of the need to control and improve health and safety performance and do so with occupational health and safety management systems. The primary function of OHSAS 18001 is to keep people safe and ensure compliance.

A SMS compliant with OHSAS 18001 is based on a number of principles: leadership, setting objectives, effective risk management, competence of workforce, consultation and communications with stakeholders, clear lines and definitions of responsibility, systematic approach, and monitoring effectiveness through audit and review. Continual improvement is built in and the key focus is on how safety efforts are applied.

The application of the OHSAS 18001 principles and the certification thereof at the mines researched had mixed approaches. Some of the mines embraced OHSAS 18001 and were certificated whereas other mines accepted the principles but procrastinated the certification of their safety management systems. Lonmin was

not prepared to pay for certification as it was deemed to be too expensive (Appendix F, Lon 2013). However, all the mines had Safety Management Systems in place, although not all certified, to systemise the complexity required to achieve 'Zero Harm' as an outcome.

Occupational health and safety management systems. ISO 45001:2018

In 2018, ISO 45001, an International Standard for Occupational Health and Safety Management systems replaced OHSAS 18001. In this approach, top management is required to set policy, objectives and ensure effective communication takes place. OHS will need to be incorporated in the overall business systems of an organisation and be included in the organisation's operations and core organisational processes.

5.3.2 Employee involvement

Health and safety agreements

At each of its mining operations each mining company is required to have its own health and safety agreement with the union representative of the majority of employees as required by the Mine Health and Safety Act of 1996. Joint health and safety committees were in place at all operation and all working places were covered by such agreements.

Safety and health committees

Formally constituted safety and health committees were a requirement of the Mine Health and Safety Act of 1996, and their effective functioning underpinned the joint responsibility for safety and health at an operational level.

The functioning of these committees was regulated by the health and safety agreements that were entered into with the representative trade unions which dealt with a broad range of safety issues, including:

- The election of full-time health and safety representatives, as well as safety stewards, and the functions that they should fulfil;
- Procedures for employees to exercise their rights to withdraw from circumstances that they perceive to be dangerous;
- Training of safety and health representatives;
- Procedures for the resolution of disputes relating to safety and health;
- Participation in incident investigations;
- Any other issues relating to safety and health which may arise, and
- By virtue of the collective bargaining agreements in place all employees were represented in these safety and health forums at an operational level.

Tripartite health and safety committee

Some companies established tripartite health and safety committees with the purpose for management, organised labour and government representatives to collaborate on matters of safety and health so as to create consistency of standards, to ensure clear roles and responsibilities, and to establish a mechanism for the monitoring and evaluation of compliance.

The committees operated independently of the company's operational mine-based health and safety structures (Appendix B, AGA 2009; Appendix D, GF 2010).

5.3.3 Wellness

Wellness in the workplace

The 'Wellness in the workplace' process recognised that safety and health were integrally related. It primarily addresses the working environment, health care and

medically affected employee programmes so as to enhance employee management (Appendix B, AGA 2009; Appendix D, GF 2016; Appendix F, Lon 2014). Wellness in the workplace embraced the following:

- Recruitment and selection;
- Dust management;
- Noise management;
- Thermal management;
- Radiation management;
- HIV/AIDS workplace initiatives, and
- TB control, etc.

Community wellness

In 2005 AngloGold Ashanti launched the Community Wellness Campaigns with the aim of creating awareness amongst employees and communities on wellness and to promote voluntary counselling and testing for HIV. The campaigns provided community members with a free health assessment and professional advice on treatment options (Appendix B, AGA 2005).

The employees' home environments could have an effect on safety, as a result of stress, substance abuse and fatigue. Lonmin was constantly exploring ways to improve safety in the workplace to prevent incidents and occupational health risks. The Employee Value Proposition aimed to create a work environment that was conducive to overall wellness and productivity. Individual safety and health was not isolated to the workplace (Appendix F, LON 2013).

Many of the safety awareness and healthcare programmes were expanded into the communities around the operations. The informal accommodation conditions of many of the settlements where employees lived were not conducive to wellness and had an extensive impact on safe and healthy behaviour.

5.3.4 Controls

Major Hazard Control Standards

Major Hazard Control Standards were developed by some of the mines which defined mandatory controls aimed at eliminating or minimising the risk of fatalities, injuries or incidents arising from the uncontrolled release of the associated hazard. (Appendix B, AGA 2014; Appendix G, IMP 2013). The Safety Standards included:

Safety standards with a people focus:

- Strategic planning, goals and targets;
- Corporate Governance, legal and other requirements;
- Safety leadership and accountabilities;
- Co-design and conversations;
- Awareness, training and competence;
- Health, wellbeing and fitness to work as well as Occupational Environment;
- Change management;
- Contractor, supplier and partner selection and management;
- Knowledge management, and
- Learning from experience;

Safety compliance with a process focus.

- Design, construction, commissioning, de-commissioning and closure;
- Procurement and disposal;
- Operational and asset integrity;
- Work planning;
- Safe work practices;
- Hazard and risk management;

- Incident management;
- Emergency response, crisis management and business continuity;
- Technology, research and development, and
- Performance measurement.

A common platform was used for easy analysis, decision-making and implementation. Operating areas completed a gap analysis in relation to the standards and implemented processes to address gaps identified.

A large company could monitor more than 100 000 critical controls on a monthly basis. Some of these were administrative or procedural in nature whereas others required engineering measures to be taken, such as placing nets and bolts in working areas or replacing manual techniques with mechanised underground development. For each critical control, the company identified the individual responsible for verifying control effectiveness, the means used for verification of the control and the required frequency of compliance checks. Data from critical control monitoring was then used as a leading indicator to address emerging risks before incidents occur.

By monitoring control effectiveness, the company could focus on underlying issues and took proactive measures to prevent major incidents from developing. There was an increasing focus on the introduction of engineering controls. Compliance to these standards was assessed through an annual self-assessment process and a bi-annual corporate-led combined assurance process (Appendix B, AGA 2016).

Knowledge management

The need for continual improvement of levels of safety knowledge and awareness amongst leadership teams was a requirement. Some senior leadership attended international best practice training, which resulted in improved communication processes and increased safety awareness amongst employees. Cross-site peer

reviews were done in order to encourage the adoption of best practice (Appendix F, Lon 2011; Appendix G, IMP 2015).

Contractor management framework

A contractor management framework was developed by Lonmin in an effort to address safe behaviour among contractors as several contractors lost their lives. Vendor application processes includes a safety, health and environment assessment of potential contractors. The safety performance of contractors was enhanced through various initiatives including:

- Issuing a 'licence to operate' to contractors;
- Pre-qualification assessments of new vendors, and
- Audits done in conjunction with the supply chain to ensure that contractors adhered to safety standards.

The Contractor Safety Management Framework set the basis for industry collaboration through standardisation and reciprocity opportunities. The framework covered all aspects of contractor utilisation from pre-qualification to closure (Appendix F, LON 2011).

5.3.5 Compliance and Audits

Compliance

It is important to ensure strict compliance for the standards, systems, processes and work methods in order for it to be effective. Individuals at AngloGold Ashanti were identified who were responsible for verifying control effectiveness, the means used for verification of the control and the required frequency of compliance checks (Appendix B, AGA 2007, 2009, 2016).

Data from critical control monitoring was then used as a leading indicator to address emerging risks. This was done by determining the underlying issues and by taking proactive measures to prevent major incidents from developing.

A tool for self-assessment and evaluating compliance to standards was revised and simplified. The tool focused on the company safety standards and was also used to establish the level of safety cultural maturity at an operating level. The results were reviewed and validated as part of the combined assurance process. The focus on compliance was used to establish a platform for continuous improvement.

The system to share learnings across the organisation was established at AngloGold Ashanti, Harmony and Gold Fields and continued to mature with increasing openness and transparency in reporting (Appendix B, AGA 2016; Appendix C, HAR 2006; Appendix D, GF 2011).

At AngloGold Ashanti the learning from past incidents and reaffirmation that corrective actions were effective was reviewed on the commemoration of the first-year anniversary of employees lost to occupational injuries (Appendix B, AGA 2016).

Specialised internal safety and health audit teams were established at Gold Fields and Lonmin to carry out comprehensive audits of all mine workplaces to enable risks identification before incidents could occur. The desired outcome remained the identification and timely correction of safety process deficiencies before these could result in an incident (Appendix D, GF 2007; Appendix F, Lon 2008-1).

The internal and external audits were conducted to provide the board sub-committee with the assurance that policies, standards and procedures were implemented at operational level. These measures complement the activities of the governance structures to provide management and the executive with the assurance required to confirm that adequate risk controls are in place to ensure

sustained or improving performance or alternatively identify short-comings for timeous remedial action.

The audits were conducted against criteria established to measure the level of conformity, review the effectiveness of the management systems and inform training needs (Appendix B, AGA 2007).

Safety officer audits

Safety officers, who were independent of day-to-day production and associated targets, visited each workplace on a monthly basis, on a 21-day audit cycle, throughout the year which was in line with legal requirements (Appendix C, HAR 2016; Appendix D, GF 2012).

Second and third-party audit teams

Harmony established second and third-party audit teams, tasked with conducting independent on-the-job observations and investigations of Lost Time Injuries. These audit teams mitigated the risk of familiarity and the lack of independence that could occur once a safety officer became part of a team.

Every lost-time injury was analysed to determine behavioural and control failures and whether breaches of safe production rules were wilful or not. All accident investigations included the human error assessment in the formal accident investigation process (Appendix C, HAR 2014-1).

Corporate safety team reviews

Sibanye set up a ‘Zero Harm’ task team to investigate serious incidents and ensure that recommendations were implemented to prevent recurrence. All fatalities were reviewed of by the Office of CEO to ensure closeouts were made to prevent recurrence (Appendix E, SIB 2016).

Internal work stoppages

At most of the companies, management initiated a large proportion of the safety shutdowns at the operations as part of the drive to 'Zero Harm', in order to ensure safe production at the operations. It was believed that management-initiated stoppages were effective in stopping substandard or dangerous work and were a helpful tool as a proactive measure to prevent injuries.

Section 23 of the Mine Health and Safety Act booklets were introduced by Implats to equipped team members to exercise their right to withdraw from dangerous workplaces. Internal safety stoppages occurred whenever the company's Life Rules were violated (Appendix F, LON 2015; Appendix G, IMP 2016).

5.3.6 Emergency preparedness

Emergency preparedness plans were in place, reviewed regularly and regular training undertaken. At Lonmin communities who were located in close proximity to operations, were involved in emergency preparations that could affect them. An Emergency and Disaster Management initiative was launched through which emergency assistance was available to company operations as well as to communities and other stakeholders in the area. Emergency Preparedness training was also provided to the surrounding community. The initiative offered a continuous and integrated multi-sectoral, multi-disciplinary process for the planning and implementation of measures aimed at:

- Preventing or reducing the risk of disaster;
- Mitigating the severity or consequences of disasters;
- Emergency preparedness;
- A rapid and effective response to disasters, and
- Post-disaster recovery and rehabilitation (Appendix F, LON 2007).

5.3.7 Post event investigations

Incident investigation process

An incident investigation process is used by AngloGold Ashanti, Harmony, Gold Fields, Lonmin and Implats to enable the organisation to learn from incidents and manage it proactively. Incidents generally have multiple and sometimes complex contributing factors at an individual, workplace and organisational level (Appendix B, AGA 2011; Appendix C, HAR 2014; Appendix D, GF 2008; Appendix F, LON 2009; Appendix G, IMP 2007).

Causes of fatal accidents	08	09	10	11	12	13	14	15	16
Explosions				33%		33%	5%		
Falls of ground: Gravity	38%	27%	56%	20%	13%	11%	14%	38%	22%
Caught between equipment		18%							
Falls of ground: Seismicity	19%	14%		13%	7%		5%		22%
Trucks and tramming	19%		14%	20%	13%	22%	14%	38%	33%
Slips and falling	5%	13%			13%				
Asphyciation		9%							
Rolling Rocks	5%			7%					
Tools and equipment		5%			7%		5%		
Winches		5%					5%		
Scrapers, rigs and ropes	5%		5%						
Falls from heights	5%								
Electrocution		5%							
Struck by Equipment		5%							
Inundation	4%				27%		9%		
Falling down an excavation				7%		11%			
Heat			10%		13%		5%		
Conveyance					7%				
Gasses						11%	41%	13%	11%
Falling structure						11%			
Conveyor belt			5%						
Headgear sheve wheel								13%	
Vehicle									11%

Table 1 Immediate causes of fatalities at Harmony between 2008 and 2016 (Appendix C, HAR 2006-2016).

The programme fostered heightened hazard awareness and provided management with a tool to record observations and monitor their progress toward resolution. A crucial step in preventing incidents and associated injuries is to understand the immediate, fundamental, and contributing causes. The incident investigation process is based on the Incident Causal Analysis method which is a ‘blame-free’

system used to assist in identifying the root causes of safety incidents to avoid repetition and promote accident prevention (Appendix F; LON 2009).

Some of the tools and interpersonal skills to facilitate comprehensive incident investigations aims at rooting out immediate causes, under lying individual, workplace and organisational factors which may have contributed to the incident. Preventative and corrective actions were taken to ensure incidents did not recur.

In most of the companies, the Chief Executive and Chief Operating Officers set the organisational tone to strengthen the safety culture and demonstrated leadership commitment to safety. They formally reviewed all fatal and significant high-potential incidents, which included analysis of underlying contributing factors for each actual or potential significant incident at the individual, workplace and organisational level.

The main reason behind the cause of accidents remained breaches in the safety rules and work procedures. This was addressed by ensuring that all employees understood the rules and procedures and the compliance requirements.

It was the view of Lonmin that it could never operate in a risk-free way. A key component of the management system was an incident reporting and investigation processes (Appendix F, Lon 2009). Operational management was responsible for reporting, rating and investigating incidents. The company adopted an incident analysis methodology which placed emphasis on incident analysis; incident follow up; the prevention of repeat incidents and the effective communication on lesson learned.

The objective of the incident analysis was that root causes were identified, and appropriate corrective and preventative actions were taken. All serious incidents which could result in the loss of a limb and incidents that could result in multiple fatalities were investigated. The Incident Cause Analysis Method (ICAM) (www.safetywise.com) that graded incidents was used to facilitate the investigations (Appendix F, Lon 2009).

Findings from these incidents informed the drive for ‘Zero Harm’ and were communicated across the operations. The outcomes of all higher-level investigations were presented to the Chief Executive Committee and the Board sub-committee. The findings from these incidents were critical to the efforts in eliminating fatalities and serious injuries and were communicated across the operations.

The ICAM was aligned with the Chamber of Mines Culture Transformation Framework requirements for risk management (Appendix G, IMP 2013). A simplified tool was developed and adopted by the business, which would facilitate a more effective environment for knowledge sharing (Appendix F, Lon 2009).

High potential incidents

High Potential Incidents (HPI) were required to be reported by AngloGold Ashanti in an effort to enhance organisational learning and to establish a broader basket of leading and lagging safety performance indicators. The long-term objectives of the system were to affect a decrease in repeat incidents, and to provide timeous and accurate information across a broad range of categories.

HPIs are incidents with major loss potential, but with minimal to no actual consequence having materialised. These incidents were used as learning opportunities to improve the safety management systems. It also served as a leading indicator for significant incidents.

Incidents took place across a broad range of disciplines including safety, health, security, community and the environment. A system was developed to formalise the reporting of incidents into a common portal which was used to distribute the details of these incidents and to share learning points arising from these incidents.

The reporting system facilitated improved performance monitoring through transparent, real-time performance reporting, diagnostics, and analytics. This allowed for it to be more responsive and to deploy critical resources strategically

where needed. Incident reporting was instantaneous and key performance indicators were reported automatically on a more frequent weekly basis, allowing for the monitor of performance more closely.

The incidents were reported and investigated in an open and transparent manner and actions were taken to prevent recurrence. This was achieved by specific and comprehensive standards, guidelines, and procedures addressing incident reporting and record keeping. The lessons from high potential incidents was embraced and extensive work was done to understand the root causes in order to prevent repeat incidents (Appendix B; AGA 2008).

Reporting, classifying, and recording of occupational injuries and illness was performed in accordance with legal requirements and was consistent with provisions referenced in the International Labour Organisation code of practice.

Fatal accident reviews

AngloGold Ashanti had a policy of investigating all fatal accidents independently of mine-based and statutory investigations using a specially assembled team convened and followed up by a formal executive review. This methodology indicated the seriousness with which the board and executive viewed fatal accidents and revealed important risk issues and lessons learnt (Appendix B, AGA 2004).

Each fatality was investigated to identify lessons learnt and action plans to prevent a similar accident. These lessons were shared throughout the company and it included issues such as key control for mobile machinery, licensing of machine operators, working under suspended loads, working in no-go zones during scraping and rigging operations and reducing the number of personnel during cleaning operations with winches (Appendix G, Imp 2016.

5.4 Conclusion

An accident is an undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss, casualty or mishap. It includes the entire interacting circumstantial framework leading up to, including, and resulting from, the accident's immediate occurrence.

Identifying the risk present in a mine through baseline, issue based and continues risk assessments are fundamental in ensuring that the mine and associated processes are systemised and designed with a safe outcome in mind. Mining is dangerous and adequate reliable risk controls needs to be in place and used to enable the workforce to be safe. Mining is not a steady state operations resulting in a significant amount of ever changing risks that needs to be controlled. From a safety perspective risk management is key to the success of achieving the strategic intent.

All hazards that mine workers are exposed to will not all be able to be eliminated and therefore safe operating procedures needs to be designed and the necessary equipment and training be provided to ensure a safe outcome. Key to the risk management concept is the actual application of the envisaged controls.

The Safety Management System responds to the safety and health risks that had been established through the Enterprise-wide Risk Management System. Different risk assessment processes are used depending on the potential risk exposure. The BowTie risk management process is used to visualise causes, controls and consequences of especially low likelihood, high consequence risks such as shafts, fires, rock mass management, trackless mobile equipment, flammable gas, etc.

There are various continuous risk assessment processes used by the mines researched used to create awareness in individuals of what had to be done before starting a task and encouraged a culture of risk awareness.

Organised labour should be involved in risk management Health and safety agreements should be available as well as health and safety committees, ideally to include the regulators as well, as appropriate.

Wellness should recognise that safety and health were integrally related. It primarily addresses the working environment, health care and medically affected employee programmes so as to enhance employee management. The employees' home environments could have an effect on safety, as a result of stress, substance abuse and fatigue. Companies should explore ways to improve safety in the workplace to prevent incidents and occupational health risks.

Major Hazard Control Standards are defined mandatory controls aimed at eliminating or minimising the risk of fatalities, injuries or incidents arising from the uncontrolled release of the associated hazard.

Contractors should be treated like employees. Contractors vendor application processes should include a safety, health and environment assessment of potential contractors.

Emergency preparedness plans should be in place, reviewed regularly and regular training undertaken.

Post event High Potential Incidents (HPI) should be reported in an effort to enhance organisational learning and to establish a broader basket of leading and lagging safety performance indicators. The long-term objectives of the system are to reduce repeat incidents, and to provide timeous and accurate information across a broad range of categories. The incident investigation process should enable the organisation to learn from incidents and manage it proactively.

All fatal accidents should be investigated independently of the mine-based and statutory investigations followed up by a formal executive review. This methodology will indicate the seriousness with which the board and executive view fatal accidents and to reveal important risk issues and lessons learnt.

It is important to ensure strict compliance for the standards, systems, processes and work methods in order for it to be effective. Internal and external audits should be conducted to provide assurance that policies, standards and procedures are being implemented at operational level. The assurance should confirm that adequate risk controls are in place to ensure sustained or improving performance or alternatively identify short-comings for timeous remedial action.

5.5 Conclusion

Research finding 3: Systemise all the activities required to achieve ‘Zero Harm’.

The approach to humanise the systems to transfer relevant knowledge and establish behaviours of all individuals throughout the organisation to enable the achievement of ‘Zero Harm’, as the next step, is shown in the ‘de Jager Zero Harm model Chapter 3-Figure 21, and is discussed in Chapter 6.

6 HUMANISE THE SAFETY SYSTEM

6.1 Introduction

The company needs to transfer the relevant safety related knowledge and establish behaviours of all individuals throughout the organisation to enable the achievement of 'Zero Harm'. The safety culture is a sub-set of the company culture, which is the collective for the way business gets done. The company culture is largely created through the vision, internal advocacy, example setting and actions of the company leadership, directed by policies, systems and procedures, risk management and behaviours of all employees. Culture is defined as the way things gets done in an organisation which includes: beliefs, thinking, systems, knowledge, experience, customs, etc.

The selection of employees to fit the company requirements such as basic competency and fitness, as examples, is a fundamental to success. Training and coaching is required to ensure that the individual obtains the relevant skills. The wellness of the individual at work is linked to the external lifestyle, which includes, housing, transportation, alcohol and drug consumption, nutrition, dreaded diseases, stress, mental issues, fatigue, etc. The company should be aware of these contributing factors as a potential for unintended triggers for unsafe behaviour. These issues could be combated by company's interface with the local society realities such awareness programmes and by addressing common issues such as housing, medical facilities, travel arrangements, shift work, etc. The approach to safety is lifestyle and should not have an on/off switch. Humans will err and it will be a fatal flaw to assume perfection.

Behavioural safety has its merits, but this approach should be used in conjunction with real risk management. Once a risk is identified and controls put in place, behavioural safety is to ensure adherence to the approved work procedures, which should result in the safe execution of the task. Unfortunately, there is an overwhelming reliance on this approach by many companies, when even the correct behaviour of the individual results in an incident.

Whenever energy is exerted which exceeds the human threshold, the behavioural aspects of the individual or group is insufficient to deal with the residual energy. In the mining industry there are several examples of energy releases, such as seismicity and fall of ground, that has not been adequately addressed to ensure that if an incident occurs that it fails to safe.

The overall strategic intent of a company is determined through centralised decision making by a few people with the involvement of stakeholders. The strategic intent is then articulated through policies, system controls and operational controls. It is a written paper driven process which perceives mining essentially to be a steady state operation and deals with a limited number of scenarios dealing with deviations which are formalised.

However, the residual risk is managed through decentralised decision making and implementation. The strategic intent is operationalised by the workers who find themselves in a dynamic state where the consequences have to be interpreted and correct decisions have to be made to deal with the reality that they are faced with. However, all humans are fallible and the incorrect behaviour of people could result in mistakes and violations.

It is incumbent on mine management to deal with the residual risk which workers are exposed to, to fail to safe and not to be overly reliant on the behaviour of individuals to always do the right thing. Behaviour of individuals should be seen as a consequence of the situation that they find themselves in and not necessarily as actions in isolation. More engineering controls needs to be instituted to reduce the residual energy and reduce the reliance on human behaviour to be safe.

6.2 Safety Culture

‘Visible Felt Leadership’ (VFL) is a term made famous by the DuPont organisation. VFL is used and practiced in the mining industry since the early 2000’s when it was required by some companies to understand how people worked, what motivated them and what motivated them to change.

VFL is used to enforce the belief that mining can be undertaken without injury by embedding the 'Zero Harm' concept throughout all levels of the organisation. Companies increased training and improved communication through VFL in order to embed the required safety culture. It was realised that it was necessary to a broad approach including the safety and health of all aspects of how an employee's lives in and outside working hours. The cultural shift that was needed in the attitude to safety extended beyond the workplace given the tolerance for high risk behaviour in general among South Africans.

Some companies re-engaged DuPont to objectively benchmark the progress in safety against world best practices. In around 2010 it was concluded that the respective mines had a dependent safety culture where employees still required high levels of supervision (Annexure B AGA 2004; Appendix D, GF 2009; Appendix F, LON 2011; Annexure G; IMP 2011).

A study was also commissioned on the external socio-cultural factors that affected management and employee behaviour in order to improve the safety programmes. This study showed that the legacy and behaviour of South Africans in general toward discipline, alcohol and drug abuse, violence and the disease burden posed by the HIV epidemic could negatively affect safety behaviour at work and needed to be addressed in the safety initiatives programmes.

There was focus on compliance and fostering a culture where safety was a priority for all employees and where there was intolerance towards unsafe work practices and behaviour. Compliance to the defined safety standards and procedures was ensured by changing the safety culture, focusing on behaviour observation, reward and communication (Appendix G, IMP 2010).

A culture of non-compliance and their consequences manifested not only in the South African mining industry safety statistics when compared to other countries, but also in many other areas of everyday lives. The example set by society at large in South Africa was a likely to be contributing factor. Non-compliance with accepted norms and acceptable social behaviour by prominent individuals was

often reported in the press. These actions as well as that such behaviour often was unpunished and the impression was created that non-compliance was somehow acceptable or condoned. It was an attitude to risk and therefore to compliance that was difficult to gauge.

It was important to significantly modify the attitude of the workforce towards risk and compliance, because, until such day as the workforce achieved 100% compliance with safety standards and practices, the 'Zero Harm' objective would not be achieved.

6.2.1 AngloGold Ashanti safety culture

A Safety Blue Print for the business was developed by AngloGold Ashanti following the launch in 2008 of '*Safety is our first value*' and the initiation of the Safety Transformation project. It included the Guiding Principles, which represented a global approach to developing a resilient safety culture and systems that created a common business platform and language for safety across the company.

The concept of safety included occupational health and safety and the wellness of employees, contractors and host communities. It was aimed to ensure that no health or safety impact resulting from the operations affected the communities.

The Safety Transformation project captured the stakeholder perspectives during the project design. It was undertaken by a series of stakeholder workshops in which government, organised labour, employees and safety experts participated. Stakeholder engagement continued as the project developed and a dedicated stakeholder engagement plan, integral to the project, was compiled. The guiding principles were to:

- Set clear accountabilities for safety;
- Understand and manage hazards and risks, in an ongoing way;
- Engage the workforce in doing this;

- Make the solutions happen by providing resources;
- Have a relentless and broad commitment to safety, within and beyond the workplace, and
- Develop a learning culture to make all of these things happen in reality, not just words.

The global approach was designed taking cognisance of local regulatory requirements, unique cultural differences and site-specific characteristics to achieve four key objectives:

- Establish new and innovative ways to manage safety, support the effective execution of safety strategies, and eliminate inefficiencies;
- Establish a common safety management approach that had a structure and language that helped to bring the organisation together with a single and consistent safety framework;
- Ensure that safety was effectively integrated with other business strategies and objectives, in support of a stable operating platform, and
- Engage every employee to create conditions that encourage them to give of their best for their own benefit and that of the company.

A technology-based knowledge management system that encouraged higher levels of collaboration and cooperation across all business units was required to support the change. The strategic initiatives to instil a culture of care were effective across the group. It was supported by empowering people to take responsibility for their own safety and health and that of their colleagues and by recognising safety achievements (Appendix B; AGA 2008).

The Safety Transformation project was created in 2009, with the intent to move the company's safety maturity from a position of vulnerability to one of resilience. This required integration of the 'Safety BluePrint' with the broader organisational change initiative, known within the company as 'ONE'. It included

the implementation of a new people management system, the 'System for People' (SP), and a major programme for business process improvement.

The Safety BluePrint was to be reviewed every six months to ensure that safety strategies remained aligned with broader business strategies. The review was intended to ensure that:

- Activities contributed towards achievement of the stated safety vision;
- Endeavours had a material impact on the adoption of the safety values and guiding principles;
- Strategies were effectively implemented, and
- Successes were institutionalised through the implementation of safety management systems (Appendix B, AGA 2009).

In 2010 the Safety Transformation project resulted in the development of a safety transformation approach, which had three components:

Engaging people:

- People and culture were vitally important in creating a safe working environment;
- Compliance with rules and procedures alone could not address or mitigate all hazards and risks, and
- A culture, which fostered improvements in safety performance, was built on people who think for themselves about safety issues and who took ownership and accountability for creating a safe environment.

Building the right systems:

- Systems played a key role in influencing the work environment, and
- Build robust systems that were specific to safety and ensuring that safety considerations were thoroughly integrated with other organisational systems that sustain safety, such as knowledge management.

Managing risks effectively:

- Eliminate hazards where possible, and if it could not be eliminated, to manage the commensurate risks, and
- It required broader thinking about hazards and risk, which would result in building more robust defences to protect people from harm, based on group-level, technical, administrative and individual controls (Appendix B, AGA 2010).

In 2011 the foundation for continued improvement in safety performance was the ongoing implementation of safety transformation into the operating system. The design and implementation of the safety transformation programme dealt with the concepts of physical injuries, health and wellbeing.

The safety transformation initiative recognised that a safe and healthy business was a more productive one. Safety transformation was about valuing people and ensuring that priority was placed on people's lives, physical security, health and wellbeing. A maturation of the safety culture was required in order to achieve the safety and health goals. The envisaged safety culture was a culture where leaders:

- Set tone and direction;
- Engaged and motivated people to give their best, and
- Shaped organisational and safety systems, which enhanced the ability of employees to manage risk effectively (Appendix B, AGA 2011).

These were translated into action through the safety and health framework as shown in Figure 27. The framework clarified the relationship between policy, strategies, standards, guidelines, procedures, regional and operational approach as well as the monitoring and measuring of performance in order to achieve continuous improvement in performance. The rationale for the approach was based on the understanding of how various industries evolved through embracing safety as a business value. In their evolution, they went through four clear stages of leadership:

- Positioning safety as a business imperative;
- Managing processes to reduce variability and deliver consistent performance;
- Re-engineering processes to find better and safer ways to do work, and
- Introducing technical innovations to remove people from risk.

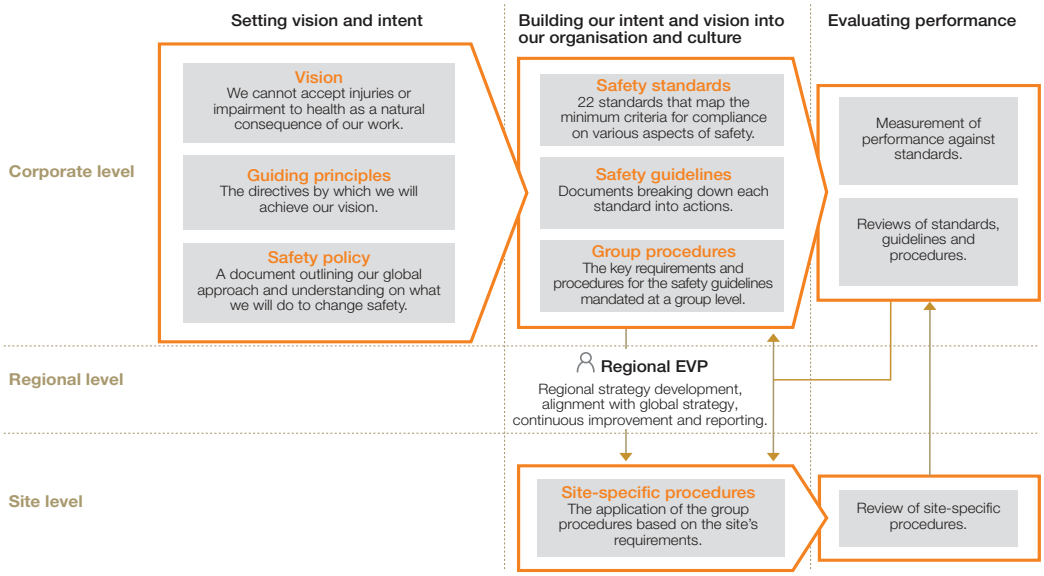


Figure 27 Safety and health transformation framework (Appendix B, AGA 2011).

This was consistent with the Project ONE, a business change initiative to improve performance levels across all areas of its business operations through consistent management and systems. It was important to ensure that all of the safety transformation components were made relevant to the business by integrating it into Project ONE.

The safety component ensured that safety accountabilities for all employees were clear and appropriate capabilities developed to ensure safe work. The approach was translated into a safety framework for the business, which was integrated into the broader operational model that had been developed through Project ONE. Implementation of the safety transformation framework through the operational

model would enable the company to target and deliver on long-term and sustainable safety improvements

6.2.2 Gold Fields safety culture

In 2008 Gold Fields strengthened the safety culture after a multiple fatality incident which was a watershed in the approach to safety, with the commitment that *'If we cannot mine safely, we will not mine'* (Appendix C, GF 2008 Page 10). This was bedded down as the single most important value, and the foundation of the company culture.

The Chief Executive Officer went on a road show to all operations in South Africa to promote the new health and safety culture and encourage the buy-in from 55 000 employees at all levels in the organisation.

A significant improvement was achieved in the pursuit to ensure a culture where the safety of everyone at the company was of the utmost importance. The operations embarked on a training project around cultural safety change and the development of personal values for safe behaviour using qualified psychologists. Systems, rules and procedures, personal beliefs and values largely directed behaviours.

Gold Fields understood that the safety culture and performance had to change radically. The commitment to eliminate all serious and fatal accidents on the mines and that *'If we cannot mine safely, we will not mine',* was reconfirmed by the board. The objective was to achieve a zero-harm working environment for all of the people. All the stakeholders including contractors, suppliers and unions embraced the new safety philosophy (Appendix D, GF 2008).

DuPont undertook a comprehensive review of the safety practices in the company, which included the assessment of management systems, culture and safety improvement objectives. The assessment included a safety perception survey, which covered a third of all employees and took the form of structured interviews,

was utilised to uncover the internal beliefs and perceptions around safety (Appendix D, GF 2009).

A year later, the follow-up health and safety audit by DuPont indicated a significant improvement in the overall safety culture, which implied that the efforts to boost safety on a sustainable basis were delivering results. It established that the various programmes resulted in a greater maturity in the approach to safety and served to entrench an improved safety mindset within the company.

The assessment showed that good progress was made towards establishing a culture where safe production and 'Zero Harm' were reflected as a standard way of working. The first value, '*If we cannot mine safely, we will not mine'*, was thoroughly entrenched throughout the company.

A fundamental requirement of a safe mining culture was full compliance with safety protocols, norms, standards and operating procedures. While significant progress was made in the overall safety performance there remained a number of areas in which a quantum shift was still required which included employee behaviour and adherence to full compliance. It was found that 88% of the fatalities that occurred during 2010 at the company were preventable accidents, which resulted from:

- Risky behaviour;
- Non-adherence to established safety protocols and standards, and
- Inadequate supervision and leadership at different stages of the production process.

An enhanced behavioural-based safety programme was designed and commenced roll out in order to reduce accidents caused by negligence or non-adherence to standards. The objective was to strengthen the values of personal and collective safety amongst the employees and to ensure that all strictly adhered to the safe production rules.

The company promise that '*if we cannot mine safely, we will not mine'* was integral to the safety culture and was acted upon on a daily basis. The 'Stop, Think, Fix, Verify and Continue' approach encouraged employees to stop work wherever there was a risk to health or safety and to examine if there were alternative, safer ways to continue mining.

If there was no safe alternative, no mining would take place rather than put the teams at risk. The company actively countered perceptions around the 'latent' dangers of underground gold mining through the promotion of a 'Safe Production Mentality'. It was based on instilling the belief amongst employees that mining could, if approached in the right way, be carried out without the need for exposure to risks. It was supported by the ongoing enforcement of the Safe Production Rules, as well as constant promotion of the 'Stop, Think, Fix, Verify and Continue' practice.

The company implemented a cultural survey which was aimed at assisting safety cultural transformation and helped to understand the key determinants of workplace culture across all levels and functions. This included the examination of national and regional cultural dynamics, specific human dynamics and collective engagement relationships. The key findings from the survey indicated improvement opportunities including:

- The ability of supervisors to interact effectively and constructively with workers;
- Vertical and horizontal communication between employees, and
- Culturally sensitive performance management with respect to the treatment of under and over performers.

The results of the survey helped efforts to implement relevant interventions under South Africa's sector-wide Cultural Transformation Framework (CTF) coordinated by the Chamber of Mines (COM) of South Africa. The framework, which was to be implemented over a two-year time frame, focused on:

- Enhanced collective leadership performance;
- Risk management;
- Incentives;
- Implementation of best practice;
- Promotion of respect in the workplace, and
- Ensuring that all relevant standards articulated by the COM and agreed to by stakeholders were met.

Gold Fields integrated the CTF and internal safety engagement pillars into the Safe Production Management Strategy. Other initiatives included enhanced safety enforcement measures, including increased resourcing.

The company continued to work with external experts to embed a safe mining mentality through on-the-job coaching. The programme was implemented by skilled employees who were trained in:

- Risk facilitation;
- Risk assessment;
- Identification of high-risk behaviour;
- Coaching, and
- The analysis of critical behaviour.

These teams visit all de-stressed areas on an ongoing basis and focused on:

- Improving workplace competency;
- Reducing high-risk behaviour;
- Improving team work, and
- Revising current working methods.

Managers and employees were encouraged to act like dynamic, engaged owners, and were rewarded for doing so. It was about aligning the interests of the workforce with those of the shareholders. Steps were taken to create the kind of corporate structure that would help to achieve this outcome. All employees were

encouraged to act as entrepreneurs, which included identifying opportunities for innovation to continually improve the ability to generate positive cash flows and to create value for all key stakeholders.

Gold Fields continued to entrench a high-performance culture that encouraged people to meet and exceed their performance targets. A work environment was maintained to support optimal functioning and to ensure that employees were safe, healthy, balanced and productive. It was planned to implement a 'cultural transformation' programme based on the CTF approach, which included:

- Manager self-assessments on safety and health leadership;
- Employee engagement surveys;
- Safety focus groups, and
- A 360° safety leadership survey for all levels of leadership (Appendix D, GF 2010).

6.2.3 Sibanye safety culture (SibanyeStillwater after 2016)

Sibanye aimed to build a corporate culture by increasing awareness of the company's vision, mission, aims, objectives and values. Employees were aligned with the purpose, vision and values and understood what was needed of them to make a meaningful contribution. The employees, officers and directors alike were required to adhere to and be bound by a Code of Ethics.

At the end of 2013 Sibanye launched the 'CARE' values which articulated the Sibanye's culture and mirrored its values. 'CARE' was part of everything that was done at the company and stood for:

- *Commitment:* Delivering on our promises to all our stakeholders;
- *Accountability:* Accepting responsibility for our actions and their consequences;
- *Respect:* Showing regard and consideration for others, and

- *Enabling:* Creating an environment where it is possible to work safely and productively.

Sibanye conducted its business in an ethical and fair manner, and promoted a non-sectarian, apolitical, socially and environmentally responsible corporate culture. The corporate culture was founded on the values of 'CARE', which underpinned the business strategy, and promoted competitiveness and success. These values were embedded through continuous communication, transformation, education and training. It was supported by the safety, health and wellbeing strategy, which had five key pillars:

- Compliance with safety rules was essential;
- Workplace and process risks must be identified and engineered out;
- Employee wellbeing was fundamental to success;
- Staying fit and healthy was a joint responsibility, and
- Relationships were important and should be based on mutual respect.

A commonly understood language, was used to convey the 'CARE' values to all employees and the company was in the process of introducing the 'New Way of Communication'. The aim of this intervention was to eradicate the use of Fanagalo and replace it with the languages identified by Wits Language School. The 'New Way of Communication' involved ongoing training as the language policy was rolled out across the Group. At the end of 2014, e-learning resources were provided to support self-learning by middle management while recognition of prior learning in isiZulu and Sesotho were provided to supervisors and employees. It was believed that this would enable safer mining with a well-trained, motivated and stable workforce communicating effectively to further embed the CARE culture (Appendix E, SIB 2014).

In 2015 Sibanye's 'CARE 'values underpinned its strategy, how it conducted its business and interacted with stakeholders. In living these values, the company showed that it cared about safe production, stakeholders, the environment, the

company and the future. The approach was holistic with clear focus on delivery of all strategic imperatives critical to Sibanye's long-term success. Sibanye recognised that:

- Safety, costs, volumes and grade were the primary operational deliverables that underpinned the business;
- Strong cash flow supported the dividend paid to shareholders and underpinned the growth, and
- Growth, both organic and acquisitive ensured the long-term delivery of sustainable value to all stakeholders (Appendix E, SIB 2014).

In 2016 changing the hearts and minds of employees to be more safety conscious in the workplace and adopt a 'safety first' attitude as a way of life, was an initiative to be pursued. Training was provided to encourage accountability for safety incidents or substandard conditions including a new slogan: 'I am safe! We are safe! Phepha mina! Phepha zonke!'

The company launched the new safety value now included in the 'CARES' value system and the roll out of the 'Sharp! Sharp!' campaign across the Group. The objective was to reaffirm the commitment to safety and to encourage safe behaviour, address the regression in the safety performance and to reintroduce a culture of continuous improvement. Visible-felt leadership was entrenched by executive and senior management at the operations to ensure close out of action plans and high potential hazards that warrant an immediate stop and fix (Appendix E, SIB 2016).

6.2.4 Harmony safety culture

In 2006 Harmony concluded that 70% of the causes of workplace accidents could be attributed to behavioural issues. It ranged from neglecting to inspect workplace support before starting work to not wearing personal protective equipment.

The Sindile Mosha behavioural-based safety programme was introduced by using an industrial theatre concept. It was envisaged that the Sindile Mosha and the newly established corporate safety auditing function would complement the Harmony Risk Management System, providing tools that could be used by everybody in the working place. The behaviour-based safety methodology placed a great deal of emphasis on and empowered the individual and had as its basis the fundamental view that production targets could be achieved within a safe environment.

Sindile Mosha meant 'safety' and 'mongoose' in the local vernacular. The mongoose was chosen due to the behaviour in nature of mongoose groups. A 'safety observer' is placed in a prominent spot to oversee the activity of the community while they carry on with their normal daily activities. This individual mongoose's sole responsibility was to look out for predators or potential dangers and warn the community so that they can take cover.

Harmony wanted to reinforce this mindset in the workplace. The slogan '*I am committed to looking after my buddy'* became one of the cornerstones of the campaign. The Sindile Mosha concept consisted of four pillars, which included:

- Leadership commitment to and support for safety;
- Engagement and training of the workforce;
- Teams taking ownership of the process, and
- Effective communication through consultation (Appendix C, HAR 2006).

In 2007 Harmony believed that Sindile Mosha contributed significantly in safety improvements and it was integrated with the characteristics of a world-class safety culture. Unions and associations were fully involved in the process and teams at mine level were given a great deal of freedom in how they implemented the concept. Harmony's approach to behaviour-based safety involved:

- Employees defining the ways in which they were most likely to be injured;

- Pursued their involvement and obtaining their buy-in, through their own behaviour, and
- Observation of their co-workers, in reducing and ultimately eliminating at-risk behaviour.

Harmony believed that 'at-risk behaviour' could be reduced or eliminated through a proactive approach of communication, consultation and education. Once the unsafe behaviour resulted in an accident, of whatever severity, the process of identifying causes and eliminating repetition became a reactive one. Behaviour-based safety was part of a broad philosophy of managing risk so that accidents are prevented, rather than analysed after the event.

Employee rights and duties regarding workplace safety, as set out in the Mine Health and Safety Act, were reinforced through comprehensive team briefings and discussions. Individual responsibility, empowerment and actively caring for one another became part of workplace culture. Safety norms became part of all employees' values. Everyone was willing, able and enabled to 'go beyond the call of duty' to ensure compliance with safety standards. Harmony initiated a 'people transformation project', in co-operation with the National Union of Mineworkers, to improve productivity (Appendix C, HAR 2007).

In 2008 it was concluded by the Harmony leadership that some of the fundamentals were no longer being done in the company. It included 'walking the talk' and not just talking about it and instilling this philosophy back into the culture was important**.** It was envisaged that much had to be done and that greater understanding would come about through face-to-face communication with all levels within the organisation, which needed improvement.

Communicating meaningfully with the employees to ensure that it was understood how jobs should be performed and assessed was a requirement. The committed buy-in from the people who actually control the destiny of the company was necessary. The placing of safety above production was a non-negotiable.

Harmony introduced a culture of ‘Zero Harm’ in the workplaces, based on the elimination of injuries and on an improvement in occupational health (Appendix C, HAR 2008).

In 2009 the employees and their representatives supported the ‘reward and discipline’ approach to safety. The company continued to encourage a commitment to safety at all levels and management was also prescriptive when deemed necessary. The lessons learnt of bonuses earned or lost due to safety targets achieved or missed, and of the rigorous application of discipline at all levels for safety infringements including dismissal were not lost.

It was believed that the behaviour-based safety programmes resulted in improved safety performance of the company. Progress was made in reducing incidents in high-risk stoping and development environment, but less so for the lower-risk, non-mining working environment.

An analysis of the fatal accidents that occurred during the year showed a high degree of non-compliance with standards and an increasing proportion of accidents in non-mining related occupations. The company focused on further instilling a culture and mindset of safety through the emphasis on behaviour-based safety initiatives and on service-related disciplines. The focus was on increasing awareness and effecting the necessary behaviour changes (Appendix C, HAR 2009).

In 2010/11, a comprehensive safety initiative was rolled out across the company’s mines with encouraging results. An important element of this initiative was effectively communicating that safety was at the heart of every action and that the consequences of unsafe behaviour permeated the company, from the operational impact of each safety stoppage, to the impact on the morale and safety of all employees.

The key issues that would underpin sustainability included transforming attitudes to safety from reactive to proactive. This produced encouraging results as

evidenced by the drop in the number of injuries in Harmony's mines. The task of changing attitudes was widely acknowledged as being the most important element in successfully managing the process of creating a safe working environment in the mining sector.

It was required to operate Harmony safely and competitively to generate the cash flows that would finance sustainable organic and acquisitive growth and pay dividends to the shareholders. Cognisance was taken of the challenges that could prevent the teams from achieving the safety and production targets. This required a holistic view of both the company creating the systems and the people's attitudes.

People were engaged in every level of the organisation to get a bottom-up commitment to common goals, based on a negotiated value system that would underpin sustainable progress for the benefit of all. By investing in the technical processes and expertise to manage these, people would be equipped to achieve the safety and production goals on which the strategy rested. The focus was to entrench the cultural alignment underpinning the new values and their golden thread of safety.

A cultural alignment survey was conducted in which employees were asked which values supported their activities at Harmony on a day-to-day basis. The feedback was used to prepare a cultural change programme.

Management continued to ensure that a safety culture was entrenched at all operations through group wide behaviour based safety programmes. The improved safety rates reflected the focus on company-specific risks and behaviour-based training.

Harmony launched a three-year culture alignment programme. The key purpose was to create one Harmony culture that supported the strategic requirement to improve productivity and safety performance, and indirectly improve share performance. It launched the coaching leadership style 'BreakThrough'

programme and 360° measurements for the top tier of leadership, empowering them to set an example by living the Harmony values and to coach the supporting leadership behaviours (Appendix C, HAR 2011). The culture alignment programme comprised of three phases:

- Phase 1: Leadership shaping: Executive and senior leadership defining a desired Harmony culture and brand strategy in support of the company's standardisation strategy and defining an employee value proposition;
- Phase 2: Leadership empowerment: Empowering executive, senior and mid-level leadership with coaching skills to build a common Harmony culture. It was important to measure leadership growth against the New Harmony values through a 360° assessment process, and
- Phase 3**:** Staff engagement: Communicating and engaging with all Harmony employees to improve alignment and bottom-up participation.

In 2012 Harmony believed that the safety initiatives under way and targets could be achieved with the correct attitude. Every employee could contribute by truly making safety the first priority to create a culture where everyone takes responsibility for their own and their fellow workers' safety and health.

A group-wide culture survey was done to collectively define the New Harmony values. A representative sample of 1 972 employees participated in the survey which was followed up in a series of feedback workshops. The culture survey results were used to engage all key stakeholders including organised labour, so that the Harmony values belonged to everyone:

- Refreshed brand strategy aligned internal employee engagement to external stakeholder engagement;
- Employee value proposition defined the expectations and responsibilities of being a Harmony employee, and
- Staff engagement strategy and engaged with all Harmony employees, motivating behaviour aligned to the Harmony values.

Harmony announced the values through multiple communication channels and implemented employee workgroup programme to enable all the employees to contribute to and engage on how to create value for all stakeholders of the business. This initiative was aligned to the Chamber of Mines' MOSH culture transformation charter requirements (Appendix C, HAR 2012).

In 2014/5, Harmony embedded the 'Safety First' culture that established shared values throughout the organisational structure, as well as systems to support safety conscious behaviour. Visible felt leadership based on the commitment to safety as a priority was enforced at all levels and was embedded in the organisational culture in order to achieve 'Zero Harm'. Initiatives were implemented at the operations to encourage safer behaviour throughout the company. Emphasis on health and safety campaigns was reinforced and regular underground visits underground by senior management with focus on training and coaching (Appendix C, HAR 2015).

In 2016 Harmony was committed to creating a culture where safety and health was the first priority. The cultural alignment programme continued with management employees completing the training. The aim of this programme was to achieve cultural cohesion throughout the company by shaping leadership, and empowering and engaging employees.

Performance improvement in terms of production and safety was beginning to show as a result of this cultural alignment programme. Safety was a standard agenda item at all meetings throughout the company. Safety awareness was improved through pro-active communication at weekly team leader workgroups meetings with the General Manager at each mine.

On-going safety messages were broadcast on strategically placed televisions throughout the operations both on surface and underground. Weekly communication meetings were held between the General Manager and safety representatives. Each General Manager attended monthly safety mass meetings at

their operation. The company ensured that employees felt part of the Harmony family through the value of ‘connectedness’.

For employees to be committed, productive and conscientious in their jobs, it was believed that they should feel valued. Harmony ensured that the employees understood their roles within the company and what was happening at the company and in the industry. They were the first to hear important news. Regular employee engagement involved communication both to and from employees. Suggestions made by employees were taken seriously and if necessary were acted upon (Appendix C, HAR 2016).

6.2.5 Lonmin safety culture

In 2007 visible leadership was one of the critical elements of a successful safety culture. Workplace interventions were designed to cultivate constant awareness of safe behaviour. These included daily safety breaks and safe behaviour observations, where employees observe each other to identify and share best practice.

Visible leadership was crucial and was a powerful aid in creating an interdependent safety culture. All managers undertook safe behaviour observations and participated with the employees in their areas in daily safety breaks (Appendix F, LON 2007).

In 2011 Lonmin had a Safety Summit in which, it was concluded that Lonmin needed to create a safety culture of safety with a set of shared beliefs about safety. Stressful, unsafe living conditions of many employees contributed to unsafe behaviour in the mining environment and that lack of sleep, poor diet, abuse of alcohol or drugs, or not respecting the inherent high-risk environment of mining all contributed to accidents and fatalities. Lonmin needed to find ways to improve the environment for employees, both at work and in the broader environment, so that they were encouraged to foster a culture of safe behaviour (Appendix F, LON 2011).

In 2012 safety was considered as part of how business was conducted and not a separate initiative, campaign, or subsection of thought before work started. Lonmin aimed to produce safely, constantly measuring forward energy, focused on proactive, sustainable work practices and growth. The company worked towards a safe culture on and off the job, with honest intent for what and how was done (Appendix F, LON 2012).

In 2014 the safety and health practices awareness campaigns and training interventions were geared towards creating a work culture that was conducive to employee and contractor wellness and productivity. It included the requirement that unsafe work be stopped or not undertaken and empowered the workforce to ensure that this expectation was understood and complied with (Appendix F, LON 2014).

In 2015 the focus expanded to proactive safety management, with an emphasis on building a safety culture to influence safety behaviour and mindset. Proactive management included leading measures like safety campaigns, and management-initiated safety stoppages (Appendix F, LON 2015).

In 2016 the company placed increased focus on proactive safety management, safety culture and consequence management. It continued the pro-active safety management procedures, nurturing a culture focused on safety. The goal was for every person in the business to have a personal understanding of, and respect for, the importance of safety in the workplace through entrenching safety principles in the organisation and increasing visibility on safety matters (Appendix F- LON 2016).

6.2.6 Implats safety culture

In 2007 there was a renewed focus on visible, felt leadership. A safety roadshow was conducted at Impala's Rustenburg operations to heighten safety awareness

and to reinforce the mindset that mining can be undertaken without injury (Appendix G, IMP 2007).

In 2008 Implats perceived that the embedding of a culture of safety awareness at all levels of the organisation was important in its quest for 'Zero Harm' (Appendix G, IMP 2008).

In 2009 the company continued with the commitment to promoting and creating an embedded safety culture through better and more frequent training, improved communications at and between all levels of the organisation and through visible leadership. It was a priority to create and promote a safety culture, which had a broad approach that included safety and health in all aspects of employees' lives so as to deepen awareness and instil a culture of safety (Appendix G, IMP 2009).

In 2010 Implats engaged DuPont to objectively benchmark the safety management practices against world-class best safety practices. It was concluded that the safety culture was a 'dependent' one where the employees still required high levels of supervision in the work situation. The major findings of the DuPont study were incorporated into the safety strategy and plans, which aimed to change the behaviour of management and all employees to one where safety was considered to be the first priority.

The company continued promoting and creating an embedded safety culture through better and more frequent training and improved communications throughout the organisation. Visible leadership remained the key to driving home a safety culture within every employee.

An independent study was also commissioned on the external socio-cultural factors that affected management and employee behaviour in order to improve the safety programmes. This study showed that the legacy and behaviour of South Africans in general toward discipline, alcohol and drug abuse, violence and the disease burden posed by the HIV epidemic could negatively affect safety

behaviour at work and needed to be addressed in the safety initiatives programmes (Appendix G, IMP 2010).

In 2011 DuPont assisted Implats in understanding the impediments to embedding a culture that would make the workplace safe for all employees and contractor employees. DuPont revealed weaknesses in some of the underlying assumptions that informed the safety strategy. It served as the template for a better informed set of interventions which were designed to lead to significant improvement in the safety performance.

Notwithstanding the new understanding of the mismatches between the strategic intent and the realities, the lost-time injury frequency rate in the Group still remained unacceptably high and eight employees lost their lives while at work.

The company focused on compliance and fostering a culture where safety was a priority for all employees and where there was intolerance towards unsafe work practices and behaviour. Compliance was ensured to the Group's defined safety standards and procedures by changing the safety culture, focusing on behaviour observation, reward and communication.

DuPont undertook an assessment of the change in leadership culture. The results showed that the leadership safety culture improved in all six of the dimensions from the 2009 baseline measured by DuPont. The overall safety culture of leadership progressed from a dependent culture to an independent culture.

Implats embraced the notion that there was a need to develop and sustain a culture where safety was considered a priority by employees and management alike, and where non-compliance with safety standards was not tolerated at any level within the organisation. The cultural shift that was needed in the attitude to safety extended beyond the workplace given the tolerance for high risk behaviour in general among South Africans (Appendix G, IMP 2011).

In 2013 the company used the Cultural Transformation Framework (CTF), developed by the Mine Health and Safety Council (MHSC), to enhance the safety culture which included:

- Leadership;
- Risk management and accident investigation;
- Bonus incentives;
- Adopting leading practice, and
- Eliminating discrimination.

The company undertook a gap analysis of how Implats progressed against the CTF (Appendix G, IMP 2013).

In 2014 the required change in the Implats safety culture was to be achieved through leadership and using the CTF (Appendix G, IMP 2-14).

In 2015 a core goal of the safety strategy was to drive a change in the safety culture across Implats. It was to be transitioned from a measured culture of dependence to independence, and ultimately to interdependence.

In the dependent culture, although there is an acceptance of the need for safe practices, these are generally only followed when effective supervision is present and demands it. In an independent culture, every employee is committed to safe working practices, taking clear responsibility for their own actions. In the interdependent culture that they were striving for, there is the added focus of helping others to adopt good safety practice. The company continued to implement the CTF and entrenched the Mining Charter's health and safety commitments.

The CEO, with the support of the executive team, was developing the right safety culture through effective leadership and by demonstrating visible personal commitment. This strong executive commitment was evidenced by the measures taken early in the year following the five fatal injuries that occurred shortly after

the return to work after the five-month strike. The CEO and members of the Implats' executive relocated to Impala Rustenburg for two weeks to assess and review the safety plans.

A revised business plan was developed with input from internal and external sources. An important aspect of the new plan was the focus on safe behaviour and compliance to standards and, where wilful deviations occurred, the enforcement of discipline (Appendix G, IMP 2015).

In 2016 the company focused on the risks around critical safety behaviours and the need to inculcate an independent safety culture and attitude in every single employee.

The company would continue to drive a shift from the prevailing 'dependent' safety culture towards an 'interdependent' safety culture through effective safety leadership and engagement with employees. This would result in an interdependent culture where all employees look after their own and others' safety moving from a dependence on supervision to ensure compliance with safety rules and procedures. The safety leadership self-assessments showed that the company continued to have a 'dependent' safety culture in which effective supervision was needed to ensure compliance with safety rules and procedures at all levels, including management.

A core goal of the safety strategy was to create an 'interdependent' safety culture where every employee was committed to safe working practices, taking clear responsibility for their own actions and helping others to adopt good safety practices. This was essential if the company were to achieve and maintain the desired safety performance and 'Zero Harm'.

The CEO, with the support of the executive team, continued to drive the overarching objective of developing the right safety culture through effective leadership and by demonstrating visible personal commitment.

The company continued to implement the five-pillar cultural transformation framework developed by the MHSC and to embed the Mining Charter's health and safety commitments (Appendix G, IMP 2016).

6.2.7 Mine Health and Safety Council Cultural Transformation Framework

AngloGold Ashanti, Harmony, Gold Fields, Lonmin and Implats used the Mine Health and Safety Council Cultural (MHSC) Five Pillar Cultural Transformation Framework (CTF) to enhance the safety culture which included:

- Leadership;
- Risk management and accident investigation;
- Bonus incentives;
- Adopting leading practice, and
- Eliminating discrimination (Appendix C, HAR 2012; Appendix D, GF 2012; Appendix F, Lon 2012; Appendix G, IMP, 2012; www.mhsc.org.za).

6.3 Behavioural based safety

Behavioural safety has been in the forefront of approaches in South Africa since the early 2000's. The focus of this approach was for the individual worker to execute a task as per the standard operating procedure and to do all the checks and balances to accomplish the task at hand successfully.

This approach has had a positive impact in reducing the number of incidents. In order for behavioural-based safety to be most successful, it needs to be conducted in a potentially safe environment. If the environment in which a task is to be conducted is unsafe already, it is inappropriate to expect that the individual's behaviour will reduce the risk if the residual risk is beyond the threshold of influence. An example would be if the macro design of a mining process is flawed

and an expectation is created to manage the residual risk by individual's behaviour. It will be too little too late.

When the Bird and Germain model of causation (Bird et al 1985; HaSPA 2012) is considered, the individual's behaviour is the last 'domino' that determines success or failure and therefor remains a critically important aspect of any safety approach as shown in Chapter 2-Figure 17. Heinrich ascribed 88 percent of accidents due to unsafe acts of humans (Heinrich 1931). Bird and Germain recognised the need for management to prevent and control accidents (Bird et al 1985). It is incumbent on a company to ensure that the risk controls in place ensure that the residual risk is of such a nature that the consequences due to an error by an individual are minimised and not catastrophic.

The mindset of blaming the injured individual for being responsible for his or her injury has reduced in many mining companies as broader accountability for accidents are being recognised. The leadership of many mining companies has been following a strategy encompassing a multi-tiered approach in order to reduce safety related incidents in mines.

It was found at Implats that more than ninety percent of incidents that resulted in injuries had a non-compliance association at a critical stage leading up to the event. Although the emphasis was placed on behaviour, the company failed to modify a deliberate attitude to risk that sometimes pervaded certain individuals in the workforce and led to non-compliance (Appendix G, IMP 2008).

At AngloGold Ashanti, seventy percent of the fatal accidents were associated with contraventions of standards (Appendix B, AGA 2007). It was believed that a great opportunity existed in the way of leading and managing the company and the way in which other stakeholders were engaged with in making safety improvements. The company actively pursued the development of a safety culture and it needed to be shared and evident in behaviour. A safety culture survey was completed through assessment by peers, managers and subordinates of safety leadership across the company to augment the existing behavioural safety programme

(Appendix B, AGA 2008; Appendix C, HAR 2011; Appendix D, GF 2009; Appendix F, LON 2011; Appendix G, IMP 2011).

In 2006 Gold Fields realised that amid productivity drives and other workplace initiatives, it was often difficult for individuals to maintain a consistent state of safety vigilance (Appendix D, GF 2006). It was believed that human nature could be influenced to the stage where behavioural changes were achieved to a level where the likelihood of accidents and incidents could be reduced by:

- Constantly innovating;
- The proper enabling environment, and
- Management leadership by example.

Several safety behaviour based interventions and team-building initiatives were dedicated to coaching safety awareness and consequent behavioural change to limit injury by highlighting the need for pre-emptive safety action.

Companies increased emphasis on behaviour-based safety training and the setting of more stringent targets. A phased and structured behaviour change process commenced to gradually change individual, team, section and ultimately the entire operation's mindset (Appendix B, AGA 2004; Appendix C, HAR 2009/1; Appendix D, GF 2007; Appendix F, LON 2006; Appendix G, IMP 2011).

A number of initiatives were launched to complement and support the behavioural-based incident-management system, which was the base for the company’s safety campaign which included: Lead by example; Critical safe behaviours, and Intolerance of non-conformance (Appendix G, IMP 2008).

6.3.1 Lead by example

One of the leadership imperatives to achieve ‘Zero Harm’ included the expectation that leaders lead by good personal example and that their conduct reflected living the company values (Appendix B, AGA 2001/2). It was believed

that prioritising communication with employees at all levels and being available to engage in face-to-face conversation would be the most powerful driver of behaviour change to create organisational capacity and resilience.

Leadership behaviours strengthened the safety culture through work routine reviews and reinforced to support for consistent safety performance. Mechanisms to review and report on safety leadership behaviours were developed.

At Harmony, the company leadership was expected to conduct at least two underground/workplace visits per week, including irregular shifts. Visits to high-risk workplaces were prioritized where training and coaching were the guiding principles during the visits.

Management continued to coach employees on how to work safely. These conversations were shaped by messages agreed by management in consultation with the unions, safety structures/representatives. A formal visible felt safety leadership coaching programme was rolled out to Managers and Superintendents to optimise safety engagement with subordinates to drive positive changes in behaviours (Appendix C, HAR 2016).

During 2006 Lonmin increased focus on safety leadership in order to achieve the goal of ‘Zero Harm’. A senior management safety day was facilitated by a DuPont consultant with the objective to improve management visibility in the workplace and to train senior managers on how to conduct audits and inspections in the workplace that would augment the goal of ‘Zero Harm’ (Appendix F, LON 2006).

In 2007 visible leadership, or leading by example, was one of the critical elements of a successful safety culture. Workplace interventions were designed to cultivate constant awareness of safe behaviour. It included daily safety breaks and safe behaviour observations, where employees observe each other to identify and share best practice. Managers undertook safe behaviour observations and participated with the employees in their areas in daily safety breaks (Appendix F, LON 2007).

In 2012 the company monitored Safe and At-Risk behaviours, and the results used to direct Visible Felt Leadership (VFL) programmes. Learnings from the visits to DuPont operational sites were made in order to strengthen VFL (Appendix F, LON 2012).

In 2016 the company continued to rollout the Lonmin Safety Leadership DNA programme which was based on the DuPont leadership programme. This programme developed the individual's safety competencies, knowledge of the safety theory, how to apply it and practise safety management. The structured workplace coaching was also part of this programme, which was conducted one-to-one to bridge individual competency gaps and to improve safety performance over time (Appendix F, LON 2016).

6.3.2 Critical safe behaviours

'Critical safe behaviours' was developed by Implats in collaboration with the HSE representatives. Training and awareness programme, and measurement system, aimed at encouraging the right behaviours needed to keep one safe, was developed in collaboration with safety representatives (Appendix G, IMP 2014).

6.3.3 Intolerance of non-conformance

The enforced of an intolerance of non-conformance with safety standards and the issue of zero tolerance around non-compliance was non-negotiable as many fatalities had a non-compliance connotation of some sort (Appendix G, IMP 2008).

Companies had a work-stoppage rule in terms of which any employee may stop a workplace if it was deemed unsafe in any manner. It was perceived that the cost of a work stoppage was insignificant compared with the far-reaching implications of a workplace incident (Appendix F, Lon 2015; Appendix G, IMP 2015).

6.4 Training

Significant training has traditionally been done in the South African mining industry. The country has 11 official languages and the literacy level in general is below par with the rest of the world. The use of Fanagalo has still not been eradicated and is still used in many instances as the means to communicate. The significant shortfall of Fanagalo is that it falls significantly short on granularity when explaining risk management principles as well as values. The older generation underground workers in many instances do not understand English and the new generation cannot speak Fanagalo. At the time of this research the use of Fanagalo still hampered communication in the mining industry, despite various interventions by most companies.

The health and safety training were incorporated into technical training programmes and learning material with reference to the workplace and work-related hazards for each and every occupation and associated tasks.

6.4.1 AngloGold Ashanti

Risk management training

The provision of appropriate training was essential to ensure that employees were competent to carry out both their duties and their responsibilities safely. A wide range of safety training initiatives were undertaken including specific training requirements that were provided for in terms of laws and regulations. Specific risk management training included:

- Risk assessment level 1, designed for and presented to all non-supervisor categories. The focus was on hazard identification;
- Risk assessment level 2, designed for and presented to supervisory categories – miner/artisan level. The focus was on hazard identification and included practical exercises on observation and inspections;

- Risk assessment level 3, designed for and presented to supervisory employees. The focus was on issue-based risk assessment.
- Enterprise-wide risk management, designed for and presented to supervisory employees;
- Advanced principles of safety management, designed for and presented to safety practitioners, learner officials and management trainees;
- Safety representative course designed for and presented to all safety representatives, and
- Hazard identification techniques were needs based (Appendix B, AGA 2012).

6.4.2 Gold Fields

Gold Fields established a specialised, on-site training facility using advanced training packages and electronic simulators to produce world-class underground mechanised miners. General and job-specific health and safety training formed part of induction and was reinforced annually through refresher training. Risk-specific training was also provided where needed (Appendix D, GF 2008).

The company rolled out the practice of removing crews, which were experiencing safety problems, from the workface for a day to deliver high quality safety training to all operations.

A Supervisory Skills and Leadership Development programme was introduced to address a number of skills gaps identified through an internal audit including those relating to safe production performance.

A new Operator Training Centre was fitted with an advanced suite of operator, tele-remote load haul dump and drill rig mesh-handling simulators. Surface driving and mining mock-up areas were used to deliver the highest standards of practical mechanised training (Appendix D, GF 2012).

Enhanced safety training for all of underground contractors at the mine was implemented. This included training on:

- Testing for flammable gases;
- Measuring environmental conditions;
- Identifying rock strata conditions that require support, and
- Installing temporary support for drilling and safely removing temporary support after installing permanent support (Appendix D, GF 2013).

Mechanised mining training

At Gold Fields, the lack of experienced mechanised mining skills was one of the largest contributors to the delay in the build-up of one of the mines and this challenge was underestimated in the past. It was further complicated by the absence of a sufficiently deep pool of mechanised mining skills in South Africa.

The skills of operating and optimising of equipment was challenging in a mining culture that was overwhelmingly conventional mining. It was perceived that mining companies and universities would need to work together to develop and train the personnel required in future.

The mine of the future would have a high-level skills set that would lead to a smaller overall workforce. This created a dilemma for many gold miners as adjacent communities relied on them for jobs and procurement.

The mining approach towards mechanisation and automation required the recruitment of the appropriate skills at the mines augmented by the company's own people through focused internal training efforts. An intensified training programme for the existing staff supported this approach (Appendix D, GF 2015).

6.4.3 Harmony

Leadership skills

Harmony embarked upon improving the required leadership skills with the implementation of leadership and training programmes at other levels in the organisation, with the aim of sharing the vision for Harmony. It was important to improve employee morale as it was under threat in an organisation undergoing change. Key non-negotiable principles included:

- Management to lead by example;
- Continuous verbal communication with all team members;
- Visible creation of awareness of safety-related issues;
- Award and recognition of safety achievements, and
- The involvement of all stakeholders (Appendix C, HAR 2008).

Safety literacy

In 2011 safety literacy was previously identified as a material issue. An e-learning programme was subsequently rolled out and approximately 16 000 employees completed the programme.

Most operations were retraining production crews on safe-making practices, with intensified supervision. Some supervisors completed hazard identification and treatment training through the e-learning medium as part of developing leading practice (Appendix C, HAR 2011).

Virtual reality training

Harmony invested in a virtual training system that offered the benefit of familiarising managers and workers with high-risk conditions and training them in the required steps to keep their colleagues safe without physically being exposed to potential falls of ground.

E-learning programmes, which included safety and refresher training, were in place to improve safety awareness. Virtual reality training was implemented to improve risk identification as part of e-learning. Pictorial briefs were also used at shaft level to communicate mine accidents and other safety messages. Harmony's ground-control strategy was converted into draft e-learning format and all blasting certificate holders were earmarked for this training at the different facilities (Appendix C, HAR 2011).

In 2014 the level of skills amongst employees and prospective employees remained of great concern. High levels of illiteracy, often combined with relatively low levels of skills, limited the opportunity for growth and development amongst employees and their progression within the company. Extensive training and development programmes, were offered in adult basic education training, portable skills training and on-the-job training.

Apart from the everyday safety procedures in place engagement took place with employees regularly on the topic through training sessions and open discussions. Management spent a great deal of time in the work place coaching employees on ways to work safely. These conversations were shaped by messages agreed on by management with union involvement (Appendix C, HAR 2014).

6.4.4 Lonmin

The company was committed to an appropriately skilled and diverse workforce as a foundation to the success of the business. There was an ever-increasing demand and competing interests for skilled recruits nationally and within the international mining industry. The development and training of the employees was critical to the establishment of a competent workforce and future leadership for the company. In 2006 human rights training formed part of the induction training for all staff (Appendix F, LON 2006).

Leadership Development Programme

In 2008 the company invested in training programmes and awareness campaigns as it formed an important component of the safety management systems. 118 Employees participated in the six-week Lonmin Leadership Development Programme, 188 employees and 592 community members participated in the Lonmin training programme and 90 supervisors completed the Front Line Supervisory Development Programme.

The initial action taken towards building leadership safety competence in Lonmin was to send the entire executive team and many senior managers, including the Chief Executive Officer, on a DuPont safety management training course. The focus areas for development of leadership was to improve the knowledge of safety, embed the principles of care and integrate safety in the business with the emphasis on the personal commitment to safety (Appendix F, LON 2008).

New training strategy

In 2009 the company developed a new training strategy for the business to refocus the training budget on better value adding initiatives that would help to address skills shortage challenges (Appendix F, LON 2009).

In 2010 the company invested significant resources, time and effort on training and education. Focused on upgrading the safe production training programmes and increased safe behaviour observations. Addressed the behavioural and cultural issues, which were fundamental to a good safety performance (Appendix F, LON 2010).

Simulator training

In 2011 safety training included simulator training for drivers and the toolbox topics were translated into appropriate languages. The skills that identified as those necessary for the development of safety leadership included transparency,

integrity, communication, management style and beliefs (Appendix F, LON 2011).

In 2012 after the extended strike Lonmin invested many hours in safety training before re-opening operations in order to minimise the risk of any safety failures, either underground or in the surface works (Appendix F, LON 2012).

Scarce skills

In 2013 Lonmin continued with individual development programmes, succession planning and retention strategies for scarce skills. There was focus on bursaries, graduate development, mentorship programmes and an Internship programme to assist students who needed to complete their practical work in order to obtain tertiary qualifications and preference was given to HDSA applicants.

Lonmin launched an artisan's training college. The company continued with portable skills development training programs to help drive productivity improvements (Appendix F, LON 2013).

Post-strike training

In 2014 one of the consequences of the prolonged strike was that safe behaviour was potentially unlearned over the long periods away from work. Employees required extensive retraining before they could return underground or to the plants safely. 1 030 Supervisors, managers and team leaders underwent preparatory training on how to engage with returning employees proactively and positively once the strike came to an end (Appendix F, LON 2014).

Safety training

In 2015 safety training formed part of induction for employees and contractors as Lonmin's objective was for every person in the business to have a personal understanding of, and respect for, the importance of safety in the workplace. It

was achieved by entrenching safety principles in the organisation and through increasing visibility on safety matters.

Contributing factors to the increased injuries included similar or repeat injuries occurring, employee behavioural challenges, and frequent safety stoppages. A programme was developed to empower front line supervisors in order to enhance safety and production performance (Appendix F, LON 2015).

In 2016, 1 428 employees were reskilled and redeployed into vacant, more productive roles. Training on safety and health practices was delivered to all employees and contractors at induction when joining the company and when returning from annual leave. The training included risk awareness and controls, the standardised approach to critical tasks and procedures, information on TB, HIV/Aids and nutrition, and section 23 of the Mine Health and Safety Act, No 29 of 1996 (Appendix F, LON 2016).

6.4.5 Implats

Zero Incident Process

In 2015 Implats' executives and all E and D level production managers attended the Zero Incident Process (ZIP) for Leaders training programme. The programme provided managers with insight into the human behavioural aspects of safety and how to influence this in order to achieve improved safety awareness and performance in their subordinates. Safety-related issues formed a key component of the five-day supervisory leadership training course that was provided for managers, mine overseers, engineers and services managers (Appendix G, IMP 2015).

In 2016 Implats' executives and all senior management and professional qualified production managers attended the best-practice ZIP for Leaders training programme. All managers completed a ZIP safety leadership self-assessment

survey every six month, aimed at measuring the perceived safety culture among this group of managers.

All E level production managers undertook a 360° health and safety leadership assessment tool proposed by the Mining Charter guideline, which entailed assessment by subordinates and colleagues (Appendix G, IMP 2016).

Safety Leadership training

Safety Leadership training programmes were embarked on which introduced tools and techniques to assist leaders in engaging employees in safety conversations, interactions, and interventions. It created an understanding that a number of factors influence the safety performance of an organisation.

Over and above skill training, specific training was provided on safety protocols and compliance focusing on safety leadership, hazard and risk management and incident management. Additional safety courses were presented aimed at key groupings. It included:

- At executive level, it focused on a broad understanding of hazards and risks to guide strategy;
- At regional and operational management level it was focused on both scope and detail;
- At supervisory level, it was designed to help supervisors understand what they need to do in the execution of their day-to-day work and to ensure that hazards and risks were understood and managed. Specific tools and techniques were also introduced which supervisors learnt to apply, and
- At operational level it focussed on creating awareness in individuals of what had to be done before starting a task and encouraged a culture of risk awareness (Appendix G, IMP 2013).

6.5 Employee participation

Management, employees and contractors all played a crucial role in achieving health and safety goals. It created awareness and commitment to standards and best practices and kept employees fully informed of their rights and responsibilities in respect of safety and health (Appendix B, AGA 2006; Appendix C, HAR 2011/1; Appendix G, IMP 2006).

Employees were represented at various levels on health and safety committees and on a range of statutory and voluntary engagement forums between supervisors, line managers and organised labour. Agreements governing the management of safety and health, which were negotiated with representative organised labour or were developed with the co-operation of employees, were put in place at all operations. The workforce was represented in formal joint management-employee safety and health committees. Their role was to monitor and advise on occupational safety and health programmes, and hence participate in the management of safety and health through forums created specifically for this purpose.

The operations had safety and health communications programmes in place and a number of the different campaigns were undertaken. Communication tools include meetings, notices and signage, the intranet, mine-based newsletters, safety newsletters, launches and other events, industrial theatre, posters, videos and induction procedures.

Emphasis was placed on the involvement of employees in both safety and health strategy and performance in line with the overall commitment to collective bargaining and employee participation.

AngloGold Ashanti had a dedicated stakeholder engagement plan encompassing the guiding principles which were to:

- Set clear accountabilities for safety;

- Understand and manage hazards and risks, in an ongoing way;
- Engage the workforce in doing this;
- Make the solutions happen by providing resources;
- Have a relentless and broad commitment to safety, within and beyond the workplace, and
- Develop a learning culture to make all of these things happen in reality, not just words.

The ability to promote safe production was supported by the active involvement of the employee representative organisations and unions, host governments and regulators. This included the DMR, which continued to provide guidance on how to improve the safety performance and meet their MHSC health and safety milestones (Appendix B, AGA 2015).

In 2012 Gold Fields held a Health and Safety Summit involving representatives from the national, regional and branch levels of the trade unions, as well as representatives from the DMR. It was agreed that all parties would cooperate in the efforts to carry out social surveys across all of operations to help inform and improve the future safety and health management efforts. The summit established a strong and broad mandate for the safety management efforts to implement enhanced safety enforcement measures across the operations. This confirmed a strong consensus around the updated safety strategy as well as collaborative work on key initiatives such as the management of:

- Fall of ground incidents;
- Rail-related accidents, and
- Dust and noise exposure (Appendix D, GF 2012).

Sibanye believed that mining and the processing of ore involved inherent hazards, which must be understood and effectively managed to eliminate or minimise risk of injury or harm to employees. This was particularly pertinent when it came to ultra-deep underground conventional mining.

Sibanye's approach to safety and health in the workplace was guided by extensive legislation and regulations, the most significant of which is the Mine Health and Safety Act (Appendix E, SIB 2013).

6.6 Safety campaigns

At Lonmin, training and awareness campaigns were an essential component in effectively implementing of the safety management systems. The safety campaigns and emergency response extended beyond the boundaries of the operations, including extensive regional road safety initiatives, the impact of life style on the working environment, and community assistance (Appendix F, LON 2015).

Community Wellness Campaigns

In 2005 Lonmin launched the Community Wellness Campaigns with the aim of creating awareness amongst employees and communities on wellness and to promote voluntary counselling and testing for HIV. The campaigns continued through 2006 and provided community members with a free health assessment and professional advice on treatment options (Appendix F, LON 2006).

The Laduma safety awareness campaign

In 2007 the Mining Division developed a learning map to reinforce safe behaviours and adherence to safety procedures in order to achieve a serious injury free workplace by 2010.

The theme of football was chosen given the popularity of football across the workforce and the nearness of the 2010 World Cup in South Africa. The Laduma campaign was developed based around a soccer match learning map, supporting materials to facilitate discussions between Supervisors and their teams around safety and rewards based on the achievement of certain safety goals. The

programme was rolled out to the mining operations and it showed early signs of success (Appendix F, LON 2007).

During 2008 the company continued with the implementation of the Laduma safety awareness campaign across the business at Marikana. Aspects of the campaign were dramatised through industrial theatre road shows across the Marikana operations (Appendix F, LON 2008).

Tsoka-Vuka-awake campaign

Lonmin rolled out a ten-week 'Tsoka-Vuka-awake' awareness campaign, which was believed to contribute towards a united alignment towards tackling the common safety goals. The Executive Vice President for Mining, who involved the senior management team, initiated the campaign. It was believed that this high level of visible leadership contributed to the success of the campaign (Appendix F, Lon 2010-1).

Prevention of Section 54s Campaign'

The 'Prevention of Section 54s Campaign' evaluated safety performance against six pillars: It included mindset, culture, safety leadership, governance, compliance, and risk assessment.

The campaign indicated the level of achievement in terms of each pillar, what could be done to improve the pillars and ultimately to reduce non-compliances as identified through inspections as per Section 54 of the Mine Health and Safety Act 29 of 1996 (Appendix F, Lon 2010-1).

Safety Calendar Campaign'

The 'Safety Calendar Campaign' linked safety talks to specific safety incidents that were more likely to occur at different times during the year. The calendar directed planned task observations relevant to the seasonal risks. It was believed

that it contributed to a culture shift towards more preventative risk behaviour (Appendix F, Lon 2010-1).

'Aziko Sper' campaign

Lonmin launched the 'Aziko Sper' Safety Campaign to reduce hand and finger injuries. Employees were asked to pledge their commitment to work safely and protect their hands when working with sharp rotating equipment and dangerous chemicals (Appendix F, Lon 2016).

Gold Fields campaigns

Specific high-risk hazards at Kloof and Beatrix were being addressed through the 'Snakes and Big Five', 'Wars on Falls of Ground' and Khuseleka campaigns which were reinforced through the use of industrial theatre (Appendix D, GF 2007).

6.7 Communication

Gold Fields held operation-level Indabas for two-way safety discussions between overseers, supervisors and crews, as well as the development of defined action plans. Monthly 'Shaft Communications' for operations and underground managers were held to engage the entire workforce (Appendix D, GF 2011).

At Harmony safety messages were broadcast on strategically placed televisions throughout the operations. Weekly communication meetings were held between the General Manager and safety representatives. Each General Manager attended monthly safety mass meetings at their operation.

The company ensured that employees felt part of the Harmony family through the value of 'connectedness'. Internal communications were a continuous interactive process and included:

- Regular meetings with heads of departments;

- Work groups and General Manager engagement platforms;
- Mass meetings and quarterly productivity meetings;
- Print, posters, internal newsletters, memos and flyers, and
- Mine television, intranet, website and text messaging as well as other social media.

The Chief Executive Officer communicated regularly with employees by e-mail, at meetings, and during internal roadshows. For employees to be committed, productive and conscientious in their jobs, it was believed that they should feel valued. Harmony ensured that the employees understood their roles within the company and what was happening at the company and in the industry. They were the first to hear important news. Regular employee engagement involved communication both to and from employees. Suggestions made by employees were taken seriously and if necessary were acted upon (Appendix C, HAR 2016).

At Lonmin a cascade communication system was implemented, which was designed to provide direct communication with every employee at every level in a personalized way. The system proved to be a huge success and a feedback loop was developed as part of the cascade process. Lonmin maintained three principal means of communicating with employees, including those not represented by organised labour:

- Lonmin's intranet;
- 'Platinum Conversations', a staff newsletter, and
- The Chief Executive's Newsletter, a monthly letter, translated into four languages, which dealt with safety, performance, operational issues and strategic matters.

The company introduced an internal television network, which proved to be popular. All safety achievements and initiatives were covered comprehensively in the *Weekly Bulletin*, an employee newsletter that promoted and upheld the values of the company.

The importance of safety and the prior day's safety performance were communicated daily to sustain awareness. Weekly safety presentations by mine managers and Chief Safety Officers included a review of all injuries and high potential incidents across the mine, as well as incidents and key lessons from industry peers. Learnings from these incidents were communicated to the teams and followed up with weekly safety briefs and senior management visits (Appendix F, LON 2006-2015).

6.8 Incentives

The companies researched had different incentive schemes. At Gold Fields the operational bonus system was changed to provide for an equal weighting between production and safety performance. This principle was extended to all executive incentive remuneration, with approximately 30 per cent of executive bonus payments linked to health and safety performance, including that of the Chief Executive Officer (Appendix D, GF 2008).

It implemented a mine-wide safety recognition programme to actively reward safe behaviour. Relevant safety targets included in managers' Individual Balanced Scorecards determined approximately a third of their variable bonuses and incentives. This helped ensure that the safety policies and guidelines were 'mainstreamed' into everyday thinking and practice (Appendix D, GF 2011).

In later years, the incentive scheme included a condition that teams would only receive full monthly bonuses in the absence of a single reportable safety incident. It was done to ensure that the scheme did not tempt unsafe behaviour (Appendix D, GF 2012).

This was followed by the inclusion of leading and lagging indicators in the analysis of the safety component of the bonus. The company worked more efficiently to improve productivity due to the restructuring and the smaller more skilled workforce. The key to this was that employees were incentivised to deliver

against clearly defined performance targets that directly supported the achievement of business objectives. The remuneration strategy was changed to attract and retain these skills. The people development approach was amended to ensure company built a robust internal skills pipeline that could supply the skills that the business needs in the future (Appendix D, GF 2015).

At Lonmin SHEC formed an important part of the Group's reward strategy, with all of the senior executive team having a material proportion of their annual bonus based on objectively measured performance against key objectives.

In 2010 a new incentive programme was implemented for production employees to increase the element of variable pay. It delivered significant efficiency improvements most noticeably towards the end of the financial year (Appendix F, LON 2010).

In 2012 employees were recognised and rewarded for good safety performance. Lonmin reviewed the range of reward and recognition programmes in place that rewarded employees for good safety performances, focusing on forward energy and preventive efforts by means of the Lonmin Corporate Balanced Scorecard (Appendix F, LON 2012).

6.9 Mechanised mining skills shortage

6.9.1 Gold Fields

During 2007 the global demand for technical and specialist mining-related skills persisted. It led to a high turnover of trackless mining skills at one of the companies and contractor capacity constraints also impacted on the project. The company had a strong pool of professionals and the need for innovative approaches to attract and retain experienced staff was being addressed with a multi-tier strategy whose main focus area were:

- Exploring a wider range of mentoring support and development opportunities to support skilled employee career development;
- Re-investing in employee benefits infrastructure, such as housing and sports facilities, on mines to support the branding of the company as an employer of choice;
- Re-engineering of skilled employee work flow to refocus skills of individuals on primary functions as opposed to ancillary roles;
- The standardisation and alignment of production bonuses, retention bonuses and artisan market allowances, and
- Large-scale training partnership initiatives.

The lack of experienced mechanised mining skills was undoubtedly one of the largest contributors to the delay in the build-up at South Deep. This challenge was under estimated in the past and was further complicated by the absence of a sufficiently deep pool of mechanised mining skills in South Africa.

A team of mechanised mining specialists joined the mine to embed a mechanised mining culture at the mine. Their key tasks were to improve fleet availability and utilisation, operator and technician skills, and the ore-handling infrastructure.

The company reduced the number of contractors at the mine by replacing them where practical with own employees and implemented enhanced management of overtime. The management team was right sized, and the new operating model was entrenched (Appendix D, GF 2007).

In 2014 the transformation of Gold Fields into a mid-tier producer had a profound impact on the profile of the workforce. It was believed that four key performance areas would be focused on in future to ensure that integrated thinking was further entrenched in the business. These performance areas were: Business optimization; People; Finance and the Social licence to operate.

Gold Fields' transformation required different skills set in that it was pioneering mechanised gold mining on a scale and depth that was new in South Africa, and

the success of the operation was largely dependent on its people. It was planned to develop the staff through focused internal training efforts and to recruit the best local mechanised mining skills to supplement the existing talent pool. The company collaborated with the South African platinum industry in setting training baselines for mechanised mining.

It was imperative for the company to introduce international best practice standards at South Deep. Mechanised mining at depth had limited industry precedent globally and by necessity the operating model continued to evolve as mining processes and practices were refined.

The shortage of mechanised mining skills in South Africa was in many instances responsible for some of the challenges at South Deep. The company placed a strong senior management team with underground-mechanised platinum mining experience in charge of the mine. The management team of South Deep was mandated to set the mine up for long-term sustainable delivery though it would require more time than was originally anticipated. The original long-term targets were relinquished as a consequence (Appendix D, GF 2014).

6.9.2 Lonmin

In 2008 Lonmin implemented recruitment programmes to attract and retain the necessary skills as there was a shortage of skilled workers. The company was successful in reducing skilled labour turnover during the year (Appendix F, LON 2008).

In 2009 there was a general shortage of people with mechanised experience in the industry and this would remain a key area of focus. The scarcity of experienced people nationally and globally meant that the industry was always chasing talent and there was an insufficient skills pipeline to address this. This impacted mainly on the mechanised shaft (Appendix F, LON 2008).

6.10 Women in Mining

In 2014 Sibanye established a task team to develop a strategy to increase numbers of women in mining and the issues they face, including successful integration of women underground as well as personal safety. These issues were monitored by women in mining forums made up of female employees at each operation (Appendix E, SIB 2014).

In 2015 the Implats Women in Mining (WiM) task team met monthly to identify and resolve safety and health issues specific to women. Personal protective equipment (PPE) for women was trialed for its effectiveness and comfort. Implemented awareness initiatives aimed at improving the safety and security of women working underground (Appendix G, IMP 2015).

6.11 Disciplinary process

In 2016 Implats ensured that disciplinary action was taken when there were breaches in safety conditions or behaviours. The disciplinary process was automated where possible, removing a manager's discretion on whether to take discipline action or not. Disciplinary action was monitored and reported regularly, and managers were held accountable (Appendix G, IMP 2016).

6.12 Managing high-risk employees

In 2016 an analysis of various Implats data sets including medical, human resources/ financial, disciplinary, production staff highlighted a number of employees who could be at a significantly higher risk of having or causing a safety incident. Steps were taken to mitigate the level of risk, for example through formal counselling. The data analysis and formal monitoring of identified high-risk individuals was ongoing (Appendix G, IMP 2016).

6.13 White Flag Days

Some companies focused on ‘white flag’ days, which were days that marked no injuries and celebrate the belief in operating without injuries. Daily communication alerts were distributed that summarised the safety performance for the prior day to continuously inform the workforce of the safety performance (Appendix B, AGA 2008; Appendix C, HAR 2012; Appendix F, LON 2015).

6.14 Other safety initiatives

Some of the specific initiatives to augments the companies’ safety drive included:

- Proper start-up procedures through workplace assessments and employees’ medical screening (Appendix F, LON 2013);
- Increased visibility underground through multi-discipline audits and management presence;
- The launch of a number of safety enablers, such as competitions and recognition awards;
- A weekly safety meeting at which all incidents are discussed and analysed;
- A compliance system checklist that ensures work was stopped if a workplace was not fully compliant with safety standards, and
- Ongoing monitoring of the top five accident causes and ensuring appropriate measures were in place.

Training initiatives were rolled out to improve a company’s safety performance, which included back-to-basics training, hazard identification, risk assessments and artisan upskilling.

6.15 Stakeholder relations at Lonmin

In 2008 workforce-related issues were prevalent and there were three one day national strikes during the year. The shortage of skilled workers was an issue, as

international markets and significant national infrastructure projects attracted resources.

Lonmin completed a major restructuring programme across the operations, with all personnel levels affected and around 20% of the total workforce leaving during the year. The restructuring programme impacted employee morale and caused some disruption to production for a large part of the year (Appendix F, LON 2008).

In 2009 the labour environment continued to be a significant influence on the performance of producers, from both a productivity and cost perspective. The shortage of key skills remained an issue for the mining industry in general. With these challenges in mind, Lonmin recognised the importance of employee engagement strategies.

Lonmin management took a number of actions, which aimed to stabilise operational performance, improve the position on the cost curve and preserve cash. An extensive restructuring exercise was embarked upon which resulted in around 7 000 full time employees and contractors leaving the business and reducing of employment levels by some 20%.

The restructuring caused disruptions to operations and the opencast operations at Marikana were closed. Rationalisation of high cost production areas at the underground operations took place and the Baobab shaft at Limpopo was placed on to care and maintenance basis for the foreseeable future (Appendix F, LON 2009).

In 2011 community relationships had been challenging and considerable management effort was going into building a more effective rapport with community leaders. Community unrest experienced at the Marikana Operations resulted in protest action, which highlighted the need to communicate continually with communities to increase understanding.

Poor standards of living and unemployment in South Africa were fanned by resentment of perceived inequality. The Government was increasingly pressured to take action to retain a greater proportion of the benefit of natural resources for local inhabitants.

Safety and labour relations were the two major operating challenges. A part of the operations lost ten production days because of an illegal strike. The incident had severe consequences for a large part of the workforce, however the company was determined to maintain a positive and constructive relationship with the entire workforce.

The biggest challenges to the sustainability of the business included skills shortages and relationships with communities and employees. Considerable management effort went into building a more effective rapport with community leaders. Accelerated investments were initiated to address skills shortages including the training of community members in mining related skills.

An illegal strike resulted in the loss of ten production days and it was the result of an internal union leadership dispute, not through any difference with management. The incident had severe adverse consequences for a large part of the workforce, which resulted in the dismissal of approximately 9 000 employees. Approximately 8 200 of the dismissed employees were subsequently re-employed. Lonmin was determined to maintain a positive and constructive relationship with the entire workforce (Appendix F, LON 2011).

In 2012 the Marikana event, in which 34 killed by police on 16 August but 10 killed in violence at the mine prior to that date lost their lives, was a defining moment for South Africa's. One of the consequences was the establishment of a platform for critical conversations needed about mining and society (Appendix F, LON 2012).

In 2013 the relationships with employees, unions and the communities all suffered major setbacks due to the Marikana incident. It was essential to have openness,

trust and mutual respect to ensure successful stakeholder engagement. In the past, some mining companies delegated much of employee communication responsibilities to human resources practitioners and union leaders, which resulted effectively as abdication of the role as managers.

Lonmin concluded a new Health and Safety agreement with all unions. The company elected new safety representatives and reconstituted the Health and Safety Committees. Lonmin had 12 full-time safety and health stewards and 1 365 safety representatives in the workplace. They represented employees on Health and Safety Committees.

The workforce was represented through these committees to help monitor the safety programmes. Topics and issues addressed through these committees included trauma care, material handling, safety behaviour, leadership and safety as well as fatigue management.

The South African mining industry was at a crossroad for decision making to resolve issues and disagreements before they turn into tension and mistrust and required a new collaborative model to be developed.

Lonmin was committed to a process of fundamental change to rebuild trust with all the stakeholders. Marikana had a six-week long strike, which was marred by violence. The Lonmin Renewal Plan included the safe start-up of the operations, securing corporate funding, and managing costs.

There was a backdrop of the hostilities that existed between rival unions, the breakdown in the relationship with employees, and the difficult economic circumstances that continued to prevail (Appendix F, LON 2013).

In 2014 the company experienced a protracted strike when the majority union downed tools on 23 January 2014 and only returned to work on 24 June 2014 after an agreement was reached (Appendix F, LON 2014).

In 2015 the company started a Section 189 consultation process to engage on implementation of the agreed avoidance measures, which included redeployment and re-skilling and voluntary separations. 3 136 employees of the 6 000 affected positions had left the company (Appendix F, LON 2015).

In 2016 the reorganisation of the business, which commenced in 2015, was successfully completed, with a reduction of 5 433 employees and contractors, and 1 426 people were successfully reskilled and redeployed into vacant more productive roles.

Lonmin experienced no labour disputes or work stoppages during the year which as a consequence of the work both the Management and the unions put into building and nurturing effective relationships. The focus was on continuing to rebuild morale throughout the operations after the reorganisation (Appendix F, LON 2016).

6.16 Absenteeism

In 2008 a Zero Tolerance approach to absenteeism was introduced at Lonmin, which was extensively communicated throughout the business, and focused on increasing awareness that persistent absenteeism would result in dismissal (Appendix F, LON 2008).

In 2014 absenteeism was at 29.3% and a direct result of the strike. The company lost 2.6 million person days due to absenteeism. Employees in the mining operations worked in teams, which affected the ability to function safely and optimally when members were not at work (Appendix F, LON 2014).

In 2016 Lonmin implemented a project to understand and address the challenge of workplace absenteeism. Absenteeism had a substantial impact on safety performance, as it affected the remaining crew members who had to deal with the absence of colleagues. Lonmin initiated a project to identify employees who were

repeatedly absent, counselled them and established the reasons behind poor attendance to address the issue on a comprehensive basis.

Follow-up actions included financial counselling, and support through the employee wellbeing service among others. Workshops were held with employees and AMCU to highlight the consequences of absenteeism, both for employees and for the company.

The company was moving towards finding solutions jointly with the employees and automating the collection and analysis of absenteeism data in real time to monitor the effectiveness of joint interventions implemented. Measures already in place to address absenteeism included linking attendance to bonus payments and the use of buffer labour crews (Appendix F, LON 2016).

6.17 Employee wellness

Gold Fields adopted an all-inclusive approach to the general wellbeing and productivity of the staff. A broad range of interventions encapsulated in the '24 Hours in the Life of an Employee' programme based on the Total Well-being Philosophy was pursued. This inclusive approach, including occupational safety, resulted in co-operation on all safety-related matters from the vast majority of the employees, contractors, leadership of the employee representative organisations and unions at the mines and the government.

The approach was aimed at improving every facet of the life of each employee and interventions included, occupational health and safety. healthcare. living conditions. nutrition. sport and recreation as well as education.

The programme was aimed to combat the impact of diseases and encouraged a healthy lifestyle. Accidents were more likely to occur if the employees were unwell as a result of occupational and other diseases (Appendix D, GF 2009)

At Lonmin the wellbeing of the employees remained crucial and the company extended the nutrition programme from three days to five days a week in support of this. Health and wellness were integrally linked to quality of life, morale, productivity and safety performance. The overall health and wellness of an employee was the outcome of a host of factors, many of which arise outside the workplace. Lonmin's safety awareness and healthcare initiatives include many programmes that extend into the host communities.

The company also piloted a project to assess the impact of daily nutritional supplements on employee wellbeing and to determine whether this has a positive impact on absenteeism (Appendix F, LON 2016).

6.17.1 Fatigue management

At Lonmin sleep disturbance and sleep deprivation, and the resultant fatigue, were health risks associated with long working hours or shift work and clearly could have negative consequences for occupational safety (Appendix F, LON 2011).

In some of the companies' workplaces were analysed in terms of empirically determined 'fatigue factors'. Factors analysed include nature of work, travel distance, degree of physical strain and workplace temperature. The analysis was envisaged to be an ongoing process, as working places and conditions changed continuously during mining operations (Appendix D, GF 2012).

Employees were also individually assessed to determine whether they resided in a mine hostel or local community, wellness and lifestyle factors. The comprehensive fatigue management programme focused on issues such as proper nutrition, prescribed rest periods and control of overtime.

6.17.2 Testing for alcohol and drugs

Over the years the companies significantly increased testing for alcohol and drugs. Drugs testing were extended to employees involved in the conveyance of

ordinary materials and goods as well as work involving heavy or potentially dangerous machinery. The testing programmes were supported by employee training on the effects and consequences of alcohol and drug abuse, as well as the available support on offer including through the Employee Assistance Programme (Appendix D, GF, 2011:Appendix F, LON 2011; Appendix G, IMP 2016).

6.18 Summary

The human being is the in interface between the strategic intent of a company and reality. The capacitation of management and employees alike is crucial for individuals and teams to operate at the appropriate level and to reduce risk exposure in the working environment. Safe behaviours start at the top of the organisation to ensure that the company culture embodies the 'Zero Harm' intent. This is achieved by the involvement of organised labour to co-create the culture.

Behavioural safety is a sub-set of the safety culture of the company. Safe behaviour is mostly achieved by the actual application of the appropriate technical training when required in a situation where the individual or team is exposed to risk.

Wellness in the workplace is an important part of safe behaviour in that fatigue, diseases and other community related issues can influence and individual's ability to recognise danger and how to deal with it.

The companies researched expended significant efforts to capacitate individuals to enable them to have safe behaviours. The integrated approach includes:

Management

- In most of the companies, the Chief Executive Officer set the organisational tone to strengthen the safety culture and demonstrated leadership commitment to safety, and

- Some senior leadership attended international best practice training, which resulted in improved communication processes and increased safety awareness amongst employees.

Organised Labour involvement

The involvement of organised labour is an important component of the collective buy in of mine employees to ensure enable safe production. It included:

- Safety agreements with the union representative of the majority of employees was available as required by the Mine Health and Safety Act of 1996;
- Some companies established tripartite health and safety committees with the purpose to bring together management, organised labour and government representatives on matters of safety and health so as to create consistency of standards, to ensure clear roles and responsibilities, and to establish a mechanism for the monitoring and evaluation of compliance;
- Procedures were available for employees to exercise their rights to withdraw from circumstances that they perceive to be dangerous;
- Training of safety and health representatives;
- Procedures were available for the resolution of disputes relating to safety and health, and
- Participation of organised labour in incident investigations;

Contractors

- The safety of contractors at Lonmin was managed using a contractor management framework which set the basis for industry collaboration through standardisation and reciprocity opportunities.

Training

- Supervisory Skills and Leadership Development programmes were introduced to address a number of skills gaps;
- Virtual training offered the benefit of familiarising managers and workers with high-risk conditions and training them in the required steps to keep their colleagues safe without physically being exposed to potential falls of ground;
- Safety literacy e-learning programme was rolled out;
- Mechanised mining training was conducted;
- The provision of appropriate risk management training was essential to ensure that employees were competent to carry out both their duties and their responsibilities safely, and
- Occupational environment as well as health and safety training were incorporated into technical training programmes.

Behaviours

- One of the leadership imperatives to achieve 'Zero Harm' included the expectation that leaders lead by good personal example and that their conduct reflected living the company values;
- Management initiated safety shutdowns at the operations as part of the drive to 'Zero Harm', in order to ensure safe production at the operations.
- 'Critical safe behaviours' were developed in collaboration with the HSE representatives;
- The focus of behavioural safety was for the individual worker to execute a task as per the standard operating procedure and to do all the checks and balances to accomplish the task at hand successfully, and
- The enforced intolerance of non-conformance with safety standards and the issue of zero tolerance around non-compliance was non-negotiable as many fatalities had a non-compliance connotation of some sort.

Communication

- Awareness campaigns were an essential component in effectively implementing of the safety management systems;
- Indabas were held for two-way safety discussions between overseers, supervisors and crews, as well as the development of defined action plans;
- Monthly ‘Shaft Communications’ for operations and underground managers were held to engage the entire workforce;
- Safety messages were broadcast on strategically placed televisions throughout the operations;
- Weekly communication meetings were held between the General Manager and safety representatives, and
- Some companies focused on ‘white flag’ days, which were days that marked no injuries and celebrate the belief in operating without injuries.

Women in mining

- The development of strategies to increase numbers of women in mining and the issues they face, including successful integration of women underground as well as personal safety.

Community wellness

- Many of the safety awareness and healthcare programmes were expanded into the communities around the operations, and
- The employees' home environments could have an effect on safety, as a result of stress, substance abuse and fatigue to prevent incidents and occupational health risks.

Absenteeism

- Absenteeism had a substantial impact on safety performance, as it affected the remaining crew members who had to deal with the absence of colleagues.

Fatigue management

- Sleep disturbance and sleep deprivation, and the resultant fatigue, were health risks associated with long working hours or shift work and clearly could have negative consequences for occupational safety.

Alcohol and drugs

- The companies significantly increased testing for alcohol and drugs.

Managing high risk employees

- Production staff highlighted a number of employees who could be at a significantly higher risk of having or causing a safety incident.

Compliance and audits

It is important to ensure strict compliance for the standards, systems, processes and work methods in order for it to be effective. Some of the initiatives included:

- Internal and external audits were conducted to provide the assurance that policies, standards and procedures were implemented at operational level;
- Second and third-party audit teams, tasked with conducting independent on-the-job observations and investigations of Lost Time Injuries;
- ‘A Zero Harm’ task team was used to investigate serious incidents and to ensure that recommendations were implemented to prevent recurrence;

- All fatal accidents were investigated independently of mine-based and statutory investigations using a specially assembled team convened and followed up by a formal executive review;
- High Potential Incidents were reported in an effort to enhance organisational learning and to establish a broader basket of leading and lagging safety performance indicators;
- The incident investigation process was used to learn from incidents and to manage it proactively, and
- Safety officers visited each workplace on a 21-day audit cycle.

Disciplinary processes

- Disciplinary action was taken when there were breaches in safety conditions or behaviours.

Incentives

- The companies researched had different incentive schemes which included a portion for safe performance.

6.19 Conclusion

Research finding 4: Humanise the safety system to transfer relevant knowledge and establish behaviours of all individuals throughout the organisation to enable the achievement of 'Zero Harm'.

The approach to operationalise the safety management system by reducing the workplace risks throughout the organisation to enable the achievement of 'Zero Harm', as the next step, is shown in Chapter 3-Figure 21, and is discussed in Chapter 7.

7 OPERATIONALISE THE MANAGEMENT SYSTEM

The safety outcome deserved by a company is essentially by design in that the exposure to risk by individuals should be minimised through active risk management. It is only through definite actions taken to reduce the risk exposure that the strategic intent will manifest itself in reality. Policies, processes and methodologies needs to be operationalised through competent trained people to ensure that the residual risks of any process are such that the correct behaviour of people will result in the safe execution of the task which will result in 'Zero Harm'.

7.1 Removing employees from risk

All mining groups in the appendixes focused on the principle of physically removing employees from high-risk areas and activities in the workplace as this is where the real difference in risk exposure is made. There are many risks associated with mining as it is a dynamic process and is ever changing where most of the underground mineworkers are employed in the stope face.

There is a need to fundamentally review the ways in which to physically remove people from the greatest areas of risk exposure. A priority is to get a better understanding of people, the way they work and the way in which to change the way that work was done as a safe working place is a productive working place in the long run.

A significant advancement in technology is required if the current or similar mining infrastructure is to be used in future for deep level underground mining. In the interim it is important to remove people from known areas of significant risks such as remnants or seismically active areas which cannot be managed to be within an acceptable risk bearing regime. The only way in which it could be sustained is to radically change the way mining is done, by using technology that

would assist in mining remotely from the area of potential danger or stop the mining in known high risk areas.

The workforce is older than it has ever been, and less physically fit, with illness and fatigues a factor as it is estimated that up to 30% of the workforce is infected with HIV. Conventional mining tasks make for strenuous work for the well and physically fit and more onerous for those who are not well and physically fit (Appendix B, AGA 2007).

Knowing and accepting these facts is an important driver in the development of in-stope conditions that are more comfortable and manageable, and ensuring that the jobs that people do are less onerous and physical demanding. Technology such as improving ventilation, cooling systems, transport to the working places, and lighter and more mechanical processes are important aspects in designing sustainable solutions.

The engineering out of safety risks should be a key priority in order as the failure of most mining activities where strict compliance to known protocol is not adhered to invariably fails to dangerous. This is consequence is opposite to electricity that fails to safe, in most instances, in abnormal situations.

7.2 Improving the working environment

In 2007 Harmony's management paid greater attention to ensure that everything that a stope team needed to have in place was actually in place. It included logistics, systems and people, appropriate environmental conditions and attending to employees' wellbeing. The company provided better transport for employees, right up to the place where they worked (Appendix C, HAR 2007).

Lonmin was characterised by a culture of a safe working environment and had the core value as 'Zero Harm' to the employees and contractors with a strong focus on the wellbeing of the employees (Appendix F, LON 2007). The company aimed

to provide a safe working environment for all of its employees, contractors and the communities the company operated in (Appendix F, LON 2016).

In 2008 while the workforce at Harmony was motivated to become involved in taking responsibility for their own safety and that of their colleagues, a key management focus was to improve underground conditions. Emphasis was placed on those areas that were deemed to be of the highest potential risk, which included shaft infrastructure and physical conditions in the workplace. The focus was on compliance with standards, the monitoring and management of ground conditions and improving logistics to and from the workplace (Appendix C, HAR 2008).

AngloGold Ashanti was responsible for seeking out new and innovative ways to ensure that the workplaces were free of occupational injury and illness. All employees lived each day for each other and used their collective commitment, talents, resources and systems to deliver on the most important commitment to care (Appendix B, AGA 2008). The company focused on creating the safest possible working environment for employees (Appendix B, AGA 2009).

In 2009 Gold Fields understood that the safety culture and performance had to change radically. The commitment to eliminate all serious and fatal accidents on the mines and that *'if we cannot mine safely, we will not mine'* (Appendix C, GF 2008 page 10), was reconfirmed by the board. The objective was to achieve a zero harm working environment for all of the people. All the stakeholders including contractors, suppliers and unions embraced the new safety philosophy (Appendix D, GF 2009).

The leadership and management of Gold Fields remained committed to its quest for 'Zero Harm' and maintaining a safe and healthy working environment for all employees (Appendix D, GF 2010). It was a key compliance issue for the company to maintain safe and healthy working conditions (Appendix D, GF 2014). Behaviour-based incident management and the strict enforcement of safety standards continued to be the pillars on which the company relied to improve

working place physical conditions and address at risky behaviour (Appendix D, GF 2016).

In 2014 physical barriers were in place at Harmony to eliminate risk and exposure to harm at the operations. Fatal risk control protocols were being developed and implemented, especially for rail-bound equipment and falls of ground. Infrastructure and equipment maintenance remained a daily focus at all the mines (Appendix C, HAR 2014).

Sibanye's vision was that every employee had the right to a healthy and safe working environment (Appendix E, SIB 2013). In 2014 the Sibanye management was conscious about the use of technology to improve working conditions and provide a safer working environment. It was about responsibly maximising production while promoting a safe and healthy operating environment and culture as well as upskilling employees. The company focus was on establishing a safe, production friendly operating environment, through the ongoing implementation of the health and safety strategy and initiatives to reduce risk in order to achieve 'Zero Harm' (Appendix E, SIB 2014).

The Implats intent to create safe working environments remained the focus of the commitment to 'Zero Harm' in the longer term and it was believed that this would be achieved, with the commitment from every one of the Implats team. It was believed that a zero-harm working environment could only be achieved if all parties involved in the production processes, including suppliers and contractors as well as the employees and management, buy into a shared safety culture and live that culture every day (Appendix G, IMP 2012).

The DMR adopted a more aggressive approach at Implats to dealing with serious safety incidents and fatalities in the mining sector, in response to what they perceived as the mining sector's failure to take more seriously their obligations to provide safe working environment for their employees and contractors (Appendix G, IMP 2012).

7.3 Mining methods

7.3.1 Lonmin

In 2008 the mechanisation strategy at Lonmin changed as it failed to significantly improve productivity from the two fully mechanised shafts. The company switched to hybrid mining at Saffy shaft, where conventional stoping methods were introduced, whilst maintaining mechanised development. This conversion process presented some challenges in that the shaft's development footprint was specifically designed for mechanised mining.

The upgrading of the infrastructure of the shaft, including the installation of ore passes and drop raises rectified it. The mining layout was designed for mechanised mining and had to be re-aligning to better suit conventional mining methods. The company faced challenges in the recruitment and training of skilled crews to adapt to the change in mining method.

At Saffy shaft productivity improved mainly as a result of substantial management effort and focus as well as the utilisation of the extra-low profile equipment. Management also focused on improving operator and supervisors' skills, as well as upgrading management operating systems. Significant changes were made to the shaft's mining layout and upgrading the shaft's infrastructure by implementing a new communication network backbone, installing new strike conveyors and constructed a new maintenance workshop at the shaft. Team-work and trust within these new crews ensured that Saffy's workforce remained stable and maintained the shaft's strong safety culture.

The K4 shaft was developed as a hybrid mine when it was planned to come into production in 2010. Hossy shaft continued to operate as a fully mechanised shaft while continuing to achieve satisfactory levels of productivity (Appendix F, LON 2008).

In 2009 Lonmin was in the fortunate position of having access to relatively shallow reserves and resources. It was recognised that the mines in the area would continue to deepen over time, with many of the easier to access reserves becoming steadily depleted. This was expected to have a consequent impact on industry costs, grades and recoveries in the future (Appendix F, LON 2009).

In 2010 Hossy shaft continued with the fully mechanised proof of concept project and the key drivers to the improvements were enhancements to the mining layout and infrastructure and equipment upgrades.

The management structure at Marikana was revised into four discrete business units, which would improve accountability and help drive performance. Saffy continued to perform extremely well, despite the multiple challenges faced by shaft management in converting from fully mechanised to hybrid mining during the year. The mechanised mining team faced challenges around machine reliability, the availability of replacement parts and the supply of trained artisans. The company had ongoing programmes to address these issues (Appendix F, LON 2010).

In 2013 the Saffy shaft production was slower than planned as it continued to face poor ground conditions and followed a process of stringent roof support systems. Hossy shaft increased tonnes, despite continuing challenges relating to machine reliability, the availability of replacement parts and retention of trained artisans, which negatively affected the mechanisation of this shaft. The introduction of hybrid mining continued to deliver positive results. The roll-out of the hybrid crews was further pursued.

The Theory of Constraints management philosophy was used to debottleneck Rowland Shaft. The programme delivered promising production output, which increased towards year end. It was planned to integrate this philosophy into the mining operating model to be rolled out to all operations. The best practice teams had undergone extensive training and assisted in the roll-out.

The company investigated alternative shift cycles to the eleven-day per fortnight shift cycle that would be advantageous for all stakeholders. A number of options were investigated and those that had the greatest probability of success were further refined for consultations with the unions during 2014 (Appendix F, LON 2013).

7.3.2 Implats

In 2006 conventional mining volumes declined with the move to mechanised mining. Mechanised production using low trackless mining vehicles accounted for 13% of total production at Impala in 2006, with 76% and 24% of production from 12 and 14 shafts respectively being achieved. Investigations and trials into ultra-low equipment, including the ultra-low profile drill rig and the ultra-low load haul dumper for use in stoping widths of less than 1.3 metres continued.

At Marula Platinum the initial mining plan was modified, and the mining method was in the process of being converted from mechanised to conventional stoping. Interim production was by means of hybrid mining, a combination of both conventional stoping techniques and mechanised cleaning assisted by an ore conveyor belt system.

The change-over to owner mining was successfully completed and a key aspect of this process was training, particularly with regard to safety and the implementation of group safety principles which went hand-in- hand with this process. The winches, in-stope roof-bolting and drill jigs necessary for the transition to conventional mining were successfully installed. Around 70% of all stoping was done using drill jigs.

At Marula, the conversion from mechanised mining to conventional mining was on schedule. Drill jig technology was being implemented, with improved rates of advance being achieved. Employee acceptance of the drill jig technology was good, as locally sourced employees did not have previous mining experience and did not have to change from previously learnt methods of operation. Emphasis

was placed on a team-based approach to drill jigs. Record footwall development and advances were achieved. Maintenance problems of the mechanised fleet and poor ground conditions caused a number of delays in the second half of the year. An underlying challenge in developing a mine was that the locally drawn workforce were largely unskilled. Many of the employees, some of whom who were in their mid-30s obtained employment for the first time ever. Training and skills development remained a priority, including capacity building within the new union structures.

At the Leeuwkop project additional evaluation work was undertaken on the project, which indicated that mechanised footwall development with conventional stoping would be more suitable for the orebody than the mechanised bord-and-pillar mining method originally proposed. The new mine plan was based on conventional mining methods which involved less risk (Appendix F, IMP 2006).

New supervisory structures were put in place to ensure targeted production was met. It included dedicated development sections, better contractor management and enhanced team productivity. The latter was addressed by implementing best-practice initiatives. It was estimated that it would take two years to restore on-reef/off-reef development to the correct balance.

7.4 Mining flexibility

In 2009 limited face availability at Impala resulted in a lack of mining flexibility. The decline in volumes was also attributed to poor operational efficiencies due to the failure to complete the mining cycle, which was compounded by safety stoppages and poor discipline. This situation was further exacerbated by the slower than anticipated ramp-up of the decline shafts.

The development of the declines was undertaken in the late 1990s as a capital-efficient way to access deeper mining areas in an environment of limited capital. However, it proved difficult to operate due to the fact it was linked to existing operational shafts.

Team efficiencies and productivity were impacted by the introduction of new teams to the conventional mining section as well as safety stoppages and industrial action during the year (Appendix G, IMP 2009).

In 2007 AngloGold Ashanti's production flexibility depended on the availability of enough face length. It was to ensure that sufficient working panels were available to allow for adequate equipping and the availability of replacement panels when required.

All the South African operations, with the exception of Mponeng, had a reduction in available face length since 2005, which resulted in reduced production flexibility. There was not a quick fix solution available, which would result in available face length. Projects commenced at the effected mines to plan for adequate development, which would ultimately result in the creation of additional face length. Closer integration with mineral resources management forums was pursued (Appendix B, AGA 2007).

7.5 Pillar and remnant mining

In 2008 a comprehensive review of all pillar and remnant mining across all operations was undertaken at Gold Fields. Extensive work was done to reassess design criteria used to assess pillars and remnant areas before a decision was made to mine these areas. The pillar mining at Driefontein and Kloof were reduced by 25 and 50 per cent (Appendix D, GF 2008). In 2009 Kloof adopted a more prudent approach to pillar mining in that identified remnant pillars were comprehensively analysed and approved by the Rock Engineering Department before any mining took place (Appendix D, GF 2009).

The Safe Technology department at Sibanye assisted with safety-related projects and mining innovation projects. The mechanised pillar extraction aimed at enabling the extraction of increased mineral resources that were contained within

strike and stability pillars at the gold operations of Sibanye (Appendix E, SIB 2014). Production trials of strike-and-dip pillar reef boring at Sibanye netted positive initial results (Appendix E, SIB 2015). High-efficiency, remote and low-cost mining systems would allow access to previously inaccessible mining areas defined as ‘white areas’ on the plan, low-grade areas, those below-infrastructure, stability pillars and sections that were inaccessible owing to seismicity (Appendix E, SIB 2016).

When mines get back into previously abandoned areas to continue mining, it would increase the company’s risk and questions the risk appetite as pillars that were too risky to mine previously have become acceptable. The adage that danger is a reality, but one’s fear is a perception of future potential outcomes and can be managed, comes to mind.

7.6 Seismicity

Underground tabular hard rock mining at depth is intrinsically hazardous, and technically challenging. The heterogeneous composition of the rock mass in which mining is to take place is predetermined by nature and not under the direct control of the mining engineer (Jager and Ryder 1999).

While high standards of strata control and support are available in order to manage rock mass energy release, the implementation thereof is not always met. The host rocks are generally strong but brittle and the exposed rocks are highly fractured which could result in falls of ground. Significant faulting are encountered and the negotiating thereof during mining poses rock engineering challenges (Jager et al 1999).

Deep mines are subjected to significant rock stress which results in a high incidence of seismicity and rock bursts. A seismic event is a sudden release of strain energy when the stress exceeds the strength of the rock mass. The resulting emission and radiation of kinetic energy in the form of ground vibrations causes a sensible ‘shock’ or tremor. The result of a seismic event of sufficient magnitude

could cause damage to excavations and support or widespread simultaneous falls of ground (Jager et al 1999).

Rockburst is a kind of artificially induced disaster by mining excavations, and it basically involves a process of energy accumulation, evolving and abrupt release of accumulated energy. The energy for rockburst occurrence basically comes from mining excavation induced disturbance. Therefore, the mechanism of rockburst based on disturbance energy induced by mining excavation is a scientific understanding for engineering practice (Meifeng 2016).

The long term viability of deep level mining will revolve around the further development of stricter application of practical and cost effective procedures aimed at rock related hazards (Jager et al 1999).

There are three types of mining-induced seismicity:

- Failure at pre-existing geological weaknesses such as faults, dykes and joints which results in medium to large events often far away from workings;
- Failure of the intact rock mass in the form of shear fractures that results in larger events close to workings, and
- Localised bursting or failure of hard, brittle rock types often referred to as strain-bursting or small events at the working face (Appendix B, AGA 2004).

When one considers that recurring accidents resulting from seismicity, falls of ground are generally not random events, but they occurs due to local circumstances. The aforementioned hazards are continuously present as the rock is being blasted and the subsequently release of energy is significant. It is therefore important that the causes of these potentially harmful activities be well understood and managed. The underground environment in which ‘miners’ are expected to operate in is essentially created by others that are not necessarily

exposed to the risk themselves. It is known that in deep level mining more potential energy is present which could be disastrous through the unexpected release thereof.

The sudden release of strain energy when the stress exceeds the strength of the rock mass which results in a catastrophic rock mass failure, known as mining induced 'seismicity', is a consequence of mining and not the cause of the incident. The controls instituted to manage these occurrences include the mining method, pre-conditioning of the ground, blasting methodology, centralised blasting, re-entry period, local and regional support requirements.

The mining companies adopted a holistic approach to *rock mass management* which included the use of sophisticated seismic and rock mechanics technologies to understand and manage this risk. Modifications to mine layouts and support technology is part of the effort to minimising the incidence and consequence of catastrophic *rock mass failure* which is a *mining induced* seismic event.

It was thought that the only way in which mining in seismically active areas could be sustained was to radically change the way mining was done. Consideration was given to use technology that would assist in mining remotely from the area of potential danger.

The behaviour of management and designers of mining in seismic areas relies significantly on knowledge. In the instance where there is an unknown lack of knowledge of a specific aspect of managing seismicity, it will manifest itself in the realising of the risk that it was intended to control. The resultant behaviour of managers and designers could then be classified as having made a mistake due to the lack of knowledge. However, if the lack of knowledge is known to management and designers and inadequate controls are instituted, the behaviour will be that of a routine violation.

7.6.1 AngloGold Ashanti

Seismic activity was of particular concern to the gold mining industry in South Africa as it has traditionally been a major cause for fatalities. (Appendix B, AGA 2001/2). The company adopted a holistic approach to the management of seismicity at its deep level mining operations in the South Africa region. Sophisticated seismic and rock mechanics technologies were used to understand and manage this risk. Modifications to mine layouts and support technology were part of the effort to minimising the incidence and impact of seismic activity, that could cause employee injury and death as well as substantial damage to AGA's operations.

It was a requirement to remove people from those areas know to present the greatest potential risk, particularly stopes and near shaft pillars. The only way in which mining in these areas could be sustained was to radically change the way mining was done. Consideration was given to use technology that would assist in mining remotely from the area of potential danger.

AngloGold Ashanti also conducted its own research through the Technology and Innovation Fund which focused on developing and implementing knowledge, rather than on fundamental research, on issues, which were specific to operations in the South Africa region. This research and development was over and above that undertaken by the industry as a whole and government (Appendix B, AGA 2004). Rock engineering related projects overseen by the fund included:

- Investigation into the development of support systems that could be transported by pipeline, e.g. packs superfill and shotcrete;
- Development of technology for the rapid dissemination of seismic data via the intranet;
- Optimisation of the daily seismic hazard rating system;
- Development of a testing and quality assurance programme for support, and

- Integration of rock engineering audit data into the integrated risk management system.

The AngloGold Ashanti mines were equipped with modern seismic monitoring systems. These varied from mine-to-mine, depending on the extent of the seismic problem. ISS International, a leader in the development and manufacture of seismic systems as well as seismic research and analysis, ran the seismic networks on a contract basis and provided a 24 hours per day service in terms of network management and analysis. Seismic information was used in terms of short, medium and long-term seismic hazard assessment as well as for back-analysing the effectiveness of different mine designs and layouts. The performance of different support types is also monitored (Appendix B, AGA 2004).

At Mponeng, an AngloGold Ashanti mine, mining took place to a depth of 3 800m. The mine implemented several strategies to reduce the incidence and effects of seismicity. These resulted in a 70% reduction in the number of potentially damaging seismic events per square metre mined since 1996, and a 75% reduction in the seismic-related lost-time injury rate since 1998. The strategies adopted consisted of three main areas: mine design (prevention), support design (protection) and monitoring.

Protection included the adoption of smaller mining spans between dip-stabilising pillars and the reintroduction of backfill. Better quality extraction sequences and the control of inter-panel leads and lags were implemented. It also included the introduction of a more dense, elongate-based support system to improve ground conditions.

Monitoring consisted of the strata control auditing system that ‘closed the loop’ between design and implementation, ensuring better compliance with support standards and layout rules. The system involved up to eight auditors visiting stopes daily to measure support spacing and monitor other potential hazard indicators. This information was entered into a database and supervisors were

informed immediately of sub-standard implementation to enable corrective measures to be taken as speedily as possible. Follow-up audits ensured that all hazards were dealt with (Appendix B, AGA 2004).

In 2011 the VCR shaft pillar and ore pass development at Tau Tona were abandoned due to a change in the mine plan resulting from safety-related concerns following seismic activity (Appendix B, AGA 2013).

7.6.2 Gold Fields

In 2008 the pillar extraction risk assessment was established based on a set of parameters, including average pillar stress, energy release rate, width to height ratio, and geological features. The ongoing monitoring of risk parameters was conducted during the pillar extraction period in order to withdraw employees should the risk factor exceed the acceptable level (Appendix D, GF 2008).

A study was conducted to determine the ground conditions that led to injuries in the event of different peak particle velocities caused by a seismic event. The outcome of the study was used to optimise the design of different support configurations and to further reduce exposure to high risk geological features (Appendix D, GF 2013).

In 2009 Gold Fields introduced a Seismic Task Team, comprising of both internal and external experts to study and advise Gold Fields on six priority activities aimed at reducing the prevalence and impact of seismic-related incidents. The priority areas were:

- Operational control to standards;
- Mine layouts and support systems;
- Estimating and managing risk;
- Modelling rock responses to seismicity;
- Seismic data collection;
- Processing and analysis, and

- Support to rescue operations.

Driefontein and Kloof Mines had underground geophones equipped with three-way sensors detected seismic events that sent the data through to a centralised control room, alerting the Seismic Task Team whenever a potentially dangerous seismic event occurred. The Seismic Task Team made great strides in quantifying the risk associated with seismicity and put strategies in place to reduce the exposure of Gold Fields' workers to seismic events. The team analysed the data to determine a more precise location within a 30 meter margin of error, before sending this information through to the shaft at the mine where the event took place. The entire process could take as little as three minutes and actively saved lives (Appendix D, GF 2009).

Gold Fields implemented centralised blasting, whereby all blasting took place during a specific time window when there were no workers underground. Research showed that seismic action was directly related to blasting activity and that 70 per cent of seismic events occur within two hours of blasting, so this strategy drastically reduced the exposure of the workforce. This was instrumental in reducing the operations' fall-of-ground (FOG) injuries by 38 per cent and a reduction of 82 per cent in the number of seismic related fatalities, from 11 in 2009 to two in 2010. Additionally, the recommendations resulted in a 65 per cent reduction in all seismic-related injuries and an improvement of 82 per cent in the number of seismic-related fatal injuries, from 11 in 2009 to two in 2010.

These major advancements were the result of the combined efforts of a team of highly qualified and experienced mining seismologists, and some of the best seismic systems in the country, all stationed at Gold Fields' Seismicity Laboratory at Driefontein (Appendix D, GF 2010).

In 2011 the Seismic Task Team continued to play a leading role in minimising underground risks within the existing operations, by pre-warning mining teams of potential seismic-related falls of ground and enhancing the blasting scheduling and techniques to minimise safety risks. The positive impact of the Seismic Task

Team remained evident. Some of the initiatives pursued included the elimination of night shifts, where the mining layout and configuration could result in elevated risk.

Although there was a short-term increase in fatal seismic fall of ground incidents from 0 in 2010 to 5 in 2011, the overall trend showed significant improvement, falling by 16% since the Seismic Task Team was formed in 2008. This was reflected in the long-term fatality trends and was making an important contribution to the journey towards 'Zero Harm'.

A particular focus of the efforts was the mitigation of fall of ground and seismic-related incidents through initiatives such as centralised blasting, pre-conditioning, selective cessation of night shifts, and continuous improvement and innovation in seismic monitoring (Appendix D, GF 2011).

In 2016 the number of seismic events at South Deep registering above one on the Richter scale increased from 73 in 2015 to 101 in 2016 (of which six were over two on the scale) as the mine accelerated its ramp-up. Despite the average energy released per seismic event dropping, the mine intensified its efforts at improving its forecasting abilities. The company engaged with 12 consultancies and institutions, including the Institute of Mine Seismology and the Council for Geoscience, to monitor, understand and mitigate against seismic underground events (Appendix D, GF 2016).

7.6.3 Sibanye

Some of the initiatives that Sibanye introduced to reduce the impact of seismicity included the pre-conditioning of rock before stoping commenced. It entailed drilling longer-than-normal holes and time-detonating explosives ahead of the scheduled blast to allow for fracturing of the rock at the face, consequently releasing energy within the rock mass. This reduced the likelihood and/or impact of strain bursting while employees were working on the panel. Ongoing mine-

planning reviews were conducted to ensure the minimisation of high-risk concentration of mining; Centralised blasting was done during a narrow time window to minimise the exposure of crews to seismicity during shift times; Regular seismic hazard assessments were conducted allowing for the temporary withdrawal of crews and the night-shift activities were stopped in some isolated areas that had a high night-shift seismic-risk profile (Appendix E, SIB 2013).

Sibanye believed that advanced mining systems would enable a drastic increase in the convertibility and sustainability of Sibanye's resources. High-efficiency, remote and low-cost mining systems would allow access to previously inaccessible mining areas such as 'white areas,' on a plan, low-grade areas, those below-infrastructure, stability pillars and sections that are inaccessible owing to seismicity (Appendix E, SIB 2016).

7.6.4 Harmony

In 2008 Harmony was committed to ensuring a safe working environment for all employees and placed the utmost importance on the monitoring and pro-active management of seismicity in an effort to reduce seismic activity, injury and damaged caused by seismic events. The incidence of seismic activity declined during the year and could be attributed to the reduction in the mining of more stressed areas following final extraction as well as the implementation of pro-active seismic interpretations.

Routine seismic monitoring enabled seismicity to be quantified and provided a tool to assist in the control of potential rock mass instabilities that could follow as a result of seismicity. When undertaking risk assessments at potential future mining sites, seismic monitoring was an essential component of Harmony's production planning and risk management strategy.

Harmony put systems in place to enable the monitoring of seismic activity at its operations. Seismometers that registered ground motion were strategically positioned underground at all seismically active mines. The high-level of quality

control on seismic data acquisition and a diligent and reporting database assisted greatly with the pro-active management of seismicity. The seismic activity monitoring system was upgraded on a continuous basis to ensure that it was kept abreast of emerging technology. The system and the seismic data it produced were frequently audited to ensure absolute effectiveness and accuracy.

All seismicity recorded by the seismometers was processed and analysed daily after which detailed reports were produced and sent to rock engineers and management on these mines to assist with planning. The emphasis was on ensuring the safety of the employees. Each mine was rated according to the number of potentially hazardous events recorded as well as the severity of damage experienced during the previous year (Appendix C, HAR 2008-1).

In 2014 an increase in seismicity in one section of the Unisel mine necessitated a change to the regional support layout, resulting in reduced face length. At Steyn 2 shaft, mining terminated in March 2014, six months earlier than the planned, due to the increased risk of seismicity (Appendix C, HAR 2014).

Chair in Rock Engineering

In 2013 Harmony initiated a three-year grant totalling R4,7 million to the University of Pretoria to establish a Chair in Rock Engineering and numerical modelling in the mining industry. This focused research on a safer working environment in the hard-rock mining industry offers benefits for all stakeholders and would strengthen the partnership between academic institutions and the mining industry in developing further safety improvements (Appendix C, HAR 2013).

7.7 Fall of ground management

Any uncontrolled fall of ground, which in essence is a *localised rock mass failure,* in a mine is unacceptable as essentially the potential energy invariably exceeds the

human threshold. The greater causes of fatalities in deep level underground mining have traditionally been due to ‘seismicity’ and tramming related incidents.

Although significant knowledge to counteract the consequences *catastrophic rock mass failure*, generally known as seismicity induced falls of ground, has been known for many years, the real application thereof in many instances has been below what could have been expected of the mine’s leadership and can be interpreted as wilful violations. In recent times, mines in the South African mining industry stopped the mining of certain areas where seismicity was prevalent despite the fact that potentially significant payable reserves and resources were written off as it was deemed too dangerous to mine.

7.7.1 AngloGold Ashanti

AngloGold Ashanti developed a fall-of-ground management system which was implemented at all its South African deep level mines to manage mining-induced seismicity and rockbursts. The elements included:

- Design of mine layout: Mine-wide, the design of mine layouts to prevent adverse rock conditions: the aim was to reduce the occurrence of mining-induced seismicity and rock-bursting as well as unfavourable stress concentrations and fracture orientation;
- Design of support systems: Locally, the design of support systems to protect against adverse rock conditions and hazards. Careful attention was given to the design of standards to cater for both rockfall and rockburst conditions;
- Human factors involved in falls of ground by training and communication to prevent accidents;
- Monitoring systems, verifying sufficiency of designs and implementation, the effectiveness of layout and support system designs, and
- Problem solving and technological development by means of research and technology development (Appendix B, AGA 2002).

7.7.2 Harmony

In 2007 the continued risk-based management of falls of ground was a focus area. Although there were many dimensions to safety in the workplace, mine design, mine support standards and seismic monitoring, it was accepted by Harmony that human behaviour played a critical role in managing risks (Appendix C, HAR 2007-1).

In 2010 Harmony continued with fall of ground prevention initiatives. Trials commenced with support netting in development ends to prevent falls of ground in the case of *rock mass failure* (Appendix C, HAR 2010-1).

In 2011 falls of ground accounted for a large portion of all lost-time injuries at Harmony. The holistic strategy was developed to minimise injuries caused by falls of ground was prioritised and it consolidated efforts to prevent fall of ground incidents and accidents. The ground control strategy was divided into two main components, ground behaviour and ground control.

Ground behaviour dealt with the strategic aspects of mine design to prevent or minimise damage to rock around mining excavations. Knowledge of the mining environment and ground stability, together with an understanding of in-situ and induced stress regimes, guided the ideal plan for each condition. Integral to this plan was integrating support systems in the overall mine design and monitoring rock mass response.

Ground control dealt with the operational aspects of the mine to protect personnel and equipment from fall of ground incidents. This was the hazard identification and treatment system where support elements, layout standards and procedures were implemented by means of training, supervision and management systems that addressed all requirements. Central to this approach were components that dealt with behavioural aspects; competency training; development; research, and new technologies.

The fall of ground strategy was developed and refined for each workplace. The combination of netting in selected spaces with better control and better awareness resulted in an improvement in gravity related falls of ground. The Chamber of Mines' MOSH process on early morning examinations and 'making safe' procedures were adopted at all operations (Appendix C, HAR 2011-1).

7.8 Triggered Action Response Plan

A pilot site at Harmony for a Triggered Accident Response Plan (TARP) which was a systematic process where fall-of-ground related hazards were identified, escalated if necessary and treated by the correct level of supervision was trialed in conjunction with the Chamber of Mines' MOSH initiative. The potential rock fall hazards were identified and catalogued, and a reference book was developed to assist underground supervisors in hazard identification (Appendix C, HAR 2013-1). The TARP demonstration mine proved very successful and all operations adopted this leading practice as from 2014 (Appendix C, HAR 2014).

In 2014 an internal team was appointed at Implats to customise the Triggered Action Response Plan (TARP) to manage fall of ground hazards in the workplace. TARP was a system that required the formal examination for known hazards in the workplace and then the formal implementation of appropriate and predetermined action and response measures (Appendix G, IMP 2014).

In 2015 TARP training was provided to all teams at all the Impala shafts which focused on the recognition and response to ground conditions. In 2016 regular refresher training was given to ensure that TARP was applied as intended and management was required to check and monitor understanding and compliance by every team. The system was fully rolled out at Impala Rustenburg and Marula was finalising its roll out (Appendix G, IMP 2015).

7.9 Lonmin 'ALLeRT' initiative

The 'ALLeRT' initiative, to Apply Lonmin Life Rules and Triggers, was developed specifically for Lonmin as a tool to provide guidance on how to manage the risk of falls of ground. It aimed to empower people at the rock face, and focused on improving the following capacities:

- Entry examination;
- Geological hazard identification;
- The treatment and support of geological features;
- Withdrawing people from unsafe conditions;
- Requesting assistance from specialists, and
- Making a decision as part of a functional team.

A system was put in place to raise the warning of a potential hazard to a team leader with a higher skills level should a team not know how to deal with it. All supervisors attended a rock engineering course as part of the initiative and high-risk areas was visited by a senior official more frequent to verify whether the correct controls were in place to mitigate the risk of fall of ground incidents (Appendix F, LON 2013-1).

In 2014 Lonmin required all supervisors to attend a rock engineering course during implementation of the ALLeRT initiative to assess the safety of underground conditions effectively. 795 crews were trained which enabled them to apply the ALLeRT initiative (Appendix F, LON 2014-1).

The Lonmin Life Rules focused specifically on those risk areas that cause the majority of fatal or serious accidents. These Life Rules were a set of five non-negotiable rules that employees must follow when working underground or in the plants. The application of these rules was regularly audited and measured per mining area. The Mining Life Rules was expanded to include out of stope hazards such as trackless mobile machinery (Appendix F, LON 2015-1).

7.10 In-stope hanging wall netting and rock bolting

Several companies installed in-stope hanging wall nets to reduce the consequences of fall of ground incidents.

7.10.1 Harmony

In 2010 the company continued with fall of ground prevention initiatives including trials with support netting in development ends to prevent falls of ground (Appendix C, HAR 2010-1).

In 2013 all the Harmony operations implemented the entry examination, bolting and netting, and making-safe leading practice developed by MOSH. Bolted netting in stopes and development faces were rolled out as a leading practice at all underground operations. A minimum standard for nets was developed and implemented through the procurement department (Appendix C, HAR 2013-1).

7.10.2 AngloGold Ashanti

AngloGold Ashanti installed in-stope hangingwall nets and welded mesh in gullies across all operations in order to reduce fall of ground incidents since 2012. Work teams were reluctant to install in-stope netting initially, as it presented an additional workload in a challenging environment, but they were convinced of its benefits during seismic incidents three months after installation when the nets contained falls of ground. There had been a decrease in fall of ground accidents in stopes since introducing in-stope netting (Appendix B, AGA 2012).

In 2012 AngloGold Ashanti starting to install in-stope bolts in the hanging wall of the panels where a remarkable improvement in hanging wall conditions was observed. It was also observed that the bolting improved the installation of the hanging wall nets.

7.10.3 Gold Fields

In 2011 Gold Fields implemented the Mine Industry Occupational Safety and Health (MOSH) leading practice for entry examination. Safety nets were installed to be used during the drilling shift to protect stope face employees from fall of ground hazards (Appendix D, GF 2011).

Roof bolting was introduced during 2011 in all stope panels at Gold Fields to supplement the pre-existing safety netting. Bolting was completed at all up-dip panels and wide raises, whilst bolting of all breast panels was due for completion in early 2012. This was specifically aimed at trying to prevent a resurgence in fall of ground fatalities (Appendix D, GF 2011). The supervisors played a strong role in maintaining constructive safety engagement between the management and crews, whilst roof-bolting at the stope faces minimised the potential deterioration of the workplaces during the strike of 2012 at Gold Fields (Annexure D, GF 2012).

In 2012 Gold Fields completed the fitting of removable safety nets during drilling shifts and the installation of roof bolting on all stope panels except where hanging wall rock conditions did not allow this, in which case alternative solutions were devised. This marked a major step forward in the delivery of a safe working environment and in terms of addressing what had traditionally been one of the most problematic areas.

7.10.4 Lonmin

In 2008 Lonmin enhanced the roof-bolting initiative in order to help prevent fall of ground incidents (Appendix F, LON 2008). In 2013 Lonmin adopted the MOSH leading practices and were in the process of rolling out rock bolting and netting (Appendix F, LON 2013).

7.10.5 Implats

In 2014 Implats fully implemented nets and bolts in most operations and successfully installed safety nets in all development ends (Appendix G, IMP 2014). In 2015 all stope panels and all 'on reef' and 'off reef' development ends required bolting and netting to be fitted (Appendix G, IMP 2015).

In 2016 all stope panels and all 'on reef' and 'off reef' development ends at Impala Rustenburg and Marula operations had roof bolts and netting fitted as protection against falls of ground. This initiative was used as a formal lead indicator component of the production bonus and accounted for 25% of the team's bonus value (Appendix G, IMP 2016).

7.11 Mechanisation and technology

There is increased responsibility on the mining leadership and stakeholders to operate safe mines. Modernising mines, including mechanising and automation could improve safety and productivity in mines. There is also the potential of increased orebody access to areas which were previously hazardous and unprofitable if mined through conventional means (Lynas and Horberry 2011).

Mechanisation provides safer operating conditions as less people are directly exposed to the prevailing risks. However, the associated competencies of mechanised mining and the maintenance of the equipment remains a challenge in South African deep level hard rock mining.

Some of the older gold mines were pursuing 'new technologies' that could be used to mine some of the previous remnants as it presents a potential to extend the life of the mines in question. Specific focus groups have been established with equipment manufacturers to realise this vision. Although significant effort has been expended, success is not in sight as yet. A complicating factor is that the older mines infrastructure, processes and available competencies are not aligned with this vision and significant effort has to be put in place to work around it. It

will take some time before this methodology will be able to augment the current mining methods substantially.

7.11.1 AngloGold Ashanti

AngloGold Ashanti created a Technology Innovation Consortium as a vehicle for developing innovative technologies and management processes to improve safety and enhance efficiencies. It brought together a number of key players from around the world, all leading innovators in their fields. Tools were developed to enhance communication opportunities between participants, using an open innovation model that brought not only diversity but also speed and a proven track record to the innovation process. It was important to transform the way mining took place in South Africa to ensure a sustainable future.

The Consortium demonstrated that, through effective investment in research and development and innovative use of technology, the following could be achieved:

- Unlock future potential, both in terms of production and improve the working environment;
- Removal of people from harm, and
- Skills training and improving capability.

In the longer term, the focus was to develop mine designs that used automated equipment in the stopes. It investigated how to mine without blasting, remove people from high-risk tasks, operate continuously and what technology to use to drive this change (Appendix B, AGA 2011).

In 2011 as AGA was mining at depths of close to 4 000m in some areas, safety would be a major consideration in mining deeper underground and it would require new solutions to the operating challenges. In anticipating these challenges, the group identified two strategic areas of work, technology innovation and the interlinked area of socio-economic development. In taking the first steps towards this ‘new mining paradigm’, the consortium investigated projects that would

enable AGA to mine without blasting, remove people from high-risk tasks, operate continuously, and using technology to drive this change (Appendix B, AGA 2011).

This initiative had a three-stage approach which focused on working towards no drilling and blasting and removing people from the stope over a period of three to five years. This was to be followed by moving to 'intelligent mining' through automation and information communication technology which was anticipated to be a five to 10-year horizon. The ultimate vision was to deliver 'gold on tap' using autonomous machines, with the ultimate goal of 'Safely mining all the Gold, Just the Gold, all the time'.

Whilst automation of the mines would address issues of safety and improve productivity and efficiency, this new approach to mining would have a high impact on the employees and on job creation opportunities in the medium to long term which was a very sensitive issue.

There was also a need to strengthen the socio-economic development strategy to find solutions to the threat that arose from the continued decrease in production nationally. It should also address the potential job losses, which would in all likelihood arise as a result of the transition to a technology-driven model. AGA pursued this issue and the related objectives of compliance with regulatory reporting obligations, strengthening community and stakeholder engagement, and continuing with initiatives aimed at facilitating the creation of employment in the host communities.

In 2013 ATIC continued to develop the technology that would enable AGA to mine safely, all the time, and at greater depths than current operations, through the development of safe and reliable technologies and approaching the mining process as an end-to-end solution (Appendix B, AGA 2013).

Progress included the establishing of a test site at TauTona mine where the development of the reef-boring application and the inclusion of Ultra-High

Strength Back fill (UHSB) were tested to evolve the mechanical mining method into an engineered, end-to-end system. By the end of 2013, 18 reef-bored holes were drilled and filled with UHSB. The development of the backfill product and delivery system produced the desired strengths for small scale applications. The reef boring was technically feasible with the development of a suitable drill head for the initial production sites.

The successful development of this UHSB, together with the reef-boring technology, created the potential for changing conventional mining methods to a mechanical reef boring method for the extraction of the gold-bearing reefs. These initial developments would allow AGA to start deploying production units in limited capacities, starting with mining opportunities that were not currently available for mining using conventional practices. The key focus areas were to speed up drilling rates, to drill holes ever closer together, and to continue developing the UHSB system for larger-scale applications.

In 2014 AGA engaged positively with internal and external stakeholders to co-design solutions for mutual value and embrace innovation in designing solutions for the future. The technological innovation extended to implementing new mining methods to create the potential to extract otherwise sterilised gold reserves from support pillars and enable mining beyond current depths of about 4 000m (Appendix B, AGA 2014).

In 2016 AGA did not want to continue to mine with people in the stopes as it could potentially expose an entire crew when there was a seismic event. Longer term plans were developed to ultimately move people out of the stopes.

Progress was made in the first phase of the ATIC projects, which identified and defined opportunities for advanced safety measures in collaboration with proven technology providers, research institutions and entrepreneurs. The consortium was unique in the partners it involved and how these partnerships were structured for a win-win in the long term for all involved. Consideration was given to how this would affect the current workforce and what was to be done to manage the

situation, and work with both unions and employees to discover potential and create future value. The ATIC demonstrated that the answers would lie beyond the mining industry. It included:

- Knowledge and exploration of the orebody by means of reverse or circulation drilling;
- The first prototype raise-bore machine (Amtek R2) was used to complete test reef holes using a double- pass technique, and
- Surface tests for the reef-boring application, the pump ability and the strength of the ultimate heat sink backfill, were concluded. Planning was in progress to construct a small-scale underground plant within the reef boring test site infrastructure so that underground trials could begin (Appendix B, AGA 2016).

7.11.2 Gold Fields

In 2016 Gold Fields established a Technology and Innovation division to develop a strategy which included a five-year implementation plan commencing with a foundational phase over the first two years, optimising the operations by year three and implementing new technologies and innovation over the full five-year period.

A platform was developed to share lessons learned and roll out successful projects. The ultimate goal was to work towards the ‘Mine of the Future’, which would be premised on automation, an integrated digital data platform, remote machine operation, virtual reality and reduced mining waste.

During the foundational phase opportunities were identified to enhance efficiencies. There were continued efforts to move mineworkers away from potentially dangerous areas (Appendix D, GF 2016).

7.11.3 Sibanye (SibanyeStillwater post 2016)

In 2014 Sibanye was conscious about the use of technology to improve working conditions and to provide a safer working environment, as well as the potential productivity benefits that may arise. The initial functions of introducing the Safe Technology concept required a comprehensive review of technologies used in the past, investigation into current industry-relevant technology development as well as establishing collaborative networks with original equipment manufacturers OEMs, research institutions and other mining houses. The focus was on modernising narrow, tabular and steeply dipping ore-body extraction. It guided interventions towards modernising the operations by using new technologies to improve working conditions. Focus areas included:

- Improving the safety, efficiency and productivity of current mining processes;
- Emphasis on reducing employee exposure to danger areas, and
- Increasing output and decreasing costs.

The team established symbiotic relationships with counterparts in the industry, innovative developers and OEMs to ensure that safety technology added value.

The development of appropriate new technology was a critical programme to ensure the safety of employees, particularly as the mines became ever deeper and more complex. The Safe Technology programme was advancing technical innovation by designing and developing machines to be deployed underground to make mining at depth safer. The machinery was to be operated remotely to enable mining safely at greater depths and in more onerous conditions than was previously possible. It would have longer-term benefits for the operations and for the country as a whole.

A paradigm shift in hard rock mining was required to remain competitive locally and globally. A stope mechanisation programme commenced aimed at enabling

the removal of the operator from danger, reduce costs and paylimit, as well as enable non-explosive continuous production (Appendix E, SIB 2015).

The Safe Technology programme assisted with safety related and mining innovation projects, which included the following:

- Mechanised pillar extraction aimed at enabling the extraction of increased resources that were contained within strike and stability pillars at the gold operations;
- Advanced transport programme to develop more cost-efficient, environmentally friendly means of transport of ore and material in particular;
- Stope mechanisation programme to develop a suite of mechanised machinery, especially for the narrow tabular environments prevalent in both gold and conventional platinum mining that was also capable of performing drilling and cleaning operations;
- Increased efficiency and accuracy of such units would improve the rate and quality of mining, reduce pay limits and allow for additional resource to reserve conversion. A significant advantage would be the removal of employees from dangerous work areas, thus contributing to greatly increased safety performance;
- Mine digitisation involved capitalising on the increased availability of data to enable development of comprehensive asset and behavioural management tools to enhance the efficiency and safety of mobile machinery. Operational transparency, greater insights, through digitisation, would enable informed, real-time decision making and dynamic responses to changing operating conditions;
- Drastically reduced environmental impact through efficient and renewable energy consumption;
- Mining horizon improvement programme involved several short-term projects aimed at improving current mining methods. The safety performance would improve markedly as employees were removed from

dangerous work areas. Advanced mining systems would enable a drastic increase in the convertibility and sustainability of resources. High efficiency, remote and low cost mining systems would allow access to previously inaccessible mining areas such as white areas, low grade areas, those below infrastructure, stability pillars and sections that are inaccessible owing to seismicity.

Mechanised sweeping

Sibanye designed a mechanised ultra-fine sweeping machine which was based on an adaptable platform. The machine was able to operate remotely, and extract ultra-fine material left in old workings, eliminating the need for employees in the danger zone.

It was envisioned that the adaptable platform would be coupled with an array of interchangeable attachments, performing multiple operations from surveying to reconnaissance (Appendix E, SIB 2014).

Reef-boring

In 2014 Sibanye commenced with the testing of reef boring and mechanisation equipment for pillar and stope mining which significantly reduced employee exposure to dangerous working areas. Following a successful reef-boring development programme, potential was identified to unlock 2.4Moz in strike and dip pillars across the Kloof and Driefontein operations. This excluded strike and dip pillars in non-operational shafts. Both mining methods significantly reduced employee exposure to dangerous working areas (Appendix E, SIB 2014).

Crush pillar extraction project

Sibanye employed conventional methods to mine high-grade crush pillars. These methods, although proven and successful, were time-consuming in terms of site

establishment and offered limited potential to increase production rates due to single-shift time blasting and face availability.

A non-explosive, remotely operated mining technique with readily available equipment and suitable support design was designed, which could present a quantum leap in production rates and safety improvements by facilitating continuous mining and removing the operator from the danger zone (Appendix E, SIB 2014).

Personnel locater system

Sibanye was focussing on developing a personnel locator, a small transmission and receiving device, which is included in the battery packs of employees and could be activated from surface. The radio waves are transmitted from one locator to the next, forming a transmission web underground and the information was relayed to surface, thereby allowing management to obtain information about where a missing person may be without the need for expensive infrastructure being put in place underground (Appendix E, SIB 2014).

Mining horizon improvement programme

The mining horizon improvement programme involved several short-term projects aimed at improving current mining methods. The safety performance would improve markedly as employees were removed from dangerous work areas. Advanced mining systems would enable a drastic increase in the convertibility and sustainability of Sibanye's resources. High efficiency, remote and low cost mining systems would allow access to previously inaccessible mining areas such as white areas, low-grade areas, those below-infrastructure, stability pillars and sections that are inaccessible owing to seismicity.

A potential consequence of the projects could result in upskilled job creation through the generation of secondary industries to manufacture and service the mechanised mining equipment. The associated need for highly skilled workers,

would contribute to local community development and have an economic multiplier effect (Appendix E, SIB 2016).

7.11.4 Implats

In 2006 the strategy regarding new technology at Implats had three principal objectives including, enhanced safety, improved productivity and reduced costs. R135 million were invested since 2004 on new technology, such as in-stope roof bolting, drill jigs and cutting machines, and creating mechanised mining at Impala Platinum.

The uptake of the drill-jig technology was slower than expected, which was mainly due to a longer than expected learning curve, both technically and operationally. This learning curve involved fine tuning the technology and consolidating processes around the drills, particularly regarding repairs, maintenance, availability and training.

The drilling technology proved to be a success, however ore removal remained a challenge and required further development. The implementation of drill jigs and roof bolting was central to the fall of ground campaign in an effort to enhance safety. In-stope bolting, which was the primary objective of the roll-out of the drill jig technology, progressed with 35% implementation at all Merensky panels.

Roof bolting in all development tunnels was completed and work begun on the development of a new drill jig for UG2 panels to improve tunnel advance. The first prototype was being tested underground. Although the drill jig technology contributed positively to efficiencies, the primary aim of this technology, given the accompanying in-stope bolting, was improved safety.

Employees encountered problems with the acceptance of the technology and there were issues with the weight of the drill, which was consequently been reduced by 20kg. The benefits of the technology were not adequately explained initially to employees and there were fears of job losses among employees.

The equipment was to be further refined and difficulties relating to the use of the equipment were to be ironed out before it could be rolled out to the rest of the operation. The company, which developed the drill jig technology, was committed to this process and was continuing with its research and development.

It was planned to implement a new R90 million blast initiation system based on 'shock-tube technology' in 2007 which was aimed at eliminating accidents involving misfired and uncontrolled blasts.

Following unsuccessful trials during the year, the Alpine reef miner project was terminated (Appendix G, IMP 2006).

7.12 Drill Rigs

Conventional handheld rock drill machines in flat-end development were replaced with drill rigs, which allowed for remote operation of drilling machines. This minimised the extent to which employees were exposed to potential hazards in development ends (Appendix B, AGA 2012; Appendix E, SIB 2013; Appendix G, IMP 2006).

7.13 Horisontal and vertical transport.

7.13.1 AngloGold Ashanti

In 2004, AngloGold Ashanti initiated a competition to motivate safety performance in horisontal and vertical transport and to create increased awareness. A quarterly report on horizontal and vertical transport issues highlighted leading indicators and lagging indicators to increase awareness. Other initiatives included horizontal and vertical transport group meetings, region wide horizontal and vertical transport audits, the implementation of enhanced track maintenance protocols, and improving design specifications for cage (vertical transport) arresting devices (Appendix B, AGA 2004).

In 2006 AGA developed a comprehensive strategy to manage safety in horizontal and vertical transport. A number of new initiatives involved improved employee selection, operator training, and equipment monitoring. Through various computer based simulation models, employees would experience a close approximation of the work environment during training, facilitating clear illustration of good and bad safety practices and their consequences. Much was also done in the assessment, upgrading and maintenance of critical winding plant and shaft infrastructure.

Off the shelf technologies were installed on horizontal transport vehicles to take people further away from the risk of injury during transport activities. These technologies included automatic couplers which enable 'hands-free' coupling of hoppers and locomotives; electronic signalling between locomotive drivers and guards, as well as front-driven trains (Appendix B, AGA 2006).

7.13.2 Harmony

In 2010 the preventing of trucks and tramming accidents was a focus area at Harmony. Some technology initiatives included the developed safer locomotives and anti-collision devices. In 2011 Harmony developed an integrated plan for rock-breaking machinery and rolling stock, aligned with the COM MOSH project (Appendix C, HAR 2010-1).

In 2012/13 rail-bound equipment (RBE) audits were conducted which verified compliance to the RBE code of practice, and specifically focused on locomotive conversions and rail conditions to comply with SANS 10339 specifications. Harmony installed a proximity detection system, fitted to mobile machinery that detected other mobile machinery nearby. The operator would receive a visual and audible warning signal to which he could react if another vehicle approached. The implementation involved much training, changing behaviour, amending infrastructure and fitting units to locomotives (Appendix C, HAR 2012-2013).

7.13.3 Gold Fields

In 2011 the MOSH leading practice of auto-coupling and guard communication systems to reduce tramming-related risks was evaluated by Gold Fields. The company prepared for the evaluation of proximity-warning systems (Appendix D, GF 2011).

In 2012 tramming incidents were responsible for five of the 16 fatalities. Gold Fields continued to initiate a new Guard Communications System programme and commenced a major overhaul of the 1 200 underground locomotives, which included improved cab designs, enhanced braking systems, and electronic data recording. Hand-held controls with 'pivot-based' safety systems and enhanced communications were introduced. This included a 'fail-safe' command system that required both the driver at one end of the locomotive and the guard at the other end to issue the same instructions to the locomotive before it would function. It also included an emergency stop function that could be instigated by either individual. It would be supported by additional, related measures such as training for locomotive operators and the implementation of safer alternatives to the manual coupling of rolling stock (Appendix D, GF 2012).

In 2013 the trial of auto-couplers and installation of proximity detections systems (PDS) to the rail-bound equipment was ongoing. This was with the aim of reducing employee exposure to the risks associated with manual coupling and collisions as well as damage to equipment. The company continued with the installation of PDS's to the trackless mobile machines for both vehicle-to-vehicle detection and vehicle-to-person detection. Automation of tip ramps was done, which were previously operated manually by the locomotive drivers (Appendix D, GF 2013).

In 2014 the company installed proximity detection systems, which help personnel avoid danger zones when working near heavy mining equipment. New rail-bound

equipment, including an auto-coupler, which eliminates the need for personnel to manually couple and uncouple rolling stock, was also installed (Appendix D, GF 2014).

In 2015 South Deep intensified its effort to engineer-out safety risks. Some initiatives included the commencement of fitting 56 locomotives with a rail-bound proximity detection system and relevant operators and artisans trained in its usage. The second phase of the project would comprise the installation of fixed beacons at the mine in 2016 to facilitate communication between the locomotives (Appendix D, GF 2015).

In 2016 the installation of a rail-bound proximity detection system was completed i.e. all 56 locomotives at the mine were fitted with this system and relevant operators and artisans training in its use was completed. The installation of fixed beacons at the mine during the latter part of 2016 helped to facilitate direct communication between the locomotives (Appendix D, GF 2016).

7.13.4 Sibanye

In 2013 Sibanye had tunnels accessing the orebody which were relatively restricted and needed to be laid out so as to prevent the risk of collisions. The company continued with the Guard Communications System programme. Underground locomotives were overhauled including improved cab designs, enhanced braking systems, electronic data recording, hand-held controls with pivot-based safety cut-out systems and enhanced direct communication with drivers.

The rolling out of a fail-safe command system continued and was completed by mid-2014. This system required both the driver at one end of the locomotive and the guard at the other end to issue the same instructions to the locomotive before it would function. It included an emergency stop function that could be initiated by either individual (Appendix E, SIB 2013).

7.13.5 Lonmin

In 2009 fatalities and serious injuries at the operations resulting from fall of ground, use of track bound mobile equipment, scraping and rigging were the key safety risks at Lonmin. Following a number of underground locomotive collisions, research was commissioned to seek an engineering solution as part of the measures to minimise possible collisions. Locomotive anti-collision devices were installed on a number of locomotives on a trial and test basis. The principle of operation used radio frequency transmitters and receivers that triggered alarms in the driver's cabin warning the driver of the close proximity of another locomotive. Further investigations were underway to establish if these transmitters could be placed at strategic hazards or obstructions in haulages to trigger alarms (Appendix F, LON 2009).

In 2014 Lonmin stopped the use of conventional light duty vehicles for underground applications. Special built emergency and service vehicles were designed and ordered, and the Lonmin Standards was changed to incorporate the new designs (Appendix F, LON 2014).

7.13.6 Implats

In 2016 all vertical shaft surface bank areas and underground stations at Implats were equipped with a fail-safe and winder interlocked safety device, which would arrest any rail bound moving stock before it gets to the shaft. A key focus at Implats was to improve the locomotive safety initiatives. It was planned to have front driven train technology and proximity detection on all track-bound machinery (Appendix G, IMP 2016).

7.14 Infrastructure maintenance

7.14.1 AngloGold Ashanti

In 2006 much was done in the assessment, upgrading and maintenance of critical winding plant and shaft infrastructure at AngloGold Ashanti (Appendix B, AGA 2006).

7.14.2 Harmony

At Harmony a third party did engineering audits at selected mines and a considerable amount of time was spent on the maintenance of infrastructure to proactively address any potential problems (Appendix C, HAR 2014-1). In 2016 infrastructure and equipment maintenance remained a daily focus at all the Harmony mines (Appendix C, HAR 2016).

7.14.3 Gold Fields

In 2008 a review at Gold Fields identified a number of infrastructure installations at the operations that required remediation to improve safety. While most of these repairs were of such a nature that it could be completed in the normal schedule of planned maintenance, three instances required a suspension or curtailment of normal production while repairs and remediation were carried out.

- At South Deep, 3 access ramps were in urgent need of additional support;
- At Driefontein, the chronic backlog in secondary support at the high grade one tertiary, four and five shafts, which plagued this mine for several years, represented an unacceptable risk. The backlog at four and five shafts was made up without an interruption in production, but the one tertiary shaft backlog could not be eliminated in the normal course of business and as a consequence all production was stopped in this area while the remediation work was undertaken, and

- The Main shaft at Kloof Mine was in urgent need of rehabilitation due to extensive corrosion. As a consequence, it was decided to limit hoisting from the shaft to one day per week for the remainder of the year so that the shaft could be repaired.

These interventions resulted in short-term production sacrifices, however, the long-term benefits to employees and shareholders alike would significantly offset the short-term losses (Appendix D, GF 2008).

In 2009 Gold Fields introduced an enhanced planned maintenance programme and condition assessments were being conducted on all vertical mine shafts and plant infrastructure. Audits were done to identify all repairs required. The Main shaft steel work rehabilitation at Kloof was completed (Appendix D, GF 2009).

In 2010 engineering integrity was a fundamental requirement for safe production in the Gold Fields deep-level mines. The programme of infrastructure rehabilitation across all mines in the region continued. It included:

- The replacement of the water pump column in the Kloof main shaft;
- The elimination of the secondary support backlog at the Kloof and Driefontein Gold Mines;
- After the implementation of updated ground support protocols in all mines, dedicated support crews consistently maintained secondary support within 120 meters of current development faces, and
- The introduction of a new enhanced maintenance system introduced during 2009 was a prime focus during the year and revised protocols were in place to facilitate rapid management of all planned maintenance issues (Appendix D, GF 2010).

7.14.4 Sibanye

In 2014 Sibanye was aware that inadequately maintained infrastructure could result in unplanned breakdowns and stoppages with possible production delays,

increased costs and industrial accidents. Maintaining infrastructure necessitated a planned programme of maintenance and upgrades, which had to be funded by capital expenditure which was linked to infrastructure risk assessment. Sibanye kept a maintenance risk register and conducted regular shaft-infrastructure maintenance management inspections (Appendix E, SIB 2014).

7.14.5 Implats

In 2013 the outlook at Implats for future infrastructure was that it would lag economic growth and therefore, hampered development. Transport, telecommunications, power and water were and would remain issues. Contingency measures were required to minimise the impact of a decline in the standard of infrastructure (Appendix G, IMP 2013).

7.15 Centralised blasting system

7.15.1 Gold Fields

In 2010 Gold Fields implemented centralised blasting, whereby all blasting took place during a specific time window when there was no workers underground. Research showed that seismic action was directly related to blasting activity and that 70 per cent of seismic events occur within two hours of blasting, so this strategy drastically reduced the exposure of the workforce. This was instrumental in reducing the operations' fall-of-ground (FOG) injuries by 38 per cent and a reduction of 82 per cent in the number of seismic related fatalities, from 11 in 2009 to two in 2010 (Appendix D, GF 2010).

7.15.2 Sibanye

Centralised blasting was conducted at Sibanye during a narrow time window to minimise the exposure of crews to seismicity during shift times. The cessation of night-shift working in isolated areas that had a high night-shift seismic-risk profile

and the company undertook regular seismic hazard assessments, allowing for the temporary withdrawal of crews (Appendix E, SIB 2013).

7.15.3 Implats

In 2014 the replacement of the entire centralised blasting system continued at Implats. It offered significantly improved levels of safety and reliability over the blasting legacy systems (Appendix G, IMP 2014). In 2015 a safe blasting system was introduced at the Rustenburg, Mimosa and Zimplats operations to mitigate the possible risk of an unintended lightning induced blast (Appendix G, IMP 2015).

In 2016 a modern safe blasting system was installed and functional across Marula, Mimosa, and Shafts at Impala Rustenburg operations. Implementation at Shaft 11 was delayed owing to financial constraints (Appendix G, IMP 2016).

7.16 Shaft safety devices

Most of the South African mining industry installed additional shaft safety devices after the Vaal Reefs 2 shaft incident in 1995 when 104 mineworkers died when a locomotive fell down the shaft.

In 2015 Implats progressed across the Rustenburg operation with the installation of new shaft safety devices and interlocking winder facilities (Appendix G, IMP 2015). In 2016 all vertical shaft surface bank areas and underground stations were equipped with a fail-safe and winder interlocked safety device, which would arrest any rail bound moving stock before it gets to the shaft (Appendix G, IMP 2016).

7.17 Electronic winch-signalling devices

In 2015 the Implats Rustenburg operation standardised an electronic winch-signalling device, which gave a 15-second audible and visual warning before it powered the motor. The system also included a facility to trip the winch from any

remote area along the length of the gully. All centre gullies were equipped with these signalling and safety devices (Appendix G, IMP 2015).

In 2016 reliability problems were resolved, and the rollout was completed in all centre gullies. Application standards for the signalling device in stope advanced strike gullies was completed and the roll out was in progress (Appendix G, IMP 2016).

Lonmin's involvement with the MOSH programme led to the implementation of winch signalling devices to reduce winch accidents (Appendix F, LON 2015).

7.18 Fire retardant conveyor belts

In 2014 all conveyor belts at Implats were replaced with fire retardant conveyor belts and in future only fire-retardant conveyor belts would be used. This was after most of the industry already installed fire retardant conveyor belts post the 1987 Kinross fire incident (Appendix G, IMP 2014).

In 2015 all identified high-risk conveyor belts were replaced with fire retardant conveyor belts and 30% of all other belts were replaced. The company was on track to have all belts replaced by 2017 (Appendix G, IMP 2015).

In 2016 following the major conveyor fire incident at Impala Rustenburg 14 Shaft, several actions were identified to enhance fire prevention controls by replacing all conveyor belts with fire retardant belts. 62% Of the operational belts at Impala Rustenburg and Marula and 70% of all standard belts across the Group were replaced and it was planned to complete replacement by 2017. The code of practice to manage conveyor belts was reviewed and redrafted with new guidelines promulgated by the DMR (Appendix G, IMP 2016).

7.19 Flammable gas

In 2014 gas sampling was undertaken at Implats to determine the flammable gas emissions at each shaft and a methane awareness campaign commenced. In 2015 measuring instruments, chargers, auto calibration test units and calibration test stations were supplied and commissioned (Appendix G, IMP 2014-2015).

In 2016 the roll-out of gas measuring devices continued to all shift supervisors, the shaft management team and full-time health and safety representatives. The monitoring of the underground flammable gas emissions at both 11 and 16 Shafts indicated low emissions with no significant change in flammable gas emissions (Appendix G, IMP 2016).

7.20 Fire detection system

In 2012 following the major fire at the KDC Ya Rona Shaft, Gold Fields reviewed safety measures to minimise the risk of such an event re-occurring. These included the revision of the fire and explosion guidelines and enhanced training for operators; Implementation of dedicated, dual-oversight of the Fire Detection Systems, and additional oversight of the electronic Fire Detection System by the shaft-based control rooms was achieved(Appendix D, GF 2012).

In 2015 the Implats underground fire detection system was enhanced to include the completion of the installation of equipment as part of the expansion of the significantly improved fire detection system at Impala Rustenburg.

7.21 Self-contained self-rescuers.

Only in 2014 were all the Implats underground employees equipped with self-contained self-rescuers (Appendix G, IMP 2014). This is after most of the mining industry introduced SCSR’s after the 1987 Kinross fire incident.

7.22 Summary

It is imperative for mines to ensure that the residual risk in a workplace is within the physical tolerances of the employees if the controls fails. In mining where significant energy used to blast, scraping, pump water, hoisting and tramming amongst others, new methods of managing the residual risks needs to be implemented.

The actual reduction of risk exposure to individuals takes place when the physical conditions that individuals are exposed to are actually changed in the working place. Too much reliance is still placed on the behaviour of individual's actions instead of increasing reliance on engineering controls to manage the residual risk.

In summary, all the mines researched focused on the process of physically removing employees from high risk areas and activities in the workplace by enhanced control measures as this is where the real difference in risk exposure is made. In future more emphasis will have to be placed on making working places safer as human rights will not tolerate some of the conditions that employees are expected to work in. The initiatives to actually reduce the risks in the working places instituted by the companies researched includes:

7.22.1 Proactive risk reduction

Safe technology

AngloGold Ashanti created a Technology Innovation Consortium as a vehicle for developing innovative technologies and management processes to improve safety and enhance efficiencies.

Sibanye created a Safe Technology programme to assist with safety-related and mining innovation projects. It commenced with a mining horizon improvement programme which involved several short-term projects aimed at improving current mining methods.

Gold Fields established a Technology and Innovation division with the ultimate goal to work towards the 'Mine of the Future', which would be premised on automation, an integrated digital data platform, remote machine operation, virtual reality and reduced mining waste.

Fire retardant conveyor belts.

Implats replaced all conveyor belts with fire retardant conveyor belts and in future only fire-retardant conveyor belts would be used. This was after most of the industry already installed fire retardant conveyor belts post the 1987 Kinross fire incident.

Electronic winch signalling devices

Implats standardised an electronic winch-signalling device, which gave a 15-second audible and visual warning before it powered the motor. The system also included a facility to trip the winch from any remote area along the length of the gully.

Shaft safety devices

Most of the South African mining industry installed additional shaft safety devices after the Vaal Reefs 2 shaft incident in 1995 when 104 mineworkers died when a locomotive fell down the shaft. In 2015 Implats installed new shaft safety devices and interlocking winder facilities.

Centralised blasting system

Gold Fields implemented centralised blasting, whereby all blasting took place during a specific time window when there was no workers underground.

The entire centralised blasting system was replaced at Implats as it offered significantly improved levels of safety and reliability over the blasting legacy systems.

Infrastructure maintenance

Infrastructure was identified as a business continuity imperative in the more mature mines as there was a general decline in the standards.

Horisontal and vertical transport

Comprehensive strategies were formulated to manage safety in horizontal and vertical transport. A number of new initiatives involved improved employee selection, operator training, and equipment monitoring.

Assessment, upgrading and maintenance of critical winding plant and shaft infrastructure took place at some of the mines.

Drill rigs

Conventional handheld rock drill machines in flat-end development were replaced with drill rigs, which allowed for remote operation of drilling machines.

In stope hanging wall netting and rock bolting

Several companies installed in-stope hanging wall nets to reduce fall of ground incidents.

Falls of ground management

AngloGold Ashanti developed a fall-of-ground management system and this was implemented at all its South African deep level mines to manage mining-induced seismicity and rockbursts.

Lonmin developed the ‘Apply Lonmin Life Rules and Triggers’ as a tool to provide guidance on how to manage the risk of falls of ground.

Harmony used a triggered accident response plan (TARP) which was a systematic process where fall-of-ground related hazards were identified, escalated if

necessary and treated by the correct level of supervision was trialed in conjunction with the Chamber of Mines' MOSH initiative.

Pillar and remnant mining

A comprehensive review of all pillar and remnant mining across all operations was undertaken at Gold Fields. Extensive work was done to reassess design criteria used to assess pillars and remnant areas before a decision was made to mine these areas.

Production trials of strike-and-dip pillar reef-boring at Sibanye netted positive initial results.

Mining flexibility

Mining flexibility was a constraint at some of the gold and platinum mines.

Mining methods

The mechanisation strategy at Lonmin changed as it failed to significantly improve productivity from the two fully mechanised shafts. The company switched to hybrid mining by using conventional stoping methods and maintaining mechanised development.

At Implats conventional mining volumes declined with the move to mechanised mining. At some of the shafts mechanised mining was converted back to conventional mining.

Improving the working environment

Harmony management paid greater attention to ensure that everything that a stope team needed to have in place was actually in place. It included logistics, systems and people, appropriate environmental conditions and attending to employees' wellbeing. The company provided better transport for employees, right up to the place where they worked.

Sibanye's vision was that every employee had the right to a healthy and safe working environment and management was conscious about the use of technology to improve working conditions and provide a safer working environment.

Implats intention to create safe working environments remained the focus of the commitment to 'Zero Harm' in the longer term and it was believed that this would be achieved, with the commitment from every one of the Implats team.

7.22.2 Consequence management

Personnel locator

Sibanye was focussing on developing a personnel locator, a small transmission and receiving device to be used in the case of accident recoveries.

Self-contained self-rescuers.

Only in 2014 were all the Implats underground employees equipped with self-contained self-rescuers This is after most of the mining industry introduced SCSR's after the 1987 Kinross fire incident.

7.22.3 Monitoring controls

Flammable Gas

Although flammable gas monitoring has being done for decades in the gold mining industry, it was only in 2014 that Implats determined flammable gas emissions at each shaft and a methane awareness campaign commenced. Subsequently measuring instruments, chargers, auto calibration test units and calibration test stations were supplied and commissioned.

In 2012, Gold Fields implemented dedicated, dual-oversight of the Fire Detection Systems, and additional oversight of the electronic Fire Detection System by the shaft-based control.

In 2015 the Implats underground fire detection system was enhanced to include the completion of the installation of equipment as part of the expansion of the significantly improved fire detection system at Impala Rustenburg.

Seismicity

AngloGold Ashanti adopted a holistic approach to the management of seismicity at its deep level mining operations in the South Africa region.

Harmony was committed to ensuring a safe working environment for all employees and placed the utmost importance on the monitoring and pro-active management of seismicity in an effort to reduce seismic activity, injury and damaged caused by seismic events.

Gold Fields introduced a Seismic Task Team, comprising of both internal and external experts to study and advise Gold Fields on priority activities aimed at reducing the prevalence and impact of seismic-related incidents.

Sibanye had an integrated seismic management system.

7.23 Conclusion

Research finding 5: Operationalise the safety management system by reducing workplace risks. Although significant effort has been expended by the mining companies researched to reduce the risks underground, there is still significant room for improvement as the fatalities and injuries occurring in the South African mining industry remains unacceptable at 73 fatalities in 2016.

The resultant safety outcomes of the collective ‘Zero Harm’ approach described between Chapters 3 to 7 are discussed in Chapter 8.

8 COMPANY SAFETY PERFORMANCE

8.1 Introduction

The safety results that the companies researched *deserved* by their approach to assessing risks and controlling it within its *risk bearing appetite* is discussed in this Chapter.

8.2 South African mining industry statistics

The ultimate safety performance indicator in South Africa is the actual number of fatalities that occurs. It is used to bring home the fact that a colleague has lost his or her life in the line of duty. It is personalised through the caring culture that has been instilled and remains business in progress.

The target of 'Zero Harm' has not been achieved as yet but there are many success stories at mining companies achieving many months without a fatality. There are some shafts that has been operating without a fatality for a number of years. Although the vision of 'Zero Harm' has not been achieved as yet and much remains to be done, it has been proved that mining can take place without a fatality.

The number of fatalities in the South African mining industry reduced from 220 in 2007 to 73 in 2016, a 67% improvement, as shown in Figure 28.

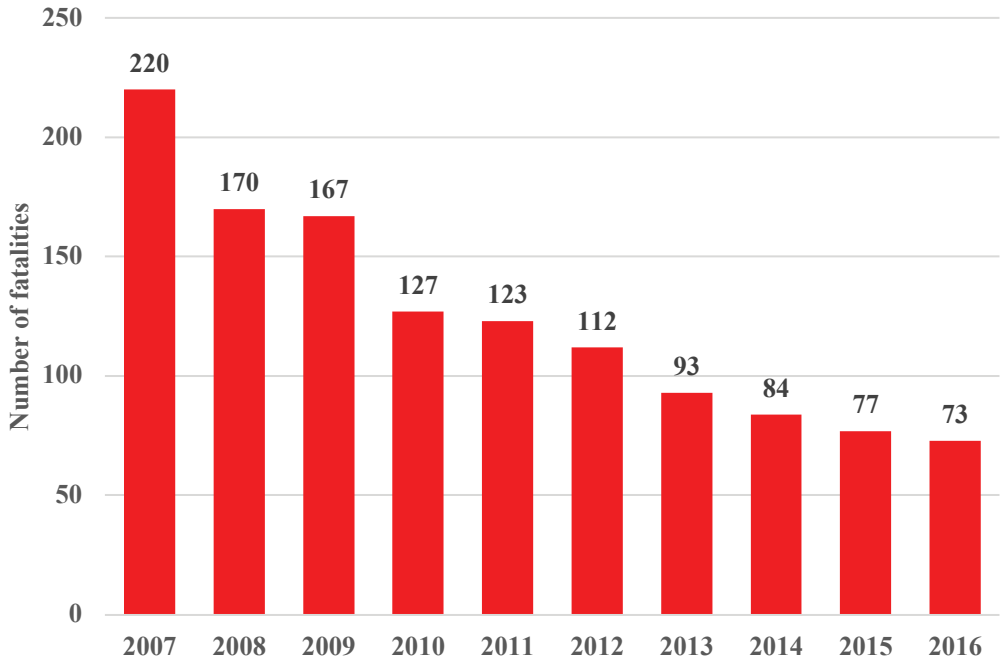
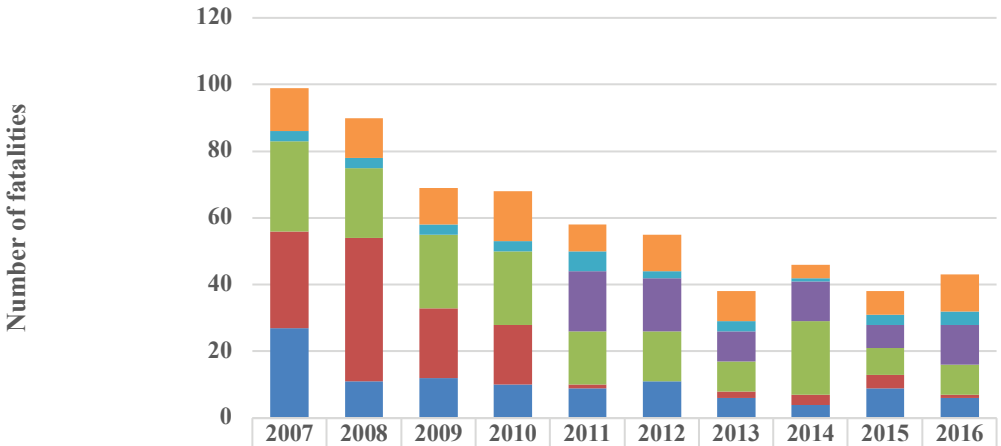


Figure 28 South African mining industry fatalities, 2007-2016 (COM 2017).

606 Fatalities, as shown in Figure 29, out of 1 246 fatalities in the South African mining industry, as shown in Figure 30, occurred at the mines researched during the period 2007 – 2016. The collective number of fatalities in the mines researched reduced from 99 in 2007 to 45 in 2016, a 45% improvement compared to 67 % of the overall industry improvement. However, the number of fatalities per annum has been escalating from 38 in 2013 to 45 in 2015 which is an 18% deterioration as shown in Figure 27 and 28.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Implats Fatals	13	12	11	15	8	11	9	4	7	11
Lonmin Fatals	3	3	3	3	6	2	3	1	3	4
Sibanye Fatals Gold					18	16	9	12	7	12
Harmony Fatals	27	21	22	22	16	15	9	22	8	9
GF Fatals	29	43	21	18	1	0	2	3	4	1
AGA Fatals	27	11	12	10	9	11	6	4	9	6

Figure 29 Fatalities 2007-2016 in the mines researched (Companies researched – Annual Reports, 2007-2016).

Harmony had the most fatalities at 171 during the period 2007 – 2016 while Lonmin had the least at 33 fatalities during the same period as shown in Figure 29 and 31. Without justifying the difference in the number of fatalities, the risk in the Harmony mines are significantly higher than that of Lonmin in that it is deeper, and has a significant amount of pillar mining in spread out areas making use mostly of conventional mining methods.

If the playing field is to be levelled, the risk controls should be such that the residual risks in the different mines are equal, which is clearly not the case. Further risk management controls are needed by all the mines to reduce the residual risk, before the application of behavioural based safety programmes will augment the engineering controls to achieve ‘Zero Harm’.

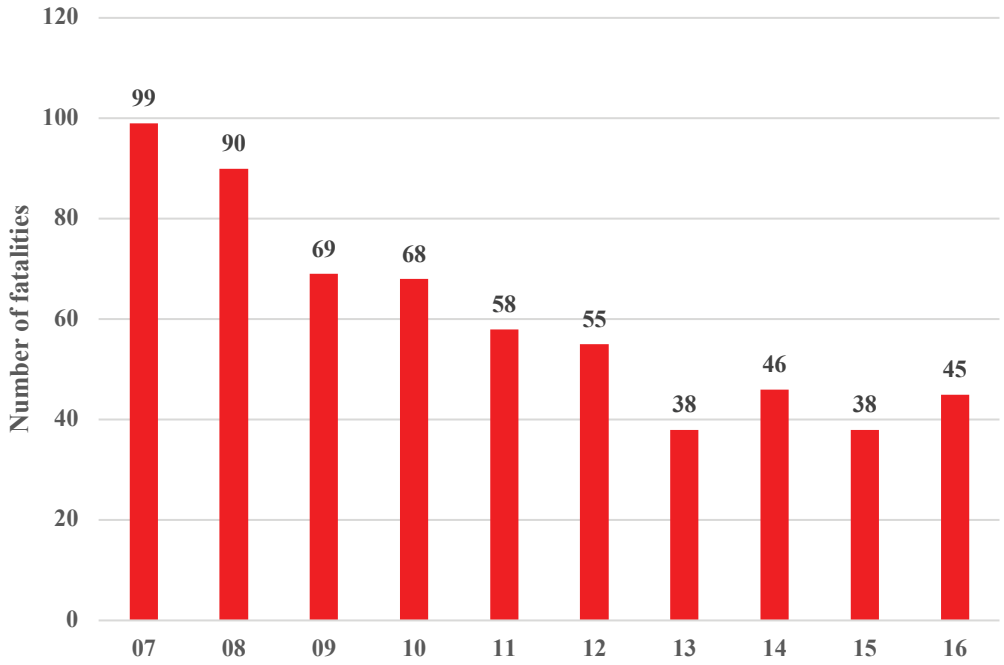


Figure 30 Number of fatalities in mines researched (Companies researched Annual reports 2007-2016).

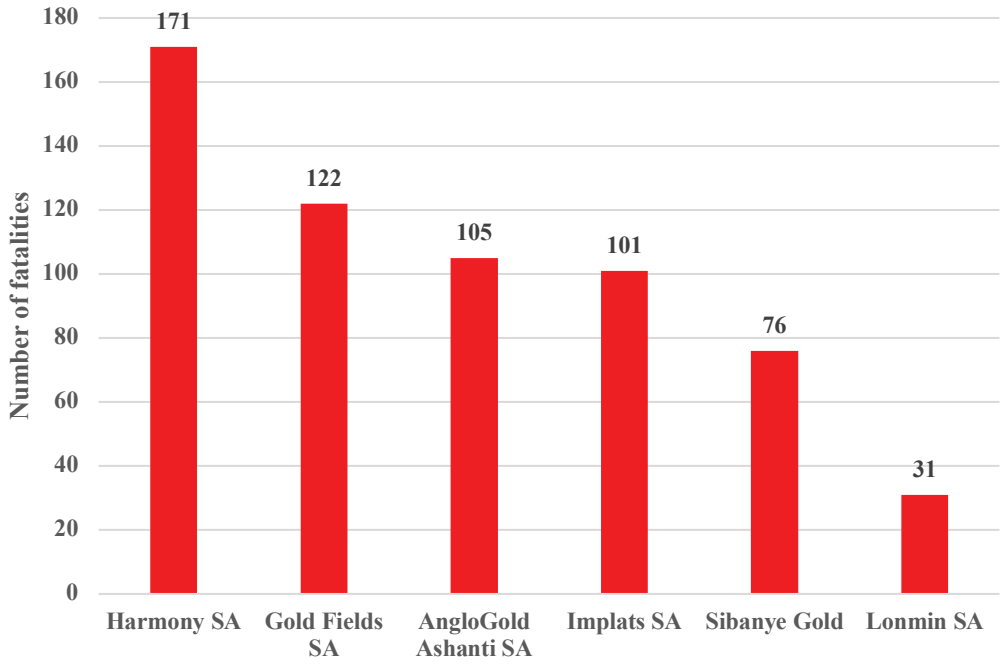


Figure 31 Fatalities per company 2007-2016 (Companies researched Annual reports 2007-2016).

8.2.1 AngloGold Ashanti

Background

AngloGold was formed in June 1998 through a merger of the gold operations, mineral rights and exploration interests of Anglo American Corporation and its associated companies. Some of the operations within AngloGold had been associated with gold mining for more than 100 years and brought with it a wealth of expertise and contributions to the industry and to the development of the towns, cities and countries in which they were located. AngloGold merged with Ashanti Goldfields in 2004 and became known as AngloGold Ashanti (AGA).

In 2006 AGA was a leading global producer of gold and uranium and had a varied portfolio of surface, open-pit and underground operations (22 in total) in 10 countries (Argentina, Australia, Brazil, Ghana, the Republic of Guinea, Mali, Namibia, South Africa, Tanzania and the USA). The group's corporate office was located in Johannesburg and AGA employed 61 453 people on average at its operations around the world (Appendix B, AGA 2007).

In 2016, a decade later, AGA had a globally diverse, world-class portfolio of operations and projects. AGA was the third-largest gold mining company in the world, measured by production. It had 17 gold mines in 9 countries, as well as several exploration programmes in both the established and new gold producing regions of the world. AGA employed 52 649 people at its operations around the world (Appendix B, AGA 2016).

The AGA staff reduced by 8 873, approximately 14%, during the decade while the gold produced reduced by 35 % since 2006, which was then at 5,6m oz and in 2016 at 3,6m oz.

During the period 2007-2016, 105 employees were fatally injured in the AGA South African operations as shown in Figure 31 (Appendix B, AGA 2007-2016).

AGA had 37 fatalities in 2006, 32 of which occurred in the South African region, which prompted the commencement of a renewed drive to reduce fatalities (Appendix B, AGA 2006). During the next 10 years the company and its stakeholders relentlessly pursued the quest for 'Zero Harm', which resulted a reduction of fatalities to 7 in 2016, 6 of which occurred in the South African Operations. Although the target of zero fatalities was not yet reached it was an improvement of 83% during the past decade as shown in Figure 32. 'Zero Harm' is a journey of continual improvement and was ongoing (Appendix B, AGA 2016).

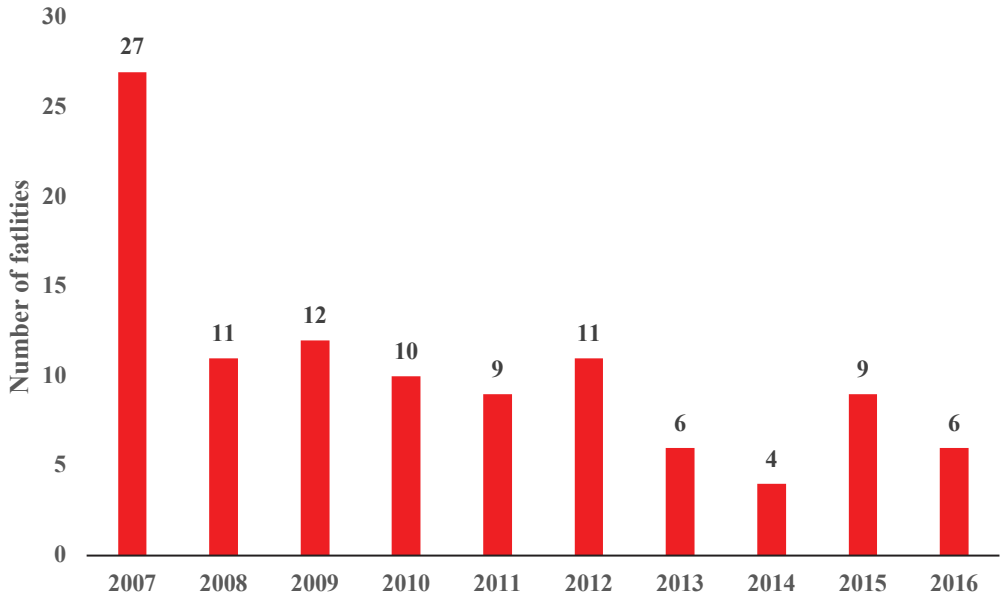


Figure 32 AngloGold Ashanti 105 fatalities, 2007-2016 (Appendix B, AGA 2007-2016)

8.2.2 Harmony

In 2006 Harmony acquired in excess of 20 companies and shafts in an attempt to achieve critical mass and unlock value. During this time the company built up a diverse portfolio, including some of the most leveraged, yet marginal mines in the world. However, along with the opportunities provided by these assets came the

reality that, within the packages acquired, were mines or shafts at the end of their economic lives, excess infrastructure and services, massive land portfolios and onerous environmental liabilities. Harmony restructured the company to ensure optimum profitability.

Harmony produced 2.4Moz of gold, predominantly from its operations in South Africa. The employee numbers were significantly reduced year-on-year, to approximately 44 000 people (Appendix C, HAR 2007).

In 2016 Harmony had operations in South Africa and in Papua New Guinea and was the third largest gold producer in South Africa and the twelfth largest in the world. The impact that the company had on the lives of the people employed, the communities that surround the mines and the environment, as well as the economic contribution made to the countries in which it operated, was well understood.

Harmony operated nine underground mines, one open-pit mine and several surface operations, which accounted for 93% of total production of 1.08Moz. Harmony employed 30 547 people in total, 25 861 employees and 4 580 contractors in South Africa (Appendix C, HAR 2016).

During the period 2007 to 2016, Harmony had 202 fatalities as shown in Figure 31 and 33.

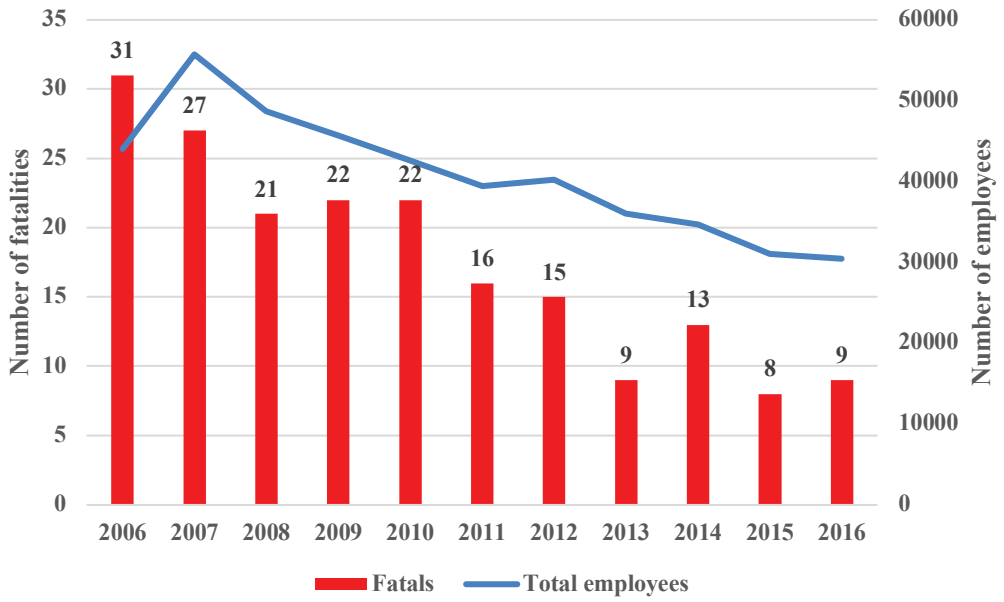


Figure 33 Harmony fatalities 2006-2016 (Appendix C, HAR 2006-2016)

8.2.3 Gold Fields

Gold Fields had 176 fatalities in South Africa during the period 2007 to 2016 as shown in Figure 31 and 34 (Appendix D, GF 2006-2016).

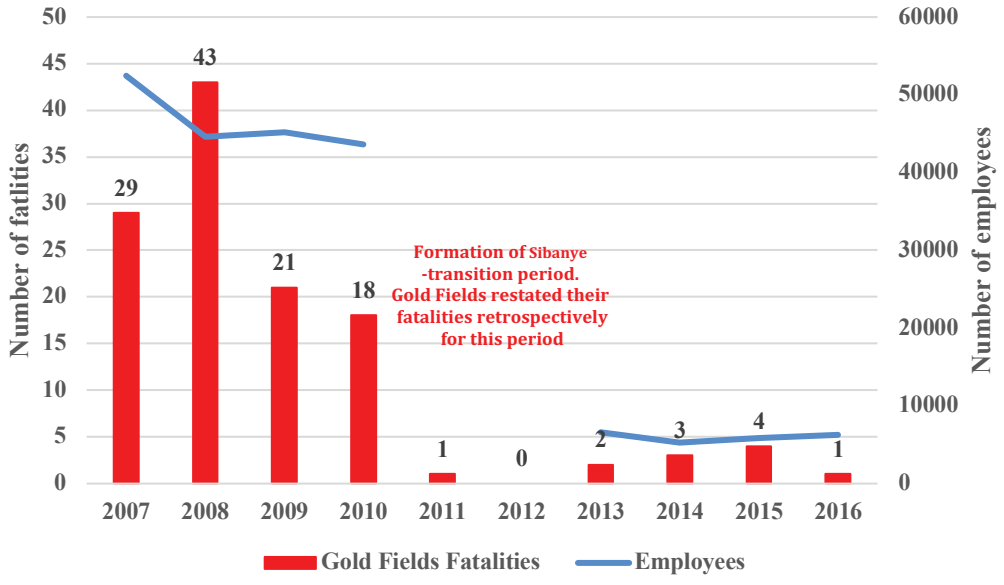


Figure 34 Gold Fields fatalities, 2007-2016 (Appendix D, GF 2007-2016).

In 2006 Gold Fields was the world's fourth largest gold producer. It was a major international employer with a total global workforce of 54 758 including full-time contractors. It provided direct permanent employment to 48 467 permanent employees (including 5 698 contractors) in South Africa (Appendix D, GF 2006).

During the period 2006 to 2016 the company underwent major changes as it changed focus from a volume to a value driven organisation. In 2007 Gold Fields acquired control of South Deep Gold Mine. Due to its proximity to Kloof Mine, South Deep constituted a logical addition to the Gold Fields franchise of high quality long-life mines in South Africa (Appendix D, GF 2007).

In 2012 Gold Fields separated mines into two distinct portfolios:

- The open pit and shallow underground mines in Australia, Ghana, Peru as well as the deep underground mechanised South Deep mine, and
- Sibanye Gold consisting of the mature, deep underground, narrow-vein Beatrix and KDC mines (Appendix D, GF 2012).

The Gold Fields employees in their South African operations reduced from a high of 54 758 in 2006 to 6 277 in 2016, which amounted to an 88% reduction (Appendix D, GF 2006-2016).

8.2.4 Sibanye (Sibanye Stillwater post 2016)

Sibanye had 46 fatalities between 2012 and 2016 as shown in Figure 31 and 35 (Appendix E, SIB 2012-2016).

In 2012 Sibanye Gold, previously a wholly owned subsidiary of Gold Fields (GFI Mining South Africa Proprietary Limited ('GFIMSA')) and owning its more mature South African assets, Kloof, Driefontein and Beatrix was spun out of Gold Fields and listed as a fully independent company on 11 February 2013 on both the JSE and the NYSE. The company had 33 773 employees and 2 501 contractors (Appendix E, SIB 2013).

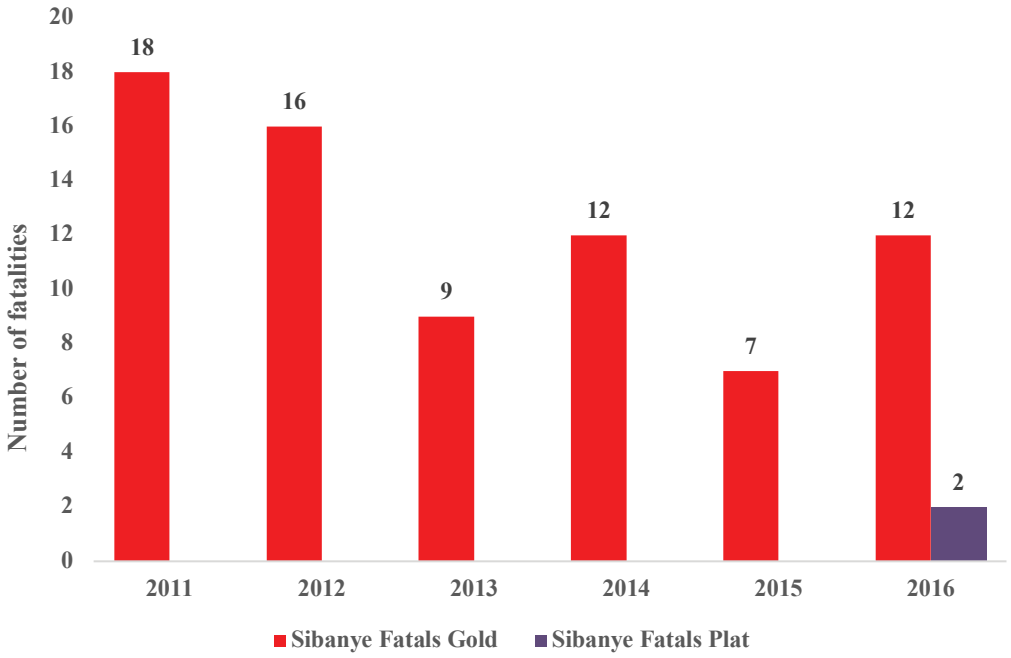


Figure 35 Sibanye (assets belonged to Gold Fields up to 2013) 74 fatalities, 2011-2016 (Appendix D, GF 2011-2012; Appendix E, SIB 2013-2016).

In 2016 Sibanye revised its organisational structure and the management of its business in order to ensure continued delivery on its strategic objectives. The company then comprised of the Gold Division and Platinum Division after significant acquisitions including:

- Aquarius Platinum Limited which included a 50% stake in each of the Kroondal and Mimosa mines, and associated infrastructure and concentrating facilities, as well as Platinum Mile (91.7%);
- Anglo American Platinum Limited assets which included the Bathopele, Siphumelele, and Thembelani (including Khuseleka) shafts, two concentrating plants, an on-site chrome recovery plant, the western limb tailings retreatment plant and all associated surface infrastructure, referred to as the Rustenburg Operations, and
- Sibanye announced the proposed acquisition of Stillwater Mining Company (Stillwater), which had palladium and platinum producing operations in Montana in the United States (Appendix E, SIB 2016).

The company had 32 712 employees and 6 598 contractors.

8.2.5 Lonmin

Lonmin had 31 fatalities between 2007 and 2016 as shown in Figure 31 and 36.

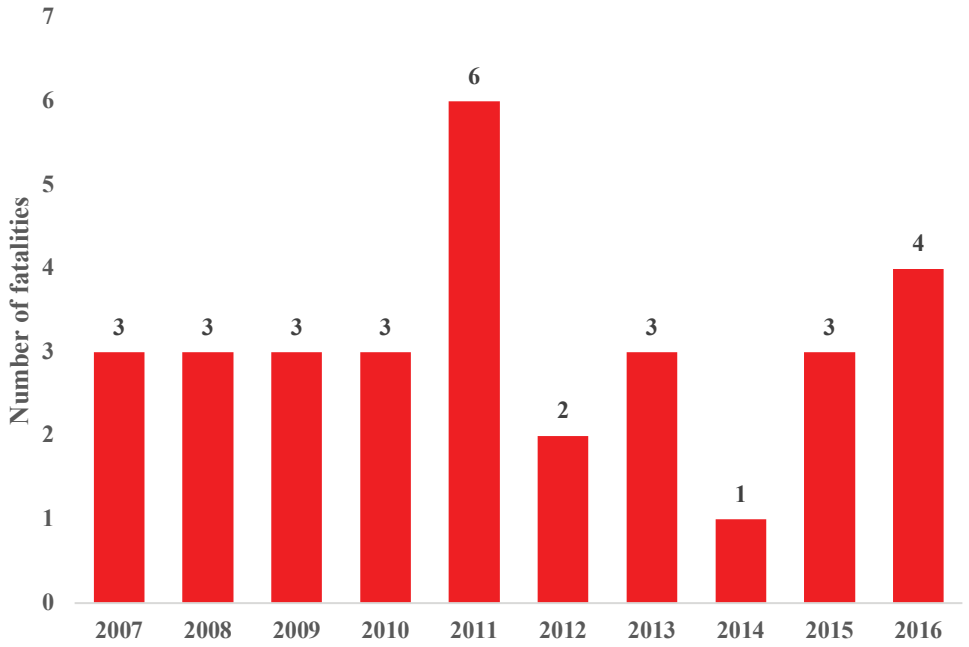


Figure 36 Lonmin 31fatalities, 2007-2016 (Appendix F, LON 2007-2016).

In 2006 Lonmin was the world's third largest producer of Platinum Group Metals. The South African operations comprised of mining complex in Limpopo located near Polokwane, Smelter and Base Metal Refinery near Marikana and a Precious Metal Refinery located at Brakpan (Appendix F, LON 2006).

In 2016 Lonmin acquired Anglo American Platinum's (AAP) 42.5% stake in Pandora, bringing the total ownership in the asset to 92.5% (Appendix F, LON 2016).

Lonmin has for a number of years experienced a combination of factors that increased the industry cost base and hindered efficient production. These factors

included rising wage demands, labour unrest, low labour productivity, above-inflation electricity and water price increases and electricity supply disruptions.

Lonmin's objectives were to reduce fixed costs, keep capital expenditure to the minimum necessary, improve efficiencies, and preserve the company's long-term value. The reorganisation of the company did have a disruptive impact on mining production.

8.2.6 Implats

101 Employees lost their lives at Implats between 2007 and 2016 as shown in Figure 31 and 37.

In 2006 Implats' operation were wholly owned Impala Platinum, Marula Platinum and Two Rivers in the South African Bushveld Complex. Implats has interests in Zimplats (86.9%) and Mimosa (50%) in Zimbabwe. Implats also has an investment in platinum producer, Aquarius Platinum Limited (8.6%), and its subsidiary Aquarius Platinum (South Africa) (20%).

Impala Platinum, Implats' primary operation, comprised the mining and mineral processing operations situated on the western limb of the Bushveld Complex, north of Rustenburg in North West Province, as well as the refining operation located in Springs, east of Johannesburg, in Gauteng. Impala Platinum's mining operation included 13 operating shafts, five decline shafts and two new vertical shafts (Appendix G, IMP 2006).

In 2016 the Chief Executive Officer resigned. Both 8 Shaft and the 12 Shaft mechanised sections, which were identified as loss-making in the low-price environment, were closed as planned at the end of December 2015. The company had major safety incidents as safety-related events at 1 and 14 Shafts in which the nine workers sustained fatal injuries. Four employees died when fumes following a fire overcame them occurred in the main underground decline at Impala Rustenburg 14 Shaft (Appendix G, IMP 2016).

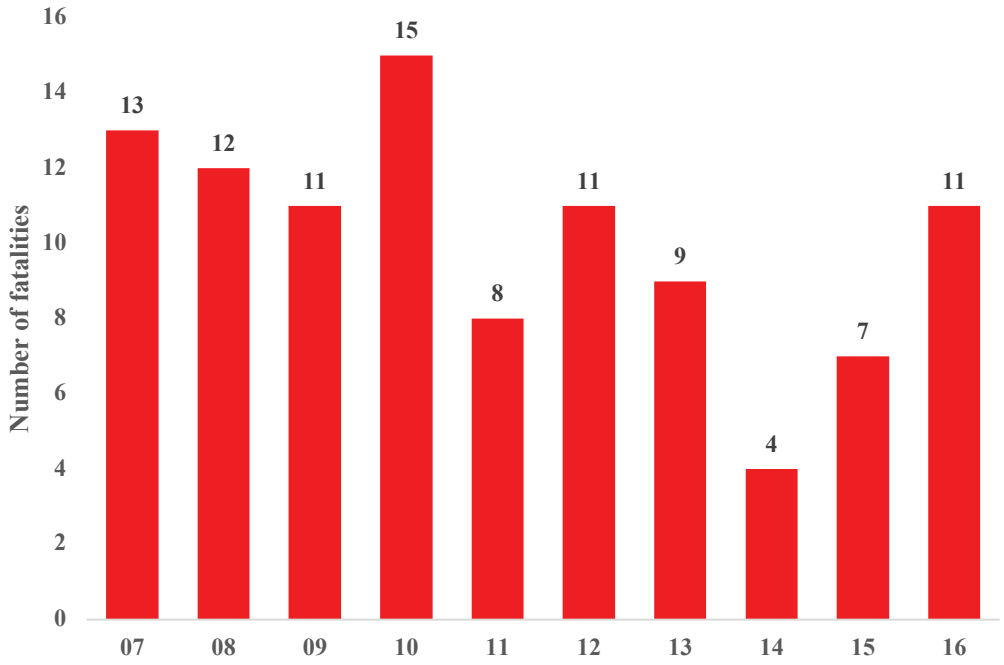


Figure 37 Implats 101 fatalities, 2007-2016 (Appendix G, IMP 2007-2016).

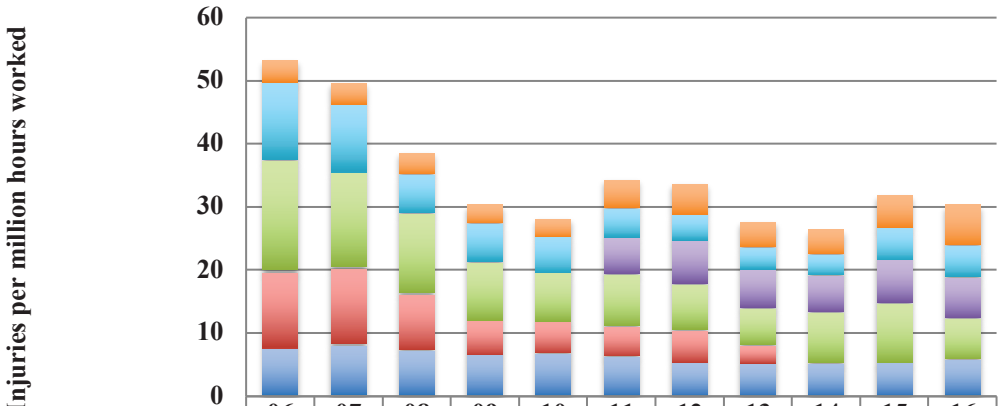
8.3 Injuries

The conversation in the South African mining industry has increasing been shifted to focus on reducing the number of injuries as well as the severity thereof. Thousands of individuals are still being injured annually in the South African mining industry.

The after care of injured individuals takes high priority in ensuring that the individual concerned recovers and is able to resume normal duties. The process is facilitated through health care facilities provided essentially through the private medical industry. Several mines have moved away from having their own hospitals and now get the service from private health care facilities.

Gold Fields stopped reporting the LTIFR as from 2014 in its annual reports. However, if a similar Gold Fields LTIFR to the 2013 figure is applied it can be seen that the collective lost time injury frequency rate of the mines researched has

reached a plateau since 2009 based on the published statistics as shown in Figure 38.



	06	07	08	09	10	11	12	13	14	15	16
Implats LTIFR	3,57	3,41	3,48	2,92	2,92	4,61	4,96	4,21	3,92	5,27	6,49
Lonmin LTIFR	12,5	10,8	6,27	6,21	5,87	4,71	4,16	3,5	3,34	5,14	4,97
Sibanye LTIFR						5,79	6,9	6,13	5,87	6,74	6,62
Harmony LTIFR	17,64	15,27	12,83	9,35	7,73	8,32	7,29	5,87	8,09	9,57	6,5
GF LTIFR	12	12,08	8,85	5,38	4,91	4,69	5,16	2,86			
AGA LTIFR	7,58	8,1	7,2	6,46	6,78	6,28	5,28	5,19	5,18	5,17	5,74

Figure 38 Lost Time Injury Frequency rate - stacked to show collective results (Companies researched Annual reports 2007-2016)

The Implats LTIFR has steadily been increasing from 3.92 in 2014 to 6.49 lost time injuries per million hours worked in 2016. Harmony has shown an improvement from 8.09 in 2014 to 6.5 injuries per million hours worked in 2016 as shown in Figure 38.

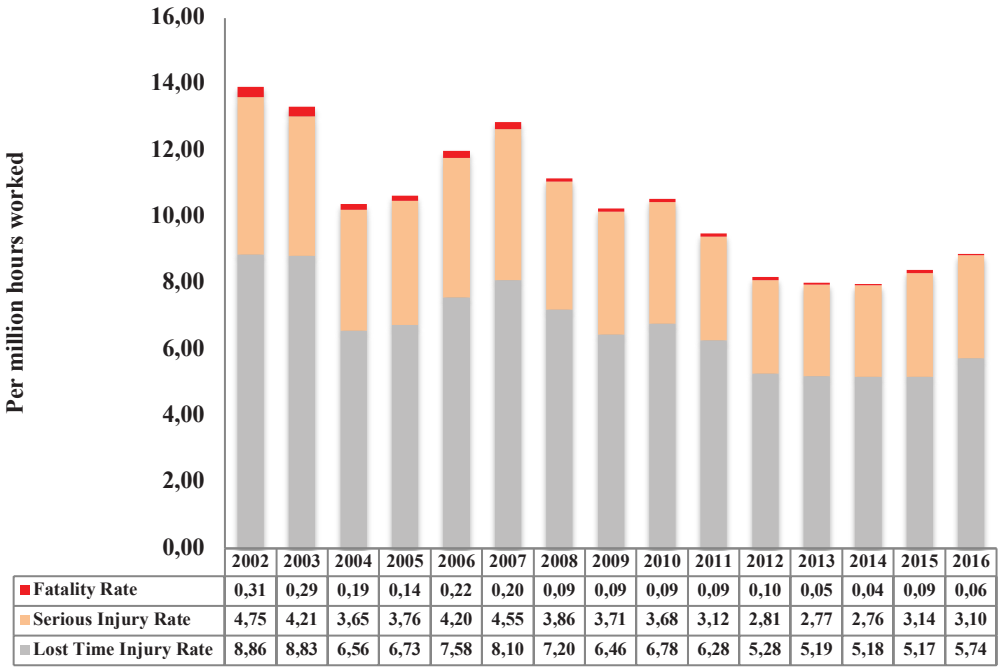
The collective observation from Figure 38 is that the mines researched have not been successful in reducing the number of lost time injuries since 2009 to the same extent that the fatalities were reduced.

The overall conclusion is that there is still significant room for improvement at the mines researched for real risk reduction in order to achieve zero in the long term.

8.3.1 All injury frequency rate

Internationally, several companies have adopted the All Injury Frequency Rate (AIFR) as an important indicator as shown in Figure 39. This is an all-inclusive rate of injuries that includes dressing cases, lost time injuries as well as serious injuries. It should however be used with caution as there are instances where it could hide some issues to the potential of not reporting dressing cases over a period of time due to other unintended consequences.

AngloGold Ashanti showed a reduction in the AIFR of approximately 50% between 2007 to 2016 as shown in Figure 39, however it was largely due to the reduction in the reporting of dressing cases. In real terms the lost time injury frequency rate, from 7,58 in 2007 to 5,74 per million hours worked in 2016 (24,2%), as well as the serious injury rate has reduced from 4,2 in 2007 to 3,1 in 2016 (26,2 %) which is significantly less than the reduction in the dressing case rate which reduced from 14,79 in 2006 to 1,92 per million hours worked, an 87% reduction, in 2016.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fatality Rate	0,31	0,29	0,19	0,14	0,22	0,20	0,09	0,09	0,09	0,09	0,10	0,05	0,04	0,09	0,06
Serious Injury Rate	4,75	4,21	3,65	3,76	4,20	4,55	3,86	3,71	3,68	3,12	2,81	2,77	2,76	3,14	3,10
Lost Time Injury Rate	8,86	8,83	6,56	6,73	7,58	8,10	7,20	6,46	6,78	6,28	5,28	5,19	5,18	5,17	5,74

Figure 39 AngloGold Ashanti All injury Frequency Rate (Appendix B, AGA 2002-2016).

One of the possible reasons for not reporting dressing cases could be the celebrating injury free days and using the ‘white flag days’ as an indicator for a company. A flag is hoisted on the head gear on a daily basis indicating the safety status of a particular shaft. A white flag means that it was an injury free day. Different colour flags are used to indicate, lost time injuries, serious injuries and fatalities. Everyone that passes the flag is then informed of the prevailing safety status.

The information is then sent to the ‘head office’ who then indicates the overall status of the company. The number of successive ‘white flag’ days then becomes an indicator of success. It is conceivable that the hype to show success can have the unintended consequence that dressing cases are not being reported as it is uncomfortable to be the bearer of bad news. If this tendency becomes entrenched it gives a skewed picture of reality and should be avoided. The AIFR has merit but it should be used in conjunction with other indicators.

8.3.2 Severity rate

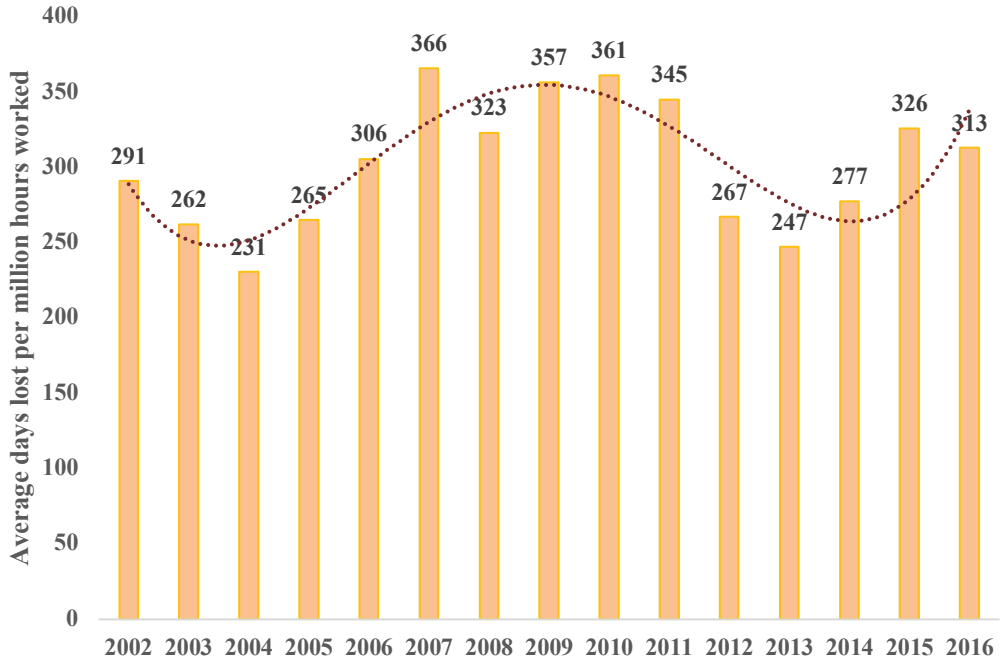


Figure 40 AngloGold Ashanti Severity injury rate 2002-2016 (Trend line - polynomial 4th order) (Appendix B, AGA 2002-2016).

Although the mines researched are inconsistent in the safety statistics disclosed, it can be seen in Figure 40 that the severity injury rate at AngloGold Ashanti has actually increased from 306 in 2006 to 313 in 2016. This means that some individuals are still severely injured and that the journey to 'Zero Harm' has still a long way to go.

8.4 International fatality comparisons

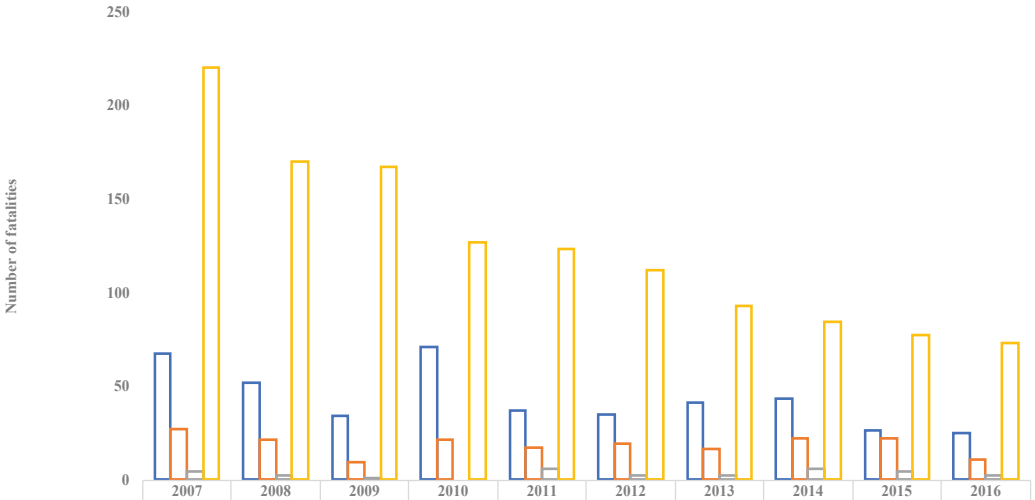
When the number of fatalities that occurred in the South African mining industry between 2007 and 2016 is compared to the USA, Australia and Ontario it is still an order of magnitude higher as shown in Figure 41. However, as shown in Figure 42 there was a 300% reduction in fatalities in the South African mining industry during this period with a consistent reduction of fatalities from 220 in 2007 to 73 in 2016 as shown in Figure 43.

The USA has shown a reduction in mine fatalities from 67 to 25, a 268% reduction, during the period 2007-2016 as shown in Figures 41, 42and 44.

Ontario has reduced the number of mining related fatalities from 4 to 2 during the period 2007-2016 which is a 50% improvement as shown in Figure 45. However, the absolute number of 2 fatalities is a remarkable achievement in their quest towards 'Zero Harm'.

Australia has reduced the mining related fatalities from 27 to 11 during the period 2007-2016 which amounts to a 41% improvement as shown in Figures 41, 42and 46.

It should be noted that despite the fact that the USA, Ontario and Australia have all reduced the number of fatalities during the period 2007 to 2016, the improvement is not consistent. It possibly proves the assertion that 'Zero Fatalities' is only possible for a limited period in a specific operation or country.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
USA	67	52	34	71	37	35	41	43	26	25
Australia	27	21	9	21	17	19	16	22	22	11
Canada - Ontario	4	2	1	0	6	2	2	6	4	2
South Africa	220	170	167	127	123	112	93	84	77	73

Figure 41 Fatalities per annum (www.cdc.gov; www.commerce.wa.gov.au; www.labour.gov.on.ca; www.ontario.ca; www.chamberbofmines.org.za)

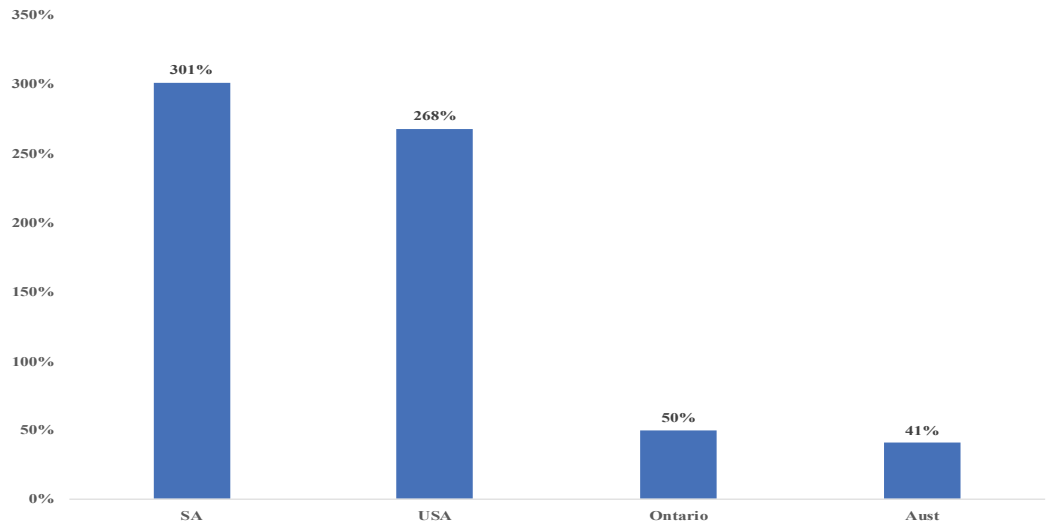


Figure 42 Fatality reduction 2007-2016(www.cdc.gov; www.commerce.wa.gov.au; www.labour.gov.on.ca; www.ontario.ca; www.chamberbofmines.org.za).

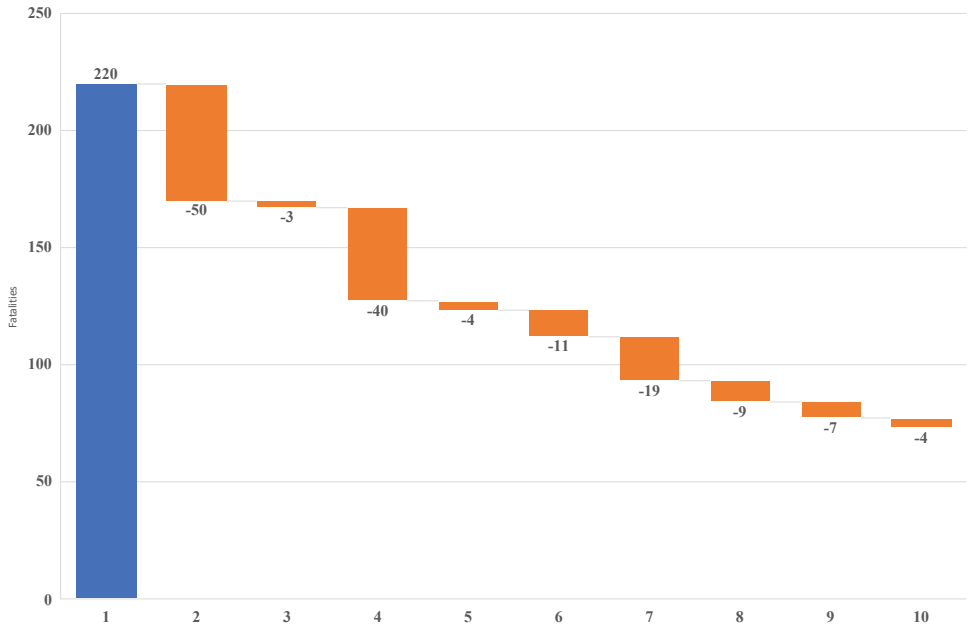


Figure 43 South Africa mining fatalities 2007-2016, 300% improvement (www.chamberbofmines.org.za).

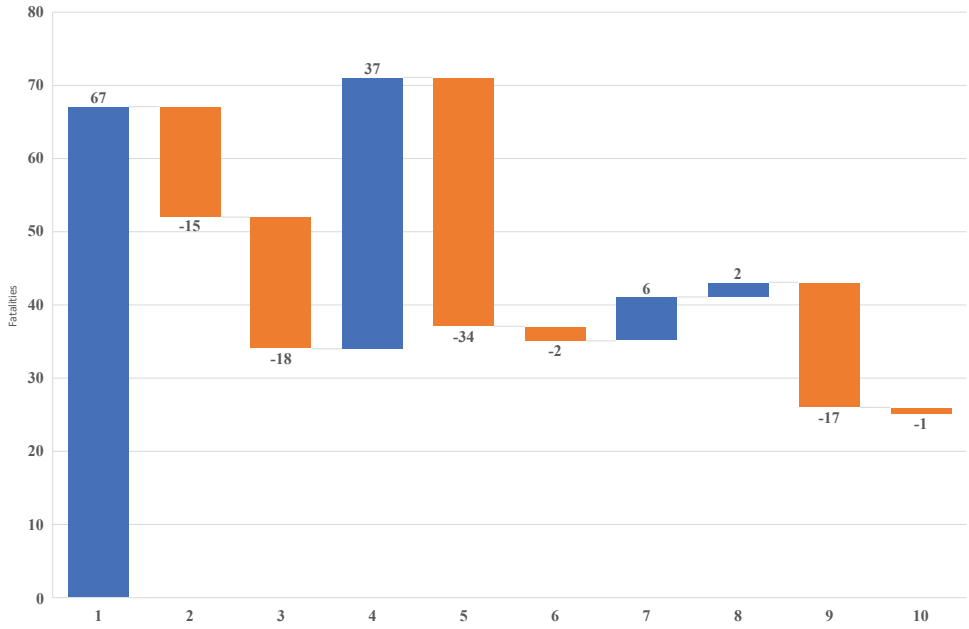


Figure 44 USA mining fatalities 2007-2016, 268% improvement (www.cdc.gov).

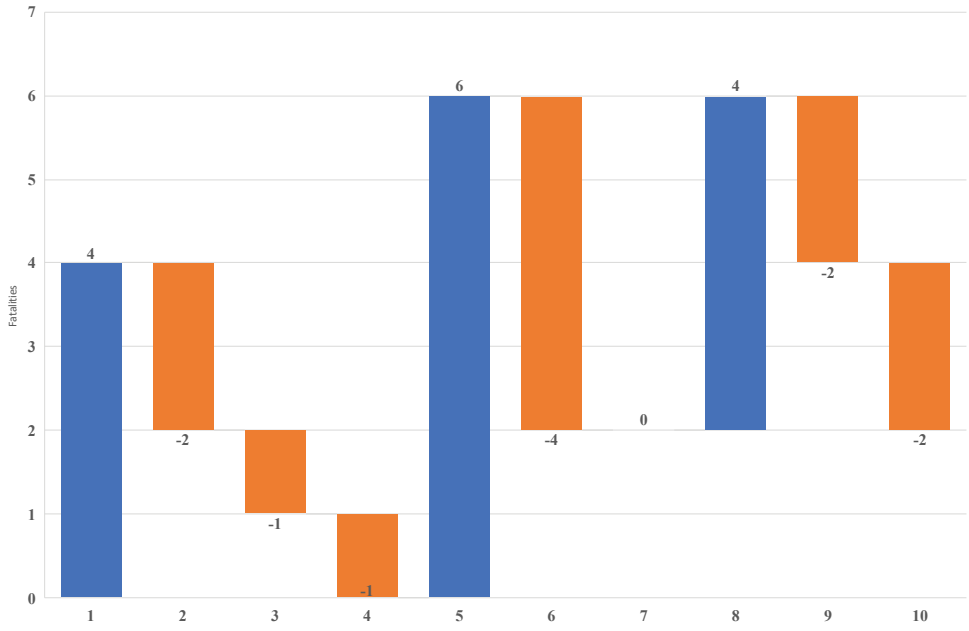


Figure 45 Ontario mining fatalities 2007-2016, 50% improvement (www.labour.gov.on.ca; www.ontario.ca).

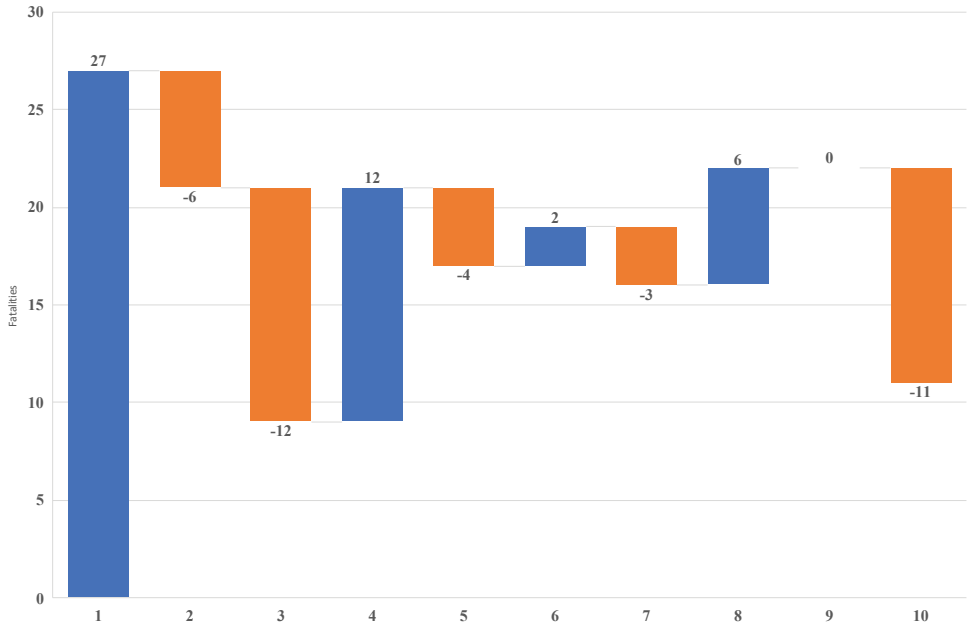


Figure 46 Australia mining fatalities 2007-2016, 41% improvement (www.commerce.wa.gov.au).

8.5 Conclusion

The concept of 'Zero Harm' has found favour in the South African mining industry and was adopted through the Mine Health and Safety Council of South Africa in and around 2003 when the tripartite stakeholders agreed on the industry targets and milestones. At the time 'Zero Harm' was meant as "every mine worker returning from work unharmed every day."

It encouraged the augmentation of the residual inherent risks after engineering controls by actively engaging people and leadership for an overall improvement in workplace health and safety outcomes. The significant safety improvements that the South African Mining industry experienced between 2007 and 2016 with a reduction of fatalities from 220 to 73 fatalities per annum has since lost some traction and consideration should be given what to do next to enable an industry turnaround.

‘Zero Harm’ is a term that has up to now not been collectively defined as it is used interchangeably by some as a specific outcome and others as a mindset or a process. ‘Zero Harm’ stems from the belief that theoretically all accidents are preventable, especially when analysed in retrospect. In order to achieve ‘Zero Harm’ as an outcome, the challenge is to have a workplace, equipment, materials and ‘known’ processes and procedures in place that when applied correctly, it will result in a safe outcome, all the time. Unfortunately, in reality, accidents do occur primarily as a result of human error at all levels of the organisation.

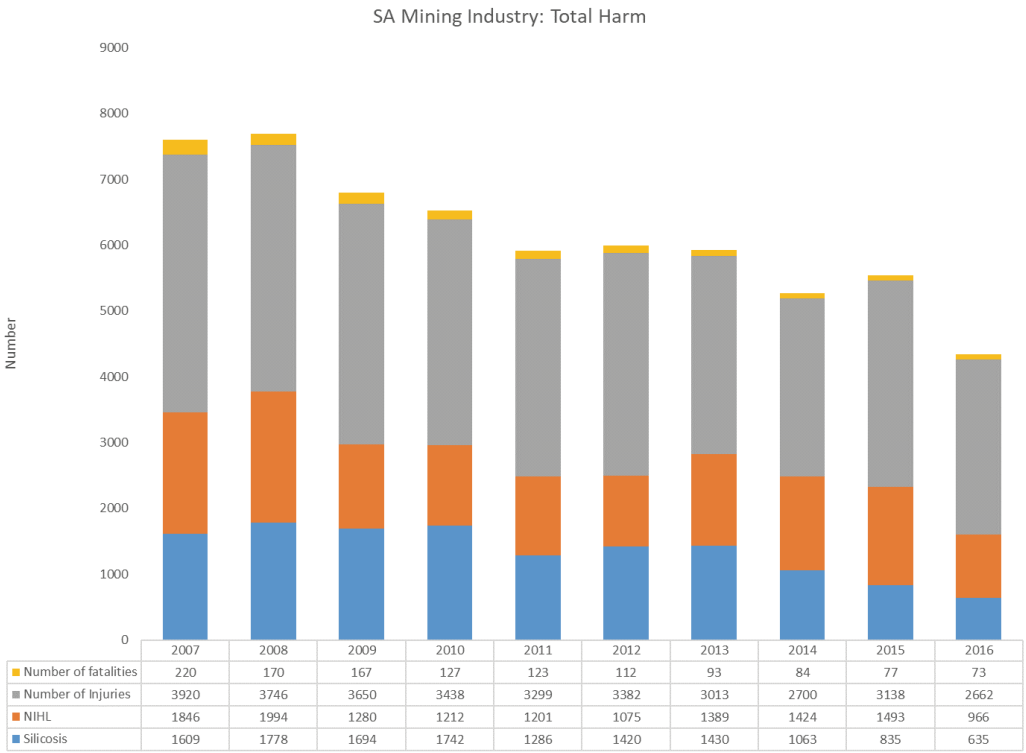
‘Zero’ is preceded by negative numbers and followed by positive numbers. ‘Zero Harm’ is at best an equilibrium point between ‘unintended harm’ and ‘intentional wellness’. The significant focus on the unintentional ’harm’ in the workplace and the less spoken about intentional ‘wellness’ in the workplace approach occurs concurrently in the mining industry.

It is suggested that the mining industry consider a more dynamic ‘pull factor’ of ‘Wellness in the workplace’ to augment the current concept of ‘Zero Harm’ which if seen as the ultimate outcome, will possibly never be achieved. A new metrics Total Harm Indicator (THI) should be introduced to measure to measure ‘Zero Harm’ progress in the mining industry. A paradigm shift should be embraced by adopting a more positive model of improving the wellbeing of individuals instead of avoiding injury.

‘Zero Harm’ should no longer be considered as a ‘final objective’ but rather consider it as a starting point for the opportunity to initiate comprehensive and meaningful deliberate positive outcomes. Changing the process from one of injury prevention, to one of health promotion, will allow for organisations to move away from a method that is inevitably limiting the scope of positive outcomes with respect to workplace health and safety. When it is acknowledged that beyond zero there are opportunities to increase the physical and mental health and wellbeing of workers, then there are possibilities of experiencing meaningful safety improvement that is both achievable and sustainable (Gutierrez, 2015).

In South Africa, a key success indicator used for the achievement of the 'Zero Harm' safety performance is the number of fatalities per annum which has clearly not been achieved and neither was it achieved in peer countries. It has in actual fact never been achieved anywhere in the world, other than for a limited period. However, an order of magnitude of mineworkers are still being injured and harm caused through latent issues such as noise and dust exposure latent health harm is still far away from zero.

The trailing 'success' indicator for 'Zero Harm' should not only be the number of fatalities but the Total Harm Indicator number which should be the total of, Silicosis cases, NIHL cases, number of Injuries and Fatalities as shown in Figure 47. The Total Harm Indicator Rate (THIR) should also be expressed as a rate per 1000 as shown in Figure 48.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of fatalities	220	170	167	127	123	112	93	84	77	73
Number of Injuries	3920	3746	3650	3438	3299	3382	3013	2700	3138	2662
NIHL	1846	1994	1280	1212	1201	1075	1389	1424	1493	966
Silicosis	1609	1778	1694	1742	1286	1420	1430	1063	835	635

Figure 47 South African Mining Industry: Total Harm (Data supplied by the SA Minerals Council)

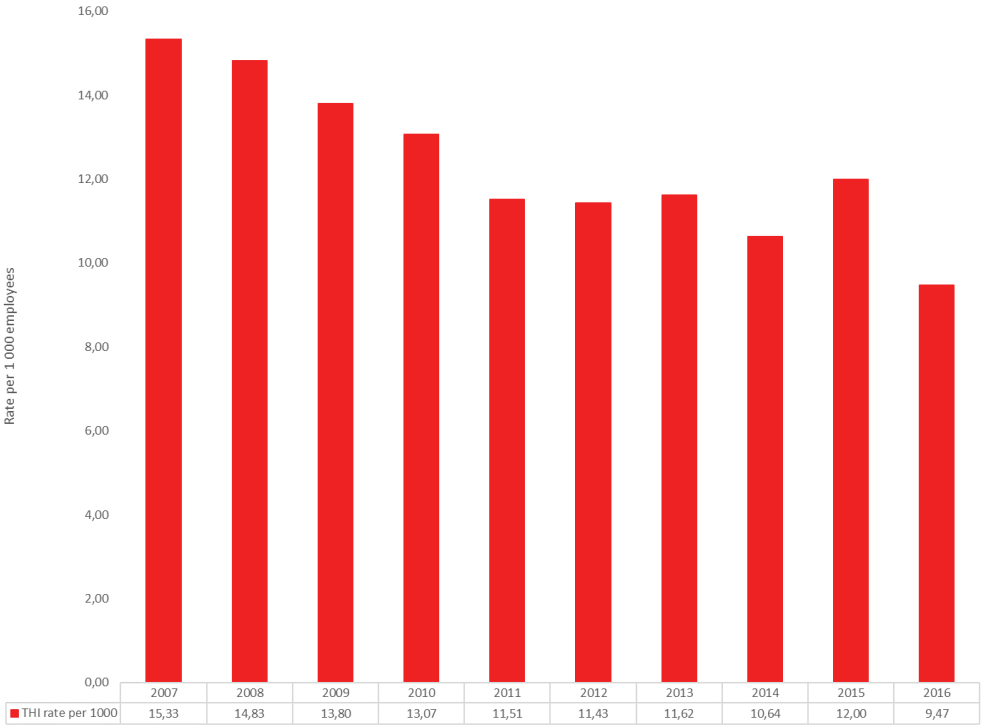


Figure 48 South African Mining Industry: Total Harm Indicator Rate (THIR) per 1000

9 CONCLUSION AND RECOMMENDATION

9.1 Introduction

Safety have always been part of mining world-wide, however, the importance of being safe differs historically between countries and different generations.

During the period 2007 to 2016, 1 246 persons died in the South African mining industry. The fatalities reduced from 219 per annum in 2007 to 73 per annum in 2016 which is a 67% improvement as shown in Chapter 1-Figure 3.

Safety remains a very important part of the social license to mine in South Africa. Although the number of fatalities has decreased significantly in recent times, it still occurs too often to be acceptable by society.

The overriding question is what has had to change to realise this significant improvement? Was the answer in new leadership, technology, processes, systems, legislation or applying that was known before?

9.2 Background

The number of deaths in the South African mining industry during the past 100 years exceeds 51 000 between 1917 and 2016, as shown in Chapter 1-Figure 1. Although the number of deaths per year has been decreasing substantially during the past 30 years since 1987, it remains unacceptably high at 73 fatalities in 2016, as shown in Chapter 2-Figure 8 and Chapter 1-Figure 3 respectively.

This reduction in fatalities has been partly as a consequence of the reduced number of employees up to about 2003 as shown in Chapter 1-Figure 2. However, it can also be seen that subsequently there is no correlation between the number of employees and fatalities as the risk exposure has been reduced.

The National Union of Mineworkers (NUM) was recognised by the South African Chamber of Mines in 1983 as a representative union. In the same year Hlobane

colliery methane explosion resulted in 68 fatalities. In 1985 NUM expressed concern over the mining industry's safety record.

In 1986 the Kinross fire resulted in 177 fatalities. This disaster was followed in 1987 by a methane explosion in the Ermelo coal mine which resulted in 34 fatalities. In the same year St Helena mine had a shaft explosion causing the cage to fall down the shaft resulting in 67 fatalities. These disasters caused NUM to embark on a National strike for 3 weeks in 1987 (Leon Commission 1995).

In 1988, the Association of Mine Managers Council decided that safety would be at the top of all agendas and AMMSA organised a safety symposium (Hocking 1997).

The safety improvement in the South African mining industry basically commenced in 1987, as shown in Chapter 2-Figure 6. At the time there was significant company restructuring and refocusing as some mature shafts were closed, some shafts were sold to 2nd and 3rd tier companies and NUM's presence was felt in the mining industry.

In 1993 the Leon Commission, was launched into safety and health in the mining industry with wide terms of reference to inquire into all aspects of the Regulation of OHS. The findings built on previous Inquiries done in 1911, 1925, 1960.

In 2007 the then CEO of Anglo American, Cynthia Caroll, closed two platinum shafts in South Africa following a number of fatalities until the workforce received more safety training. This level of consequence management was unheard of in South Africa at the time. The DMR has subsequently been stopping shafts or part of the operations at regular intervals for transgressions, despite lacking consistency in the approach.

In 2008 the Presidential Mine Health and Safety Audit was commissioned, and recurring themes were again recognised as was the case in the 1960 Marais Commission (Leon Commission 1995).

A Tripartite Safety Summit was held in 2008 with union, government and industry representatives to address safety concerns in the mining industry.

Why were some of these recommendations not implemented at the time? The compelling answer is probably that the mining industry at large was not held accountable for their actions and non-compliance had insignificant consequences for the individual companies in the past.

The mining industry's response to safety has changed significantly in the past two decades and the historical prerogative to 'ignore' safety issues is no longer an option as mining companies are being held accountable for their actions.

9.3 Theoretical Approach to Achieve 'Zero Harm'

It is imperative that leaders involved in safety and health holistically understand the interdependencies of various safety aspects in dealing with the concept of 'Zero Harm' and how to achieve it. It has been experienced that that in large organisations, very few individuals actually understood the interdependencies of the overall safety management 'system' as a whole.

It's critical to recognise that safety success isn't an 'or' issue (one strategy or another), but rather an 'and' issue (one strategy and another). Safety excellence is not the result of a singular strategy.

In a complex environment or a very large organisation, it is conceivable that only a few people, if any at all, understands the overall interdependencies of all the aspects of the 'Safety Management System'. There should therefore be a consistent, simplified safety storyline available so that the majority of the staff understands how the various components fit together as a whole in order to achieve 'Zero Harm'.

As a start, the Leadership of a company must have 'Zero Harm' as a non-negotiable value for the company. However, it should be understood that 'Zero

Harm' is a reactive mindset in that it implies that an incident is expected to occur, but that the consequences should result in 'Zero Harm'. The next desirable pro-active mindset is that of 'zero incidents', meaning that all risk management controls are appropriate and applied.

Genuine caring for people creates an environment conducive for 'Zero Harm'. 'Values' on a wall poster that are not being applied, especially by leadership, have significant negative consequences on the safety culture in the longer term. Management must be seen to live the values and lead by example.

The company's safety efforts should be documented and contained in a Safety Management System (SMS), agreed to by all and applied by all stakeholders in the company. Participative management is important to the success of the 'Zero Harm' concept.

The SMS must be underpinned by a credible dynamic Risk Management process. Risks at all levels of the organisation must be identified and controls instituted. Controls must be applied by all so as to ensure that activities are within the company's residual risk tolerances.

Safety is a result of pro-active risk management and is a concurrent activity to ensure that controls are in place before and during the execution of any task and not something that is done subsequently. For every task to be performed there should be an agreed safety procedure available and all staff should agree to work to it.

What gets measured gets done. The safety information system must be appropriate for the company with leading and lagging indicators which are relevant, accurate and available timeously. More importantly, appropriate action should be taken should indicators trend negatively.

Human factors, which include the theory of behaviour as well as human errors, should be well understood, including human limitations. This will include the

behaviour of leadership as well as the individual who is in the line of fire. Behaviour turns systems and procedures into reality.

Benchmarking of relative industry performance should be undertaken, and system audits should be done regularly to ensure compliance of the company's Safety Policy. The company should strive for continual improvement of their safety performance (de Jager 2015).

9.4 Safety is a business imperative

The safety expectations by individuals, society-at-large as well as companies, matured over time. What was acceptable in the past is no longer acceptable and will evolve further in future.

In the past the majority of employees in the mining industry were illiterate and were required to do manual labour underground in challenging conditions. The mineworkers were largely recruited from remote labour sending areas and neighbouring countries and were housed on the mine in hostels, away from their families. They had an expectation to earn a wage to support their families and eked out a living. At the same time, they expected to potentially contract phthisis and lose hearing over time due to their exposure to dust and noise. Additionally, they could get injured, be maimed or die as a result of the nature of their work.

However, over time, the individual's expectations matured and now expects a decent wage and benefits, living with their families in houses as well as not to be injured at all or exposed to other occupational diseases.

Company and other stakeholders' expectations have increased dramatically over time resulting in increased complexity and effort to have a sustainable business. Making adequate returns on investments is paramount to ensure business success but it cannot be done at the expense of society expectations. Mining companies cannot operate in isolation and society creates an enabling environment if expectations are met and the opposite if it is not met.

Exposure to occupational risks that results in diseases, injuries and fatalities are not acceptable and some investors and clients are no longer willing to deal with mining companies that have unacceptable safety performance. Times have changed and if companies do not adapt, how long will they survive?

9.5 Society's view on accidents

Society has different views about public commuting deaths versus a similar incident in a mine and the reactions are vastly different.

A hypothetical example of a taxi commuting accident versus an underground people transportation accident is used to illustrate the different potential consequence.

If the public use cars, taxis, trucks and buses on public roads, there are common rules applicable with respect to road safety. Adhering to the rules of the road seems to be optional in many cases in South Africa. In the case of speeding, as an example, the adherence to road rules are randomly checked by the traffic officers and violations are dealt with, largely in the form of fines, which are to be paid subsequently.

Pro-active collision avoidance driver competencies such as advanced driver training is dependent on the attitude and requirements of the individual driver, unless prescribed by company rules. Collision avoidance technology in a vehicle, such as park distance control, cameras, ABS, EBD, lane change assist are vehicle manufacturer's self-imposed requirements, which maybe a requirement by some countries. In some countries, failure to produce a safe car could result in class action suits against the manufacturers, which could have a significant negative impact of a brand. Just about none of these controls are available in the taxi industry in South Africa.

Consequence controls in a car such as airbags and crumble zones are requirements set by manufacturing bodies and there are different requirements throughout the

world. Vehicles used on public roads are supposed to be roadworthy and from a safety perspective, only the wearing of seatbelts in certain types of vehicles are prescribed by law in South Africa.

In the case of an accident by a taxi in South Africa, which results in multiple injuries and fatalities, which happens too regularly, it becomes news, not headline news. These accidents invariably happen when an over tired driver, pushed for turnover, drives an un-roadworthy vehicle, probably disregarding the rules of the road, takes another chance and this time it fails.

The victims are buried, in many instances government officials attend and speaks out about road safety, the families are distressed, bread winners may be lost, some passengers may be maimed, and others are lucky to escape unhurt. The driver may get a fine, but it is not inconceivable that he or she would be back on the road in due course carrying on with the same old habits and same 'old' routine.

There may even be an outcry by the local authorities and at times even an outcry by the government which fades fast. If the locals complain about a driver's recklessness, they won't have a lift the next day.

Other than sharing the intent that all drivers must comply with the traffic rules, there is no government requirement that subsequent to a taxi fatality that all drivers must be retrained, all taxi services be stopped to facilitate the retraining, all un-roadworthy taxis be scrapped, new on board technology for collision avoidance be introduced etc. The same old just continues and it is business as usual.

Therefore, the society have come to accept that riding a taxi is just part of life and the potential negative consequences has become part of the South African culture.

In 2016 there were 14 071 road accident related fatalities in South Africa (RTMC 2016). The equivalent number in Australia was 1 290 fatalities during 2016 (Bitre 2017).

Contrary to this, if an accident which results in multiple fatalities occurs underground, while transporting employees, the mine will be stopped; the driver probably be relieved of his duties and lose his or her job or the licence being revoked; the manager and the company may be fined; significant retraining to be done by all the drivers and new technology expected to be introduced to prevent a reoccurrence.

The original equipment manufacturers could be brought in and in a tripartite process be established to find a solution. It would probably become an industry strategic safety thrust; case studies will be done, and papers written about the remedial measures. Significant cost will be associated with this mishap; the company and mining industry image will be tarnished; the unions could even strike, and investors could become reluctant to be further associated with the company concerned.

9.5.1 Safety is a business imperative

This exaggerated rendition of similar accidents in a different context and varying society and government expectations, points out that the consequences of mishaps for the mining industry is enormous.

The Chamber of Mines of South Africa (COM) estimated that the Department of Mineral Resources (DMR) Section 54 instructions to stop mines or part thereof, as a consequence of safety related transgressions, cost the industry some R13.6 billion between 2013 to 2015 (Moneyweb 2017).

There are therefore compelling reasons for a company to mine safely and to regard it as a moral and business imperative to ensure sustainability.

9.6 Is ‘Zero Harm’ possible?

Society at large is increasingly expecting that for mining to be sustainable, the safety performance must improve dramatically. It is not acceptable to kill

somebody in the course of their work. Society's expectations and the mining industry's response has moved closer over time to the mutual vision of 'Zero Harm' was adopted although it has not been achieved as yet.

Will 'Zero Harm' ultimately be reached? Probably not as mining is inherently dangerous, and people make mistakes. The focus of the mining industry is to make the mining process safer and for people to make fewer mistakes.

9.6.1 Mining context

Mining is not a steady state operation and is very dynamic as the environment is constantly changing and it is therefore an abnormal normal environment. The mining method employed such as conventional drilling and blasting, mechanisation and automation largely dictates the potential safety outcome. This outcome is fine-tuned by the interface between humans, machinery and the environment created.

In the South African mining industry, there are a significant number of elements that create the context within which miners are expected to operate. It includes mature mines, pillar mining, mining at depth, heat, significant underground travelling distances, and seismicity, amongst others.

The mining method, taking into consideration the inherent characteristics of the orebody, is the singular most important predictor of the safety outcomes as everybody working in the resultant environment will be exposed to the risks created by design.

There is a direct relationship between energy used to mine and the potential consequences of it used in a positive or negative manner. In mining the amount of energy used is invariably significant to turn ore reserves ultimately into a saleable product.

Mining involves intruding into an inherently high- energy space and environment. The very rocks surrounding the excavated openings are charged with latent energy. The way to manage this latent or potential energy has a lot to do with safety.

The laws of thermodynamics and entropy mean that latent energy stored in the rocks surrounding any excavation is looking for a way of release. The very environment in which mining takes place is charged with energy and any irresponsible behaviours could result in an unwelcome release of that energy. It is therefore no surprise to conclude that the safest mining is no mining at all.

9.6.2 Risk management

There is no single answer to achieve ‘Zero Harm’ as the overall efforts necessary to ensure that the residual risks created by deep level, hard rock mining are enormous and complicated. Continuous improvement is required in order to move closer to achieving ‘Zero Harm’.

The South African mining companies in general have put in significant efforts to reduce the residual risks. The mining industry has renewed it’s efforts to apply known solutions better in the prevailing circumstances.

Certain practices were either stopped, or the risks mitigated for example pre-conditioning of mining in seismically active areas. New collision avoidance technology in horizontal transport underground reduced the risk of two locomotives coming into contact with each other and persons which has resulted in improved safety results. However, more of the same can only do so much and something new is required to create the next step change in safety performance.

Risk management processes have not changed in the past 80 years. The application methodology and monitoring thereof has become more sophisticated over time. Unfortunately, if the collective wisdom by all stakeholders fails to

identify the risk, the controls to potentially reduce the risk exposure will not be envisaged or implemented.

Paper solutions are patient, but the reality is that the mining environment is dynamic, and conditions change continuously. The company leadership should cater for the possibility that the requirements to achieve 'Zero Harm' will not always be executed perfectly. This resultant gap is where incidents occur that can cause harm.

If a risk is not identified upfront, the rest of the available potential controls are all irrelevant. However, if the risk has been identified and the controls are inadequate, the correct application thereof could still result in an incident.

People are exposed to the real environment and will have to take these dynamics into consideration to make informed decisions on the spot. The result of these decisions will determine whether 'Zero Harm' is achieved, or not. The perfect human being has not been found as yet and the rest of society is still fallible and has the potential to make mistakes.

If the risk was identified and the controls are adequate, behavioural safety can make the difference between success and failure when the individual decides whether to apply the intended risk controls or not.

9.6.3 Inadequate risk controls

Fatalities will not occur if the risk controls in place were adequate and applied perfectly. If one considers the 73 fatalities that occurred in the South African mining industry during 2016, how many of the fatalities were due to inadequate controls being in place?

Some generalities are quoted by the individual companies that 70-80% of accidents are due to human behaviour, which normally refers to the behaviour of

the individual that was injured. This means that the risk controls were in place but not adequately applied which resulted in harm.

The converse must then be true that 20-30% of incidents had inadequate risk controls in place, designed by the company leadership. That being the case, is this oversight due to mistake or is it a violation? Ignorance is bliss, but it is unacceptable in mining.

The residual risk is the interface by the individual to this environment by a prescribed working methodology using prescribed equipment. The onus of ensuring that this interface can conceptually be safe rests with the company's leadership to determine policies that will create an enabling environment to achieve the lowest possible anticipated residual risk. It is only by the perfect application of this strategic intent that the real residual risk will equate to the planned residual risk.

9.6.4 Seismicity

Fatal injuries ascribed to a 'seismic' event is a misnomer in that 'seismicity' is the consequence of the way mining is done and not the cause of accidents. Mining induced 'seismicity' can be described as a *catastrophic rock mass failure*. *Rock mass management* should be a holistic approach to design, protect and monitor mining in areas that are prone to *catastrophic rock mass failure* the characteristics of which are similar to naturally occurring seismicity.

If mining takes place in 'seismic' areas, and the industry acknowledges that further research is necessary to manage the risks better, it means that inadequate knowledge is currently available. Similarly, if mining in 'seismic' areas continues in the meantime and it is done knowingly that the controls in place are probably inadequate, the leadership behaviour could be classified as a wilful violation as it is a known unknown. This in turn becomes a moral debate and no longer a technical debate.

9.6.5 Safety by design

At the conceptual level the focus of the South African mining industry is to remove people from risk by changing mining methods and by introducing new technology. This approach has had some success, but its full potential is still to be achieved. The primary reason for this is that most of the current mines operate mainly using conventional methods which continues to expose people to risk.

Mining is dangerous, and it is not possible to eliminate all risks completely, as ultimately there is a dependence on human behaviour. Humans are not perfect, and mistakes do happen. However, ‘Zero Harm’ is an important mindset and goal that should be relentlessly pursued, and the safety culture be enhanced continually.

The law makers, mine designers, process and procedure designers, equipment manufacturers, trainers and individuals regard safety as a priority and a non-negotiable. There are probably no individuals who have the wilful intention to design unsafe conditions. At worst, in isolated cases it is possible to make a mistake, primarily due to insufficient knowledge, that a design is inadequate.

Can it be true that if there is an accident, that in most cases, the response at company level is that the individual concerned has erred? It comes down to a perceived wilful violation by the individual as he or she was trained to do the job properly but did not do what he or she was supposed to do, for whatever reason.

Is it possible that the prevailing conditions were such that the individual concerned made a mistake in that what was trained was not quite applicable to the situation encountered? How many people would wilfully violate an agreed process and specifically have the desire to be injured or killed?

9.6.6 The residual risk is still too high

When risk controls are devised, it is envisaged that when they are perfectly applied, the residual risk will be acceptable. The tolerance for non-adherence of the control requirements is minimal in the instances where the potential energy that the individual is exposed to is beyond human tolerance.

The unintended release of energy such as a fall of rock, premature blasting, fall from height, in the way of equipment, misuse of energy normally exceeds human tolerance and results in harm. These releases of energy, which an individual could potentially be exposed to, invariably does not fail to safe, as would normally be the case with electricity that has a trip switch.

Maybe the consequence of a 'small' non-adherence to agreed procedures is such that the consequences are disastrous. Surely one must then query whether adequate controls are in place to deal with such situations.

It can therefore be concluded that the residual risk could be too high and should be engineered such that the consequences of potential mishaps are minimised. It is inappropriate to place such a significant dependence on the behaviour of individuals in the cases of accidental energy releases beyond human threshold.

9.6.7 Behavioural safety

When risk controls are formulated, they cater for a broad range of possible eventualities and it is perceived that the residual risk will be within the acceptable risk tolerances. This will only be achieved by the perfect application of the prescribed rules.

Danger is real, but it is the individual's interpretation of the perceived future residual risk that will determine his or her actions. It is possible that an individual could find him or herself in a situation where there is no ready-made solution available and that an on the spot solution needs to be made to deal adequately

with the risk at hand. If the outcome is misinterpreted, the risk mitigation will be inappropriate which could result in harm.

It is for this reason that a significant amount of technical training is imparted to the individual as an enabler to envisage potential solutions of unanticipated situations. This training is augmented by behavioural safety training to equip the individual with the necessary emotional intelligence to make informed decisions to avoid harm.

Accidents are invariable blamed on the injured individual's immediate actions. However, when causal analysis is done to determine the root causes it can be concluded that there were other issues that contributed to the particular incident. The combination of contributing factors has one common denominator in that the higher order risk management controls were designed and are intended to be executed by human beings. Assuming that all individuals in the run up of incident are technically competent to make relevant informed decisions, why is it that things still go wrong?

Ergonomics helps harmonise things that interact with people in terms of people's needs, abilities and limitations. From an ergonomic vantage point, the common denominator is human beings. Again, assuming that the individual is competent in what he/she is expected to do what remains is the individual's physical wellness and mental wellbeing.

9.7 Towards achieving 'Zero Harm

Research was done to determine what actions were taken to improve safety in six South African deep level mines using publicly available information for the period 2007-16. All the mines were GRI compliant.

The conclusion was that the acceptance of global and national societal expectations; the embracing of these requirements; the creation of an enabling environment; the real reduction of risk in most cases and being held accountable,

resulted in the reduction of fatalities in the South African mining industry over the past decade.

Emerging themes were observed which enabled the companies to create sustainable safety outcomes. This high-level approach could be adopted by the relevant companies and organisations in a country to improve the safety performance shown in the 'de Jager Zero Harm model' in Figure 49.

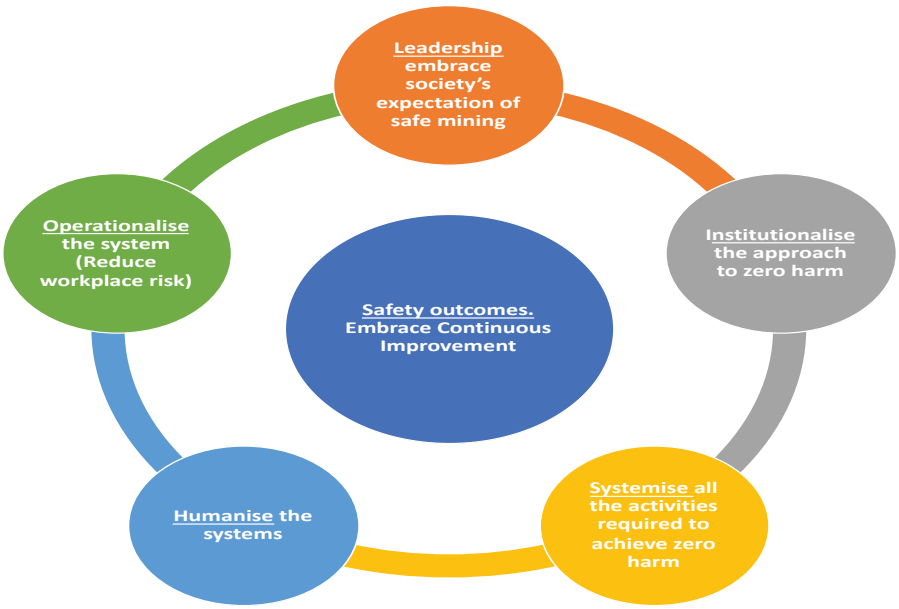


Figure 49 'de Jager Zero Harm model'

Most importantly, society norms and expectations need to be articulated consistently through various institutions, organisations and actions to enable the mining industry leaders to clearly understand what is expected from them. Other major themes include:

(1) The country/company's leadership to take heed of the broader society's expectation and requirements that mining must take place safely.

(2) The country/company leadership to institutionalise the approach to 'Zero Harm' by articulating the strategic intent and to create an enabling environment to achieve 'Zero Harm'.

(3) Systemise all the activities required to achieve ‘Zero Harm’.

(4) Humanise the safety system to transfer relevant knowledge and establish behaviours of all individuals throughout the organisation to enable the achievement of ‘Zero Harm’.

(5) Operationalise the safety management system by removing or reducing the risk to acceptable levels in the workplace.

(6) Monitor and manage the company safety outcomes.

(7) Embrace continual improvement.

9.8 Summary of findings

There is no one specific action that improved the safety performance in a mature mining company in South Africa between 2007 and 2016. It required a combined effort by all stakeholders including, companies, government, organised labour, relevant organisations and employees, aspiring to achieve ‘Zero Harm’, to turn the vision into action.

It was concluded that national and international society expectations were acknowledged and turned into actions by the mining industry to improve the safety performance which included:

(1) A tripartite mining industry safety game plan facilitated by the Mine Health and Safety Council of South Africa was developed and re-focused bi-annually, where necessary.

(2) Measurable industry safety goals was determined and agreed to by the tripartite alliance which includes, government, organised labour and mining companies.

(3) The mining industry is being held accountable for their safety performance by all stakeholders including the broader society, shareholders, organised labour, the Department of Mineral Resources and by the company boards.

(3) The Chamber of Mines of South Africa is acting as a collective enabler for industry's safety initiatives.

(4) Guidance safety principles and processes provided by the International Council on Mining and Metallurgy are used.

(5) The mining industry established a co-operative Chief Executive Officer's working group to reduce fatalities by initially focusing on specific initiatives such as fall of ground and underground horisontal transport. The results were highly successful.

(6) 'Zero Harm' is aspirational and it is a process in progress.

(7) Commitment by company boards, leadership and employees to achieving 'Zero Harm'.

(8) Consistently articulating the strategic intent aspiring towards 'Zero Harm'.

(9) Institutionalise 'Zero Harm' as a process through company values, policies, procedures and governance processes and definite plans to achieve it.

(10) Manage the interdependencies of all requirements to achieve 'Zero Harm' by systemising it. (Plan, do, check, act.) It includes all aspects of the zero-harm approach including enhanced risk management methodologies, international certification, audits, reviews, investigations, critical control measures, information systems, contractor management, etc.

(11) Spend significant efforts on enabling employees to progress towards 'Zero Harm' by creating a safety culture focused on 'Zero Harm'. Some of the aspects included involvement by all relevant parties; safety culture transformation,

wellness of the workforce; significant training; enhanced behavioural safety programmes; fatigue management; campaigns, leadership training programmes, stakeholder relationships, women in mining, absenteeism, incentives, disciplinary processes, etc.

(12) Operationalise the collective efforts by the 'real' reduction or elimination of risk. It includes reviewing and changing mining methods, technology introduction, mechanisation and automation, seismicity, rock bolting, netting, collision avoidance in horizontal transport, fire prevention, maintenance of infrastructure, enhanced secondary support, amongst others;.

(13) Measure and manage the safety performance at company and industry level.

(14) Aspire to continual improvement.

9.9 A potential implementation plan

It is recommended that in the instance where a company or country's safety requires improved safety performance, the following summarised methodology, as shown in the 'de Jager Zero Harm model' Figure 47, can be used to determine what should be done to improve the safety performance. The proposed steps include:

1) *Recognising* that the safety performance needs to be improved; A company's safety performance is *deserved* as it manages risks to be within the company's *risk appetite.*
2) Review and implement 'real' reduction or elimination of risk opportunities by creating *an enabling environment*. It includes reviewing and changing mining methods, technology introduction, mechanisation and automation, seismicity, rock bolting, netting, collision avoidance in horizontal transport, fire prevention, maintenance of infrastructure, enhanced secondary support, amongst others;

3) Review efforts spent on *enabling and empowering employees* to progress towards achieving 'Zero Harm' by creating a values-based safety culture. Some of the aspects included involvement by all relevant parties; safety culture transformation, wellness of the workforce; significant training; enhanced behavioural safety programmes; fatigue management; campaigns, leadership training programmes, stakeholder relationships, women in mining, absenteeism, incentives, disciplinary processes, etc;
4) Manage the interdependencies of all requirements towards achieving 'Zero Harm' by *systemising* it. (Plan, do, check, act.) It includes all aspects of the zero-harm approach including enhanced risk management methodologies, international certification, audits, reviews, investigations, critical control measures, information systems, contractor management, etc;
5) *Institutionalise 'Zero Harm'* as a process through company values, policies, procedures and governance processes and definite plans to achieve it;
6) Have *engaged leadership* at all levels of the organisation by the commitment of the company board, leadership and employees to strive towards achieving 'Zero Harm' and consistently articulating and capacitating the strategic intent to aspire towards achieving 'Zero Harm'.
7) Confirm the relevant societal advocacy and distinguish between expectations versus requirements.

These activities should concur concurrently to devise the overall safety and health improvement strategy. It is recommended that the relevant stakeholders including organised labour and regulators be involved throughout this journey. Although all these processes are necessary the *real reduction of risk* in the work place is key where conditions are not conducive to facilitate safe behaviour. Work places should be stopped if mining cannot take place safely.

Another key aspect is to capacitate employees to behave safely, no matter what. Although employees are legally empowered to withdraw from a

workplace if they deem it to be unsafe, invariably this does not happen. The key is for individuals is to make a key decision whether in one's perception the work place is safe and it is actually safe. This decision is made using technical training and competence. The moment before that decision is made is based on the perception of a future outcome in the individual's mind. Danger is real, and one's perception of the future potential outcome will dictate one's behaviour. In the case where the situation is perceived to be safe and in reality it is dangerous, the outcome could be disastrous. An idiosyncrasy is that if in one's perception the situation is safe and it is actually dangerous, the chances are good that the reporting to the supervisor, in the form of a safe declaration, will not alert that additional effort is required to mitigate the risk. This type of situation that occurs very frequently and should be minimised by the use of behavioural safety, and to some extent, additional technical training.

9.10 Recommendation

9.10.1 Zero Harm as the starting point

'Zero Harm' should no longer be considered as a 'final objective' but rather consider it as a starting point for the opportunity to initiate comprehensive and meaningful deliberate positive outcomes.

Changing the process from one of injury prevention, to one inclusive of health promotion, will allow for organisations to move away from a method that is inevitably limiting the scope of positive outcomes with respect to workplace health and safety. When it is acknowledged that beyond zero there are opportunities to increase the physical and mental health and wellbeing of workers, then there are possibilities of experiencing meaningful safety improvement that is both achievable and sustainable.

9.10.2 Zero Harm as a mindset

'Zero Harm' can at best be adopted as a mindset that should be pursued as aspirational to ensure that all persons involved in risk management remains conscientious and apply professional risk management techniques in order to achieve the lowest possible residual risk achievable. This implies a deep psychological understanding of belief systems at play in the organisation or social setting in relation to the belief system expected in the workplace. Through focused transitional development interventions these aspirational belief systems can be imbedded and embodied as is probably the case in the South African mining industry.

9.10.3 Zero Harm Success Indicators

In South Africa, a key success indicator used for the achievement of the 'Zero Harm' safety performance is the number of fatalities per annum which has clearly not been achieved and neither was it achieved in peer countries. It has in actual fact never been achieved anywhere in the world, other than for limited periods. However, an order of magnitude of mineworkers are still being injured and harm caused through latent issues such as noise and dust exposure latent health harm is still far away from zero.

The trailing 'success' indicator for 'Zero Harm' should not only be the number of fatalities but the Total Harm Indicator number which should be the total of, Silicosis cases, NIHL cases, number of Injuries and Fatalities. A Total Harm Indicator Rate (THIR) should also be expressed as a rate per 1000.

9.10.4 Wellness and wellbeing in the workplace

Wellness and wellbeing are not the same things. Wellbeing refers to a more holistic whole-of-life experience, whereas wellness refers just to physical health. Employers can have a big influence over employees' wellbeing

(workplaceinfo.com). Wellness gets firmly associated with health and prevention, whereas well-being becomes more associated with happiness (globalwellnessinstitute.org).

Wellness and wellbeing programs in the workplace can provide a substantial return on investment: motivated and productive employees, loyalty in the workforce and curbed long-term health care costs. Effective wellness programs with high levels of employee participation lead to increased productivity, reduced absenteeism, the ability to attract and retain top talent, and the overall feeling among employees that theirs is a good place to work. (www.concentra.com).

The current uncoordinated wellness approach in the South African Mining industry needs to be augments in order to improve employee wellbeing and productivity. The factors contributing to the mine's risk profile includes the individual lifestyles, prevailing challenges in the mine workings as well as employee and employer expectations.

The South African mining industry is still largely dependent on migrant labour who historically lived in mine hostels close to the mine. In the recent past, the single sex hostels were converted to single bedrooms for improved privacy and at the same time. Living out allowances became an option for the hostel dwellers, many of whom opted for it. The unintended consequences of this arrangement in that a vast majority of the incumbents are living in informal settlements which exacerbates issues such as fatigue, long travelling distance, malnutrition, alcoholism, drugs, violence, HIV and TB.

The mining industry expects for workers to be nourished, rested, fit, not under the influence of alcohol or drugs and healthy before going on shift. However, this is not the case and the mining industry will have to increase its efforts to ensure that the prevailing external factors do not increase the employees' risk profile to an unacceptable level.

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APPENDICES

Appendix A: Journey towards ‘Zero Harm’ timeline.

Appendix B: The safety journey of AngloGold Ashanti between 2007 and 2016.

Appendix C: The safety journey of Harmony between 2007 and 2016.

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A systems approach to improved safety in the South African gold and platinum sectors, post 2006.

Appendices

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Annexure A

The South African mining industry journey towards zero harm timeline.

- **1890:** Chamber of Mines of South Africa formed.
- **1902:** Milner Commission of Inquiry into Phthisis in 1902 followed by regulations promulgated in 1905 to inhibit the formation of dust (Leon Commission 1995).
- **1907:** Krause Commission, had the effect of extending the system which had been developed in the Transvaal for regulating mine safety to the whole of what was then the Union of South Africa (Leon Commission 1995).
- **1911:** Commission of Enquiry into the prevention of explosions of gas and coal dust in Natal collieries (Leon Commission 1995).
- **1911:** Enacted the Mines and Works Act of 1911.
- **1913**: Chamber of Mines introduced the "Prevention of Accidents Committee."
- **1925:** Mining Regulation Commission inquiry into the effect of regulations dealing with the supervision of underground working places, on the accident rate, the safety and health conditions in the mines, and the extent to which mining regulations affected good relations between employers and employees (Leon Commission 1995).
- **1944:** 57 Fatalities in a methane explosion at Hlobane colliery near Vryheid, Natal (www.disa.ukzn.ac.za).
- **1960**: 437 Fatalities due to failure of support pillars at Coalbrook Colliery near Sasolburg, Free State (Leon Commission 1995).
- **1960**: Marais Commission of Inquiry into the Coalbrook disaster (Leon Commission 1995).
- **1978:** Frank E Bird, of the International Loss Control Institute in Atlanta, Georgia, together with South African officials, spent many weeks developing what was known as the International Safety Rating Programme (ISRP).
- **1980:** The Chamber of Mines of South Africa Prevention of Accidents Committee was reorganised to improve its effectiveness and renamed the Mine Safety division.

- **1982:** National Union of Mine Workers (NUM) secured recognition on 2 mines.
- **1983:** NUM was recognised by the Chamber of Mines. Safety was an important issue at the 2nd Annual Conference and resolutions were taken to negotiate safety agreements and appoint safety stewards (www.disa.ukzn.ac.za).
- **1983:** 68 Fatalities due to a methane explosion at Hlobane colliery near Vryheid, Kwazulu Natal (www.disa.ukzn.ac.za).
- **1985:** NUM attacked the mining industry poor safety record.
- **1986:** 177 Mineworkers died at the Kinross Gold Mine near Secunda, Mpumalanga Province (SAHISTORY 2018).
- **1987:** 34 Fatalities due a methane gas explosion at the Tafelkop Shaft at Ermelo Mines, east of Johannesburg, Gauteng Province (www.mineralscouncil.org.za).
- **1987:** 67 Fatalities due to a methane explosion causing the cage to fall down the shaft at St Helana Mine in Welkom, Free State (www.mineralscouncil.org.za).
- **1988:** Association of Mine Managers (AMMSA) Council decided that safety would be at the top of all agendas (Hocking 1997).
- **1989:** The Chamber of Mines, as part of their cost cutting exercises privatised the Mine Safety Division.
- **1993:** 53 People died due to a major coal-dust explosion at Middelbult Colliery near Secunda, Mpumalanga Province (SAHISTORY 2018).
- **1993:** Leon Commission of Inquiry started its work (Leon Commission 1995).
- **1994:** 17 People died when a Harmony Mine tailings dam failed and flooded the suburb of Merriespruit, Virginia, Free State Province (Tailings 2018).
- **1995:** 104 Mineworkers died in the worst shaft accident in Vaal Reefs Mine disaster near Klerksdorp, North West Province (www.mineralscouncil.org.za).
- **1996:** Introduction of Mine Health and Safety Act.

- **1997:** 18 Fatalities in a rockburst at Hartebeestfontein Mine, near Stilfontein, North West Province.
- **1997:** 10 Fatalities in a rockburst at the Deelkraal Mine, near Carletonville, North West Province.
- **1998:** Formation of the Mine Health and Safety Council.
- **1999:** 19 Fatalities in a methane ignition at Mponeng Mine, near Carletonville, North West Province.
- **2001:** 13 Fatalities in methane explosion at Beatrix Mine near Virginia, Free State Province (SA Colliery Managers 2018).
- **2003:** Tripartite stakeholders agree on 10-year health and safety milestones to improve performance.
- **2007**: More than 3 000 people were stranded underground following the fall of a compressed air column into the Harmony's Elandsrand shaft near Carletonville, North West Province. Not a single person was hurt in this incident (Appendix C: HAR 2007).
- **2007:** In December 2007, the National Union of Mineworkers went on strike to protest at unsafe working conditions which impacted over 240 000 workers at 60 sites across the country.
- **2008:** Development of Mine Health and Safety Council Tripartite Action Plan to achieve health and safety milestones.
- **2008:** Formation of Regional Tripartite Health and Safety Forums.
- **2008:** Establishment of the mining industry Occupational Safety and Health Learning Hub.

- **2009:** 82 ‘Illegal miners’ died from inhalation of poisonous gasses created by a fire in the workings of Harmony’s Eland Shaft, a previously closed down mine shaft in Welkom in the Free State Province (Appendix C: HAR 2009).
- **2009:** Nine employees lost their lives in a massive fall-of-ground incident at Implats. north of Rustenburg, North West Province (Appendix G: IMP 2009).
- **2010:** Inclusion of health and safety in the revised Mining Charter.
- **2011:** Tripartite stakeholder principals approve the Mine Health and Safety Council Culture Transformation Framework.
- **2012:** Establishment of the Chamber of Mines - CEO Elimination of Fatalities Team.
- **2014:** Tripartite stakeholders agree on 2014 milestones on health and safety and the launch of the Centre of Excellence.
- **2015:** A methane explosion occurred at the Brand 1A ventilation shaft in Welkom, Free State Province, which was being rehabilitated causing R25m damage (Appendix C: HAR 2015).
- **2016:** 3 Miners died and 76 trapped miners were rescued due major land subsidence at Lily mine in Barberton, Mpumalanga Province. As at July 2018 the 3 bodies of the deceased had not been retrieved (Business Day 2018).
- **2016:** Tripartite stakeholders signed declaration of actions to be taken as a step change to improve the industry OHS performance, harness the achievement of 2024 milestones and accelerate the industry’s journey to Zero Harm.

Appendix B

The AngloGold Ashanti safety journey between 2007 and 2016 case study.

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1 AngloGold Ashanti company background

AngloGold was formed in June 1998 through a merger of the gold operations, mineral rights and exploration interests of Anglo American Corporation and its associated companies. Some of the operations within AngloGold had been associated with gold mining for more than 100 years and brought with it a wealth of expertise and contributions to the industry and to the development of the towns, cities and countries in which they were located. AngloGold merged with Ashanti Goldfields in 2004 and became known as AngloGold Ashanti (AGA 2004).

In 2006 AGA was a leading global producer of gold and uranium and had a varied portfolio of surface, open-pit and underground operations (22 in total) in 10 countries (Argentina, Australia, Brazil, Ghana, the Republic of Guinea, Mali, Namibia, South Africa, Tanzania and the USA). The group's corporate office was located in Johannesburg and AGA employed 61 453 people on average at its operations around the world (AGA 2006).

In 2016, a decade later, AGA had a globally diverse, world-class portfolio of operations and projects. AGA was the third largest gold mining company in the world, measured by production. It had 17 gold mines in 9 countries, as well as several exploration programmes in both the established and new gold producing regions of the world. AGA employed 52 649 people at its operations around the world (AGA 2016).

The AGA staff reduced by 8 873, approximately 14%, during the decade as shown in Figure 1, while the gold produced reduced by 35 % since 2006 which were then at 5,6m oz and in 2016 at 3,6m oz (AGA 2006-2016).

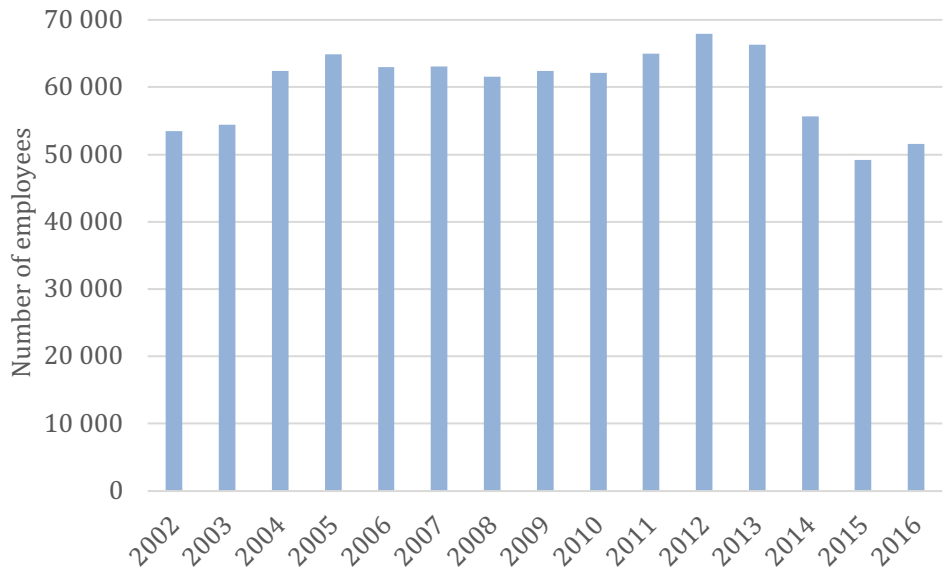


Figure 1 AGA Labour profile, 2002-2016 (AGA 2006-2016).

1.1 Scope of the case study

Only issues affecting the AGA South African operations within the context of the global AGA were addressed in the case study. Significant interventions by AGA on malaria, HIV Aids and other medical conditions affecting the wellness of the workforce were not addressed in this case study. All information in the case study was obtained from the AngloGold Ashanti Annual reports for the period 2002-2016.

2 Safety advocacy

2.1 External influences

The dynamic external factors that AGA faced over the past decade as well as the strategic imperative of sustainable development required the organisation to be dynamically reorganised to deal with the challenges it faced. The AGA board adopted global terms of reference in order to advance efforts towards improved safety and health performance.

2.1.1 International Council on Mining and Metals

AGA was a founding member of the ICMM in 2001. In 2002 the Chairman of the AGA Board said:" AGA has always sought to be guided by the sentiment expressed by Sir Ernest Oppenheimer, Anglo American's founder, that we should "... make profits, but do so in such a way as to make a real and lasting contribution to the communities in which we operate". This philosophy resonated with the 1987 Brundtland Commission's interpretation of sustainable development to mean, that which "meets the needs of the present without compromising the ability of future generations to meet their own needs." (AGA 2001/2).

At the time AGA had a broad understanding of the sustainable development obligations and the substantial challenges and complexities that faced the mining industry in the future. The company was an active participant in the global mining industry debate on sustainability for a number of years prior to 2002. The then Chief Executive Officer (CEO) of AGA assisted in the drafting of the Toronto Declaration of the International Council on Mining and Metals in May 2002 (AGA 2001/2).

The board adopted the 10 principles of the International Council on Mining and Metals (ICMM) as guidelines for sustainable mining. It was crucial to incorporate sustainable development as a business imperative and included the principles in all work that was done (AGA 2012). Sustainable development was not left to a service department to perform as a side line to AGA's core business.

The ICMM members believed that the mining, minerals and metals industries acting collectively could best ensure continued access to land, capital and markets as well as build trust and respect by demonstrating the ability to contribute successfully to sustainable development. The members sought to offer strategic industry leadership towards achieving continuous improvements in sustainable development performance.

The ICMM continued to define the mining and metals industry's commitment to the responsible production of the minerals and metals society needs. AGA supported the ICMM's effort to define a leadership position for this commitment to responsible production. It included areas of health, safety, environment and community, materials stewardship, and the social and economic contribution of mining to society which were all material to AGA.

AGA was committed to continual improvement in its performance and contribution to sustainable development so as to enhance shareholder value. In striving to achieve this, AGA would:

- Implement and maintain ethical business practices and sound systems of corporate governance;
- Integrate sustainable development considerations within the corporate decision-making process;
- Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who were affected by the company's activities;
- Implement risk-management strategies based on valid data and sound science;
- Seek continued improvement of health and safety performance;
- Seek continued improvement of the environmental performance;
- Contribute to the conservation of biodiversity and integrated approaches to land use planning;
- Facilitate and encourage responsible product design, use, re-use, recycling and disposal of products;

- Contribute to the social, economic and institutional development of the communities in which it operated, and
- Implement effective and transparent engagement, communication and independently verified reporting arrangements with the stakeholders.

AGA implemented risk management strategies based on valid data and scientific base in the context of the ICMM Sustainable Development Framework. The global risk management system was an ongoing programme of engagement with key regional and operating personnel, as well as functional discipline owners within the corporate and regional offices. Additionally, AGA sought continual improvement of the health and safety performance within and beyond the workplace and was based on the ICMM principles. The ICMM corporate membership included a commitment to measure corporate performance against these principles.

2.1.2 United Nations Global Compact

In 2004 AGA became a signatory to the United Nations Global Compact following the merger with Ashanti. Ashanti had previously been a member since August 2001 (AGA 2004).

2.1.3 Global Reporting Initiative

In 2004 AGA registered as an organisational stakeholder of the Global Reporting Initiative (GRI) and was committed to reporting in accordance with GRI's principles. The GRI was a multi-stakeholder process and independent institution whose mission was to develop and disseminate globally applicable Sustainability Reporting Guidelines (AGA 2004).

These guidelines were adopted as a standard for reporting on the economic, environmental and social impacts caused by its everyday activities and the progress thereof to the society at large. The guidelines represented the organisation's values and governance model as well as demonstrating the link between its strategy and its commitment to a sustainable global economy. It was

the key platform for communicating sustainability performance and impacts whether positive or negative.

2.1.4 Chamber of Mines of South Africa

In 2007 AGA held meetings with other mining companies through the Chamber of Mines of South Africa (COM). An industry wide study on falls of ground and seismicity commenced through a COM committee. A principle was adopted that safety would come before production and improved safety would ultimately lead to productivity improvements as well. It was no coincidence that the best performing crews were also the safest.

The COM facilitated a safety leadership tour to five selected mines in the industry to identify industry best safety practice. The tour included operational visits, interviews and presentations to the delegation. AGA's Mponeng mine was unanimously nominated as an example of good safety leadership in the industry (AGA 2007).

Mining Industry Occupational Safety & Health Initiatives

The Mining Industrial Occupational Safety & Health Initiatives (MOSH) leading practice adoption system aimed to help the mining industry meet the ultimate target of zero fatalities and injuries, and the 2013 Mine Health and Safety Council's milestone to achieve world-class safety performance.

In 2012 technological interventions were in various stages of implementation across the region. It was found that the workforce and operating systems were not interchangeable in the move towards mechanised mining and a progressive safety plan had to be considered in this instance (AGA 2012).

The MOSH initiatives, under the sponsorship of the COM's leading practice adoption system, aimed to help the mining industry meet the ultimate target of zero fatalities and injuries. MOSH identified leading practices in safety and helped with the widespread adoption across industry focused on "people" issues in overcoming resistance to adoption.

The medium term interventions included technology, which was in line with MOSH leading practice as well as “off-the-shelf” systems. It included the installation of in-stope hanging wall nets to reduce fall of ground incidents, which was in line with MOSH guidelines. Welded mesh was installed in gullies across all operations in the region.

Off-the-shelf technologies, already tried and tested and used extensively in various industrial applications, were also taking people further away from the risk of injury. These technologies included:

- Automatic couplers which enable “hands-free” coupling of hoppers and locomotives;
- Electronic signalling between locomotive drivers and guards;
- Front-driven trains, and
- Drill rigs controlled from a platform or cab at a distance from the rock face (AGA 2012).

2.1.5 Department of Mineral Resources

Section 54 notices

Section 54 of the Mine Health and Safety Act (Act 29 of 2006) provided for the Mine Safety Inspectorate to close part or all of a mine should it believe that any particular occurrence or condition may endanger the health and safety of any individual on the mine.

In 2004 the then Department of Minerals and Energy (DME) instigated a total of 13 withdrawals/partial withdrawals and/or stoppages in line with Section 54 during the year. Two stoppages resulted in a significant interruption of more than three days to the business. Work was stopped for three weeks at Great Noligwa mine while the mine instituted remedial safety measures, following a multiple fall of ground seismic-related fatal accident. Work on the reef horizon was suspended for five consecutive Sundays following a fatal accident at Tau Lekoa mine (AGA 2004).

A fine of R200 000 was imposed by the DME relating to a gas explosion that took place at Mponeng mine on 29 June 1999, in which 19 employees lost their lives. The investigation conducted by the DME after the accident highlighted a number of procedural shortcomings at the mine, although these were found not to relate directly to the accident (AGA 2001/2).

AGA received several instructions in terms of Section 54 to close significant sections of mining operations during the past decade. Fatalities and safety related stoppages continued to be a major business risk and although the incidence of fatal accidents reduced year on year, the impact of such stoppages remained severe (AGA 2004-2016).

AGA continued to seek a dialogue with the Department of Mineral Resources (DMR) at every level with the primary aim of improving safety and ensuring fair and proportional application of safety legislation. Where there was disagreement, AGA would continue to use the proper appeal mechanisms and legal remedies available under the Mine Health and Safety Act and associated legislation. AGA believed that with close co-operation among stakeholders; fair application of regulations with due regard to proportionality; continued vigilance in an unpredictable operating environment, and further improvement on the safety gains made in the past decade could be achieved.

AGA was a strong supporter of robust and constructive safety regulation however, in 2016 AGA elected to challenge one such stoppage, as it was believed that the sanction levied by the regulator was disproportionate to the safety threat identified (AGA 2016). AGA received a verdict in their favour from the Labour court. It provided a helpful guideline for the industry with respect to the fact that stoppages should be proportional to the overall threat posed by an identified safety infringement. It should obviate many mine-wide stoppages in future, where a safety violation may be solved more effectively through a localised stoppage, rather than shutting an entire mine. The benefits of this outcome for the industry at large should be twofold:

- Improving safety while also helping preserve the viability of a high fixed-cost business that had suffered severe damage related to significant revenue losses in recent years.
- Mine management should not hesitate to stop mining in any area that did not meet the AGA safety criteria.

Presidential audit

In 2008 there were major developments during the year on safety and health from a regulatory perspective. Safety audits were instituted by the former President of South Africa and were undertaken across the mining industry to determine the degree of compliance by mining operations with safety and health provisions as prescribed by the Mine Health and Safety Act. All of AGA's operations in South Africa were audited (AGA 2008).

The Parliamentary Portfolio Committee and the National Assembly approved amendments to the Mine Health and Safety Act in September 2008.

Fall of Ground Regulations

The DME formulated new Fall of Ground Regulations, in accordance with the provisions of Chapter 14 of the Mine Health and Safety Act, in July 2002, which came into effect in January 2003. These regulations came about as falls of ground remained as one of the most significant causes of fatal accidents in the South African underground mining industry (AGA 2004).

Two groups of employees were affected by these regulations:

- People who were required to declare a working place safe ('Competent Person A').
- Those who were required to install, maintain or remove any support unit ('Competent Person B').

These groups needed to be assessed and found competent in accordance with education and training standards and qualifications as generated by the Mining

Qualifications Authority (MQA). The MQA determined the specific competencies required to perform these activities and grouped the associated unit standards into clusters. These clusters of unit standards were registered as skills programmes.

As this was one of the first sets of regulations that placed the responsibility on employers to determine the competence of employees, the MQA decided to select four lead sites to pilot the implementation process. AGA was selected as a gold mining lead site. The assessment and implementation processes were carried out at AGA's South Africa region's business units simultaneously, so that any problems encountered could be timeously communicated to the MQA.

Roughly 16 000 production employees, who performed the tasks referred to in the regulations, had to be found competent. It was envisaged that a period of 18 months would be necessary for the completion of the implementation plan.

2.2 Internal safety advocacy to achieve 'Zero Harm'

In 2002 AGA believed that every employee had the right to retire free of injury or occupational disease at the end of his or her working career. The Leon Commission of Inquiry into Health and Safety was a turning point for the industry and that safety issues were receiving much greater prominence. AGA adopted the "Ontario" a Lost Time Injury Frequency Rate (LTIFR) of 65 per million hours worked as a benchmark (AGA 2001/2).

Some noteable quotes at the time were:

- "If people are the mine's best asset, safety cannot be negotiable." (AGA 2001/2, Page 15).
- The then CEO's commitment to bring to an end, "the ungodly era of people going to work to die." (AGA 2001/2, Page 15).
- "No rock will fall uncontrolled." (AGA 2001/2, Page 15).

A General Manager at AGA at the time who was successful with safety and an example to many, believed that:

- Recognising and building on those intangible elements such as values, beliefs, attitudes and dignity among his colleagues, could achieve a mindset change;
- Any example of bad workmanship could be attributed to a mindset problem. "If the correct mindset was in place, it would automatically deliver the positive measurable." (AGA 2001/2, Page 15).
- Instilling a culture of safety was to be visible among the workforce, and to lead by example, and
- A key aspect of the mindset change was a focus on communication and eroding sometimes hardened attitudes (AGA 2001/2).

In 2004 the moral license to mine was pursued by AGA in order to maintain the ability to continue production, as improved returns to shareholders would be compromised without it. Although it was almost impossible to calculate its contribution to the bottom line the international market economy's legitimacy depended on it (AGA 2004).

In 2006 AGA remained committed to eliminating accidents at work and was determined to achieve significant improvements in the years ahead. In the words of the then CEO, "Every death is unacceptable. While we have achieved significant improvements in recent years and expended a great deal of effort, the recent trend means that we simply have to intensify our efforts." (AGA 2006. Page 117).

In 2007 the AGA leadership committed the company to working with all parties including organised labour, employees, government, other mining companies and stakeholders in this endeavour, as it became clear that no single-dimension or single party effort would be sufficient to achieve the next major step-change in safety improvement (AGA 2007).

AGA resolved that no employees would be required or permitted to work in an area, which they or their supervisor regard as unsafe. Performance standards and training would be reviewed by management, government officials and trade union representatives to support the delivery of a workplace free from health impairment and accidents.

On 10 October 2007, prompted by the one million fatality-free shifts achieved at Great Noligwa mine, the Chief Executive Officer declared ‘Safety’ as the ‘first value’ of AGA. The company subsequently embarked on a consultative review of the company’s mission, vision and values, building on the commitment of ‘Safety is our first value’ (AGA 2008-1, Page 67).

In 2008 an extensive safety initiative commenced to ensure that this value was both understood by all and put into practice at all levels within the group. AGA placed people first and correspondingly put the highest priority on safe and healthy practices and systems of work. The company was responsible for seeking out new and innovative ways to ensure that the workplaces were free of occupational injury and illness. All employees lived each day for each other and used their collective commitment, talents, resources and systems to deliver on the most important commitment to care (AGA 2008).

Significant interventions took place on the work practice aspects of safety and health, including the introduction of the ‘Care’ and ‘It’s OK’ initiatives. Production declined during 2008 compared to 2007 largely a result of reduced volumes and lower grades mined due to safety and power related stoppages.

In 2009 people were at the centre of the business and it was reaffirmed that injuries or impairment to health as a consequence of work would not be accepted. The company would not continue to operate sustainably with such an unacceptable toll on the people. Incremental advances in safety performance was not enough and a transformational target and approach was required (AGA 2009).

The first objective focused on safety reinforcing the philosophy of ‘care’. Commitment began with accountability. As with the commitment to safety, leadership, accountability and resources were required to ensure that this objective was achieved.

AGA focused on creating the safest possible working environment for employees. This was reflected in the goal to reduce accident rates by 70% over the next five years, from the baseline of average rates over the period from 2006 to 2008 and

the long-term objective of achieving an accident-free business. Globally, it was a year in which relationships between business and government were recalibrated, as governments intervened to offset the worst effects of the financial crisis (AGA 2009).

2.2.1 Safety strategy

In 2004 a Safety Summit was held where five strategic thrusts for the South African safety programme were identified (AGA 2004). This was followed by a re-launch of the South African safety programme involving a symbolic ceremony where the various business unit managers committed themselves and their business units to the implementation of the five strategic thrusts. These were:

- Mindset change;
- Risk management;
- Fall of ground management;
- Horisontal and vertical transport, and
- Implementation of fall of ground regulations.

In 2006/7 external parties, included representatives from AGA's major shareholder, at the time, Anglo American, participated in a review of the region's safety and health strategy (AGA 2007). The review found a strong foundation in the region's strategy with a high level of commitment, monitoring, modelling and programme development in place. The review also indicated that the safety and health strategy should be used to leverage change and build upon it for further enhancements. A number of areas were also identified for possible improvement and the company acted upon it. The review team endorsed the importance and relative weighting of critical factors in the area of safety and health management in that positive results could only be achieved with an emphasis on people. The approach comprised systems (10%), engineering (20%) and people (70%). The strategy review team identified the following seven strategic safety issues to be addressed:

- Fatigue management;

- Production flexibility;
- Retention of skills;
- Development of a safety culture;
- The review process;
- Fall of ground management, and
- Removing employees from risk in the workplace.

In order for AGA to achieve visible and tangible results, the company had to put significant time, effort and money into safety interventions in order to meet the industry targets, which were agreed to through the Mine Health and Safety Council Safety Summit. The targets required a 20% reduction in fatalities year-on-year between 2007 and 2013 and to meet its obligation to employees to provide a working environment that did not cause them harm.

In 2008 the group's values as well as the group's undertakings and business principles were reviewed and revised where appropriate. The business principles regarding safety and health served also as the group policy and guide regional and operational policies and practices (AGA 2008).

The organisation was restructured as part of the renewed focus and subsequent strategy on safety, improved productivity and enhanced shareholder value. The AGA executive team was restructured, and among other appointments an Executive Vice President (EVP) Sustainability, was appointed to oversee this strategic safety issue. The EVP reported on safety and health matters at the company's regular Executive Committee meetings as well as executive safety meetings. The Group Safety Manager reported to the EVP.

The company moved towards a regional operating structure, with three operating heads, responsible for operations teams in Africa, the Americas and Australasia, who report directly to the Chief Executive Officer. The Africa operations comprised of two divisions, Accra in Ghana and Potchefstroom in South Africa.

AGA embarked on an occupational safety and health leadership transformation project to create a strategic 'blueprint' for occupational safety and health in the

company. The project was conducted in conjunction with external consultants and with the full involvement of the group's safety and health management structures. It included extensive consultation with core disciplines, operational management and union leadership. These activities took place within the context of the group's change of its safety and health policy and strategy and the implementation of a global 'safety is our first value' initiative.

The project team undertook site visits as well as in-depth management and employee interviews through both face-to-face and focus group sessions. An extensive employee safety and health culture survey was conducted in order to achieve a better understanding of the group's current management cultures, structures and systems. Analysis of the macro environmental drivers, industry trends and best practice was undertaken in order to develop future scenarios that might affect safety and health. Strategic initiatives to instil a culture of care were effective across the group. These were supported by empowering people to take responsibility for their own safety and health and that of their colleagues, and by recognising safety achievements.

In 2009 the Safety BluePrint for the business was developed, included the Guiding Principles, which represented a global approach to developing a resilient safety culture and systems that created a common business platform and language for safety across the company. The concept of safety included occupational health and safety, and the wellness of employees, contractors and host communities. It was aimed to ensure that no health or safety impact resulted from the operations affected the communities (AGA 2009).

It was perceived by AGA that 'Leadership' was the driving force behind safety gains achieved. The leadership role was reformed on the basis of the position that *"Safety is our first value"*. Further gains were anticipated through a systems approach that included:

- Building and ensuring safety competence in all organisational roles;
- Incorporating safety accountabilities into all organisational roles, as appropriate to the nature and complexity of the work being performed;

- Incorporating rules for safety decision-making into the business processes, that was dealing with effective hazard identification and management, and enabling the safe execution of work, and
- Incorporating appropriate safety performance metrics, with analysis rules integrated into the business process framework. Institutionalise 'Zero Harm' as a business imperative.

In 2010 AGA rebuilt the business to ensure realising its full potential designed to deliver long-term sustainable value for all its business and social stakeholders. The strategy was based on the establishment of a stable growth foundation and included the regeneration of the financial capacity as well as the reinvigoration of operational performance. These implied significant improvements in safety performance and constructing a range of new projects and development opportunities. Sustainability could only be secured by navigating the future together with local communities (AGA 2010).

Improving safety performance was the most important business goal and remained the most significant business challenge. In order to achieve the long-term goal of operating an accident-free business the company launched the Safety Transformation Project. This approach incorporated three elements:

- Engaging people in the work of creating a safe environment;
- Building robust systems which support safe work, and
- Managing risks effectively through appropriate controls at all levels.

AGA undertook detailed design work that was required to integrate the safety transformation into the Project ONE operating model. It was essential to integrate the thinking into the DNA of the business if sustainable gains in safety performance were to be made.

Work was undertaken through various industry and government bodies on sustainability issues, particularly as it related to the mining sector. AGA continued to support the ICMM and the work of the Extractive Industries Transparency Initiative as well as the goals and objectives of the UN Global Compact

principles. The AGA values together with the international standards provided a guideline for implementation of the strategy. AGA used independent sustainability experts to critique the approach and progress.

It was expected that the AGA sustainability vision would take time to be fully realised, which would enable the company to provide a better set of outcomes for the industry and its stakeholders.

In 2011 the company's vision was to become the leading mining company and its mission was to create value for shareholders, employees, and business and social partners by safely and responsibly exploring, mining and marketing gold. Although the primary focus was gold, AGA would pursue value-creating opportunities in other minerals where it could leverage its existing assets, skills and experience to enhance the delivery of value (AGA 2011).

Being the leading mining company implied making the transition to a global organisation, by leveraging key skills and best practices globally across all operations. In order to achieve this the company reviewed the way in which it operated. It included the following:

- Strengthening people and technical systems to reflect an aligned and consistent working model that could be adopted across a range of operating contexts;
- Developed five-year and long-term delivery targets. These targets reflected performance consistent with the vision of becoming the leading mining company;
- The long-term goal was to operate without accident or injury. It was aimed to reduce the all injury frequency rate to less than 9 per million hours worked, by 2015;
- Target to have continuous improvement in productivity, achieving a 20% improvement in gold production per employee by 2015 from a 2010 baseline;
- Target a 20% increase in production from a 2010 base, taking the total production to between 5.4 and 5.6Moz by 2015, and

- A sustainable development framework was outlined for the business in order to progress delivery on the strategy and objectives.

AGA intended to continuously improve all aspects of the business so that positive contributors to society and exceptional managers of the assets that were entrusted to AGA's care and development could be seen. Seven long-term success focus areas were defined to monitor the progressive improvement of the business across the following areas:

- Safety: To care for the safety and health of every employee and business stakeholder;
- Environment: To minimise the environmental footprint in the context of the business activities;
- People: Recognise people more than assets and have the potential to create a business that leads the industry in terms of social and business outcomes;
- Production: To maintain a critical mass that supports the leadership position in gold and the delivery of value to the shareholders and the social partners;
- Costs: Recognising that the company must be industry competitive so that management and long-term decisions consistent with delivering long-term sustainable value;
- Returns: The creation of value that ensures the long-term benefit and support of the shareholders, and
- Community: To deliver value in the context of the community stakeholders that ensures the long-term support of the 'partners in development'.

It was believed that the vision and the areas of focus identified were consistent with the concept of 'sustainable development', which included economic, social and environmental stewardship. Building the sustainability model was about building long-term competitive advantage. Safety and health were not only business imperatives but were part of the obligation to operate with respect for human rights. AGA continued with external and internal focus on improving the safety and health performance of the operations.

Ongoing work included the development of the remaining guidelines and the development of a performance monitoring, review and assurance system, as outlined in the safety framework.

In 2012 AGA built the foundation for systemic changes in the way it did business and how sustainability across all areas of the business was considered. The building of systems and processes were well understood and provided the boundaries within which operations took place (AGA 2012). It included:

- Safety was regarded as the most important business priority;
- AGA was in the process of implementing the safety transformation project, which targeted a step change in safety performance;
- Group-level targets on safety performance were established and were well communicated throughout the group;
- AGA subscribed to a definition of good health as a state of complete physical, social, mental and spiritual wellbeing and not merely the absence of ill health;
- AGA did not accept ill health as a natural consequence of the business, and
- Employee and community health were regarded inseparable, and targeted integrated occupational and community health strategies where possible.

In 2013 AGA focused on managing the restoration of healthy labour relations in a turbulent mining industry following unprotected strikes of 2012 (AGA 2013). AGA's global health strategy was approved for implementation. The key components of the strategy were to optimise organisational health systems and processes to address health risks. The company integrated health and non-health systems and activities to enhance value and focused on appropriate sustainability-based initiatives to drive mutual benefit. All regions developed aligned strategies, and implementation commenced to address particular localised challenges. The long-term goal remained to operate a business that was free of occupational injury. AGA continued strong focus on:

- Major hazard management, including systematic analysis of risk, identification of critical controls, and implementation of routine monitoring;

- Building more resilient management systems;
- Adopting technology to remove people from harm, and
- Instilling safety leadership attributes and a culture of care for fellow workers.

It was an extremely challenging year as the gold price dropped by 26%, which resulted in AGA having to refocus its strategy to adapt to this rapidly changed environment. The enhanced strategy consisted of five building blocks, which included:

- The foundation of the business was safety, people and sustainability;
- Pro-actively ensuring that AGA has financial flexibility during volatile times;
- Aggressively tackling all aspects of the cost base;
- Improving AGA's portfolio quality by bringing on stream quality mines and removing marginal production from the mix, and
- Keeping the long-term optionality intact at a reasonable cost (AGA 2013).

AGA underwent a process of unprecedented organisational redesign and internal restructuring, with a view to removing duplication, work that did not add value and redundant layers within the organisation. Throughout the redesign and restructure of the business AGA sought to retain the commitments to community programmes and social investments.

AGA continued the pursuit of the establishment of an organisational culture where sustainability was embedded to the extent that it was integral to the business strategy and practices. It became the way of how AGA did things and the company continued to improve the overall performance as it navigated difficult and unprecedented economic and social conditions.

It was understood that sustainability had to be at the core of the business, serving as a key driver of the long-term business effectiveness and competitiveness, and achieving and enhancing its social license to operate. AGA would retain this focus despite an environment of short-term budget constraints. In order to meet the sustainability challenges, it was required to continue focusing on:

- Protecting the people from harm and operating safe workplaces;
- Nurturing and strengthening community and other stakeholder relationships;
- Managing the environmental impacts, particularly in respect of avoiding adverse impacts on communities' water supply;
- Demonstrating that AGA did not contribute to armed conflict and ensuring the application of sound human rights practices in all that was done;
- Constructively addressing the encroachment of unlawful artisanal mining on the AGA concessions, recognising the need to support economic opportunity in the regions around the operations, and
- Acceptably addressing a range of legacy issues, demonstrating the commitments to sustainable practices.

AGA was confident that there was an appropriate focus on the challenging sustainability issues that AGA faced and reassured stakeholders that sustainability considerations would continue to be a core value of AGA's business and its operations. AGA demonstrated a reaffirmation of its own values and commitment to improve the quality of life of the communities and societies in which it operated. People were the business, especially employees and communities. AGA committed to:

- Focusing on employing, deploying and developing the right people, and providing meaningful employment and career development opportunities;
- Structuring the organisation appropriately, to support operational excellence;
- Driving safety as the first priority, focusing on eliminating fatalities and injuries;
- Earning the social license to operate, addressing and mitigating the social, economic and environmental impacts of the operations, and creating a positive sustainable legacy, and
- Being mindful of the need to balance short-term financial objectives with long-term sustainability outcomes.

In order to improve AGA's sustainability performance as well as position sustainability as a key driver of the business strategy and success, AGA enhanced the sustainability function within the company.

The EVP: Sustainable Development a member of the AGA executive committee had accountability for all sustainability matters at a group level. The EVP had considerably greater authority to intervene and to manage sustainability challenges at the operations. The EVP and the two Chief Operating Officers had a clear understanding of their accountabilities in respect of sustainability issues and continued to have excellent working relationships.

In 2014 data on safety incidents showed that AGA consistently experienced a higher frequency of incidents in South Africa, with the greatest safety risk areas being fall of ground incidents and vertical and horizontal transport. An intense effort was made to address known risks and hazards at the South African operations, which operated ultra-deep level mines (AGA 2014).

Efforts were directed at deepening the understanding of how risks materialise at the operations and identifying sequences of events, which resulted in safety incidents. It included the controls required to manage major hazards more effectively and helped to put the controls in place at all the operations. While being successful in reducing minor incidents in the past, the historical safety performance indicated that there was no correlation between the rates of occurrence of major incidents and minor incidents. This indicated that a single approach to safety management would be insufficient to address both categories of accidents.

In order to understand better how and why such incidents occurred, a Bowtie risk analysis methodology (BTA) was adopted. BTA was a simple and effective tool for communicating risk assessment results to employees at all levels.

Risk management principles were applied through a rigorous focus on major hazard management. AGA continued to ensure that the words were backed by

actions. The work undertook on safety was long term in nature and it was expected to continue in the ensuing years. These focus areas included:

- Major hazard management;
- Identifying and monitoring critical controls;
- Instituting measures to reduce control deviation, and
- Continue to build organisational safety capability and capacity.

The guiding principles included the application of risk management principles in order to understand the risk pathways, which gave rise to safety incidents as well as to prevent occurrence.

In 2014 the strategic plan focused on ensuring that leaders were actively engaged in progressing the business along the maturity journey. They were equipped with the knowledge and tools to inspire, motivate, and empower employees. It focused on ensuring that all employees were risk aware and consistently applied tools in the workplace to prevent or mitigate incidents (AGA 2014).

AGA recognised that a resilient business culture with favourable safety outcomes could only be achieved by having a common understanding of the challenges and developing a shared view of the future. AGA confirmed that it was not enough to simply publish policies; it needed to embed the ethics in every business decision taken. It was required to build the capacity of employees to understand the policies, so they could deliver against the values in order to uphold becoming conduct. It required clear and consistent communication using various platforms throughout the global organisation to reach every employee.

Employees had to have the ability to report contraventions of the policies, both through discussion and via anonymous whistleblowing mechanisms. Strong and reliable disciplinary measures were put in place to hold individuals accountable, regardless of their seniority.

Management deliberately communicated sustainable development as the foundation of the business strategy as it was believed that the ability to maintain

the social license and achieve sustainable outcomes was dependent on the interactions with people, the planet and the economy. A focus on people, safety and sustainable development was the foundation of the company strategy and supported the core business goal of achieving sustainable cash flow improvements and returns.

The ability of the business to secure and maintain its social license was central to achieving sustainable returns. AGA earned and developed the social license by a responsible approach to mining, which included working with all stakeholders in pursuit of harmonious co-existence, and mutual benefit, within the complex socio-economic and political landscapes in which it operated.

The business competitiveness and the social license to operate increasingly depended on the ability to navigate and seek to meet broader and deeper stakeholder expectations. The AGA group Sustainable Development strategy sought to identify the actions required to contribute to AGA's business competitiveness and to enhance the social license to operate.

The strategy aimed to establish the value proposition clearly among stakeholders by managing sustainable development according to a set of common guiding principles, which were relevant across all countries and all disciplines. The guiding principles informed the strategic focus areas and the priorities in terms of sustainable development.

In 2015 the deterioration in the safety performance in South Africa prompted an urgent and thorough review of the Safe Production Strategy. The primary objective of the strategy review was to calibrate and refine the plan considering business challenges, operational specific themes and to agree on the work plans for 2015-2017 (AGA 2015).

A process to ensure broader business alignment and ownership was agreed on. Key historic, current and proposed safety interventions were reviewed in order to develop an improved framework for leadership practices and imperatives. The review included all senior safety and operational leadership.

As a result of the review, the five strategic objectives from the three-year safety plan were condensed into three specific themes supported by detailed work plans. It included:

- The importance of leadership commitment, engagement behaviour and organisational capabilities;
- Understanding and managing major hazards, and
- For the standards, systems, processes and work methods to be effective, all had to ensure strict compliance.

These three themes then formed the basis of a workshop with the senior leadership team. This collective session was a first for the AGA Group, and represented a shift in the approach to creating a unified, standardised approach to safety. A common understanding and commitment across the three themes was established.

Culture change started at the top through leadership commitment, engagement behaviour and organisational capabilities, thus enabling AGA to build organisational capability and encourage positive behavioural change.

A number of leadership imperatives were introduced to identify measurable behaviours and consistent work routines. This would ensure the creation and institutionalise accountability at every level of the business to address all forms of non-compliance. It would involve introducing behaviour-based safety programmes tailored to operational level requirements aimed at modifying at-risk behaviours. The company focused on several key areas including:

- Strengthening the company's safety culture by demonstrating the leadership commitment and living the organisational values;
- Implementing resilient safety standards, procedures and supporting systems;
- Building and maintaining organisational capability and capacity through comprehensive safety training programs;
- Proactively identifying threats, assessing risks and instituting controls and improving engineering focused on priority unwanted events;

- Strict adherence to principles of good corporate governance, and compliance with all regulations and standards, and
- Work places free of occupational injury could be achieved, however it had to be driven by the acute safety awareness within the business and operational leadership and with safety controls embedded into the way capable people work.

One life lost was one too many and AGA was committed to the objective of striving to achieve 'Zero Harm' AGA continued to work relentlessly towards this goal. If AGA was to remain sustainable in the long term, it was critical to remain true to the values which demanded to:

- Always to put safety first;
- Respect the environment;
- Conduct the business ethically and transparent;
- Treat people with dignity and respect, and
- Create shared value for all stakeholders.

Safety remained the single biggest challenge and consistent with the company values it was the top priority. AGA continued to address the safety challenges with dedication, and with considerable investment of time, resources and skills in finding lasting solutions that would rid operations of all injuries.

The company continued to actively analyse 'High Potential Incidents', or near misses, that could have resulted in fatalities, in order to treat the causes, rather than the symptoms of workplace accidents. AGA embedded the safety standards and safe working practices across all operations and implemented improved critical control monitoring systems for major hazards, in order to further reduce risk.

The company was determined to improve the safety performance and achieve workplaces free of occupational injury and illness. Improvements were demonstrated in the continued improvement of the all-injury frequency rate.

Several AGA operations outside of South Africa passed important safety milestones, including some that passed the year without a single lost time injury.

People were the core of the business and the health and safety of the people who worked with AGA was the top priority. The company was committed to living this value through unrelenting vigilance, analysis and the constant pursuit of innovative, effective controls to improve the safety performance. It was again acknowledged that the people were exposed to hazards and risks associated with the core mining activities. The approach included a robust hazard and risk management system that combined structured work processes focused on building and constantly reinforcing a strong safety culture throughout the company.

While safety challenges remained complex, the ability to identify and understand risks and how it materialised improved significantly over time. Through continuous research and analysis of incidents it was recognised that procedures alone could not create a safe work environment. Improving the ability to operate safely required a multi-layered approach.

In 2016 AGA's key strategic focus was to safely generate sustainable free cash flow and returns. It required maintaining and improving the AGA social license to operate and to have every person return home safely to his or her families each day (AGA 2016).

Safety continued to be important for leadership at all organisational levels, setting the tone and reinforcing the importance of safety through consistent leadership behaviours. All operating units had aligned safety strategies and the implementation progressed. Activities were cascaded to all operating areas and a scorecard evaluating implementation progress was developed for executive review. Employee safety continued to be a priority and the elimination of fatalities and injuries in the workplace remained. Progress was made in the three strategic imperatives:

- Leadership commitment, engagement behaviour and strengthening organisational capability;

- Understanding and managing major hazards, and
- ensuring compliance to the standards, processes and work methods.

Employee safety remained a challenge which required further work to create workplaces free of occupational injury. AGA remained open to learn from experiences and to ultimately improve the way business was conducted and to increase the positive impact on society.

3 Institutionalise the approach to safety

3.1 Values

In 2004 the group's values and business principles on safety and health and accompanying safety and health policy were minimum guidelines for the group in respect of safety and health. Regions and operations were encouraged to develop their own specific principles, guidelines and policies in line with local conditions and legislation (AGA 2004). The company:

- was committed to complying with all relevant occupational health and safety laws, regulations and standards. In the absence of such standards, leading practice would be adopted;
- was committed to providing a working environment that was conducive to safety and health;
- strived for employee involvement and consultation with employees or their representatives to gain commitment in the implementation of these principles;
- was committed to providing all necessary resources to enable compliance with these principles;
- would not tolerate or condone deliberate breaches in standards and procedures;
- would implement safety and health management systems based on internationally recognised standards and we would assess the effectiveness of these systems through periodic audits;
- would conduct the necessary risk assessments to anticipate, minimise and control occupational hazards;
- would promote initiatives to continuously reduce the safety and health risks associated with the business activities;
- would set safety and health objectives based on comprehensive strategic plans and would measure performance against these plans;
- would monitor the effects of the company's operational activities on the safety and health of employees and others, and would conduct regular performance reviews;

- would provide all necessary personal protective equipment;
- would establish and maintain a system of medical surveillance for employees;
- would communicate openly on safety and health issues with employees and other stakeholders;
- would ensure that employees at all levels receive appropriate training and were competent to carry out their duties and responsibilities;
- would require contractors to comply with these principles and the company would seek to influence joint venture partners to apply them as well, and
- The management of occupational safety and health was a prime responsibility of line management, from the executive level to the first line supervisory level;

In 2006 the AGA mission was: 'Our business is gold' (AGA 2006). We consistently strive to create value for everyone with a stake in our company, by finding and mining gold and by developing the market for our product.' The values that AGA subscribed to were:

- AGA consistently strived to generate competitive shareholder returns by replacing profitable gold reserves and by continuously improving the performance of key resources, people, assets and the product.
- Conduct to be with honesty and integrity;
- Provide employees with opportunities to develop their skills while sharing risks and rewards in workplaces that promote innovation, teamwork and freedom with accountability;
- Embrace cultural diversity;
- Every manager and employee took responsibility for health and safety, and together strive to create workplaces that were free of occupational injury and illness;
- Strive to form partnerships with host communities, sharing their environments, traditions and values, and
- Communities to be better off for AGA having been there and was committed to work in an environmentally responsible way.

In 2007 the AGA values were reviewed, and it was confirmed that safety was the number one value. It was viewed that in many respects that the South African underground environment was a microcosm of South African society and transformation at all levels in the organisation commenced. An important principle was the need to treat one another with integrity, dignity and respect, so that people were empowered to be masters of their own destiny (AGA 2007).

In 2013 AGA believed that the leading mining company of the future would be a values-driven company, with a spirit that always put safety first and respected humanity and the planet. Business sustainability and prosperity were inextricably linked to achieving such an approach to doing business (AGA 2013).

3.2 Health and safety policy

In 2006 the group's Safety and Health Policy was underpinned by the AGA values and business principles on safety and health and were minimum guidelines for the group in respect of safety and health. Regions and operations were encouraged to develop their own specific principles, guidelines and policies in line with local conditions and legislation (AGA 2006).

In 2008 while the group-level safety and health policy was applicable to all operations, each operation also had in place safety and health policies that had been developed to take into account country and operation specific conditions, regulations and requirements (AGA 2008). Policies and agreements varied from region to region, considering local collective bargaining structures, legislation and site-specific circumstances. Local policies and agreements typically covered issues such as:

- The provision of personal protective equipment;
- Joint management-employee safety and health committees;
- Participation of employee representatives in inspection and audits;
- Training and education;
- Grievance mechanisms, and
- The right to refuse unsafe work.

Contractors and specialist services were subjected to the group's safety and health policies and practices. The group's safety and health policy, procedures, standards and requirements formed an integral part of procurement and contractor engagement processes. Contractor safety and health performance was a key criterion when the company considered the appointment or re-appointment of contractors.

3.3 Sustainable Development

AGA published its first Report to Society in 2002 with the intent of informing stakeholders in future of the company's objectives and plans for managing the obligations to them, society and the environment. The company subsequently established a number of board committees on which the non-executive directors played leading roles. A Safety, Health and Sustainable Development and the Employment Equity and Development committees were established, and these Board committees met regularly to oversee the implementation of strategy agreed to by the Board (AGA 2001/2).

The AGA philosophy in 2002 was that through sensible, responsible and ethical corporate behaviour that reflected true awareness of and concern for employees, neighbours and the environment in which they lived, AGA would be successful in business. The objectives were:

- Workplaces that were safe and healthy;
- Environments that were ecologically sound and sustainable;
- Communities that derived real social benefits from the fact that AGA was in business there, and
- Deliberate measures for accountability were built into the company's governance structures.

AGA's social investment initiatives were aimed at delivering significant and lasting benefits to employees, communities and other stakeholders in partnership with governments, international agencies, labour, health and non-governmental organisations.

The safety and health of employees were fundamental to the sustainability of the business. Management and representatives from trade unions and government combined their efforts in working towards improving safety and health in the workplace. The company would identify and implement best practice across the company, with the aim of eliminating accidents and meeting or exceeding international best practice. AGA's aim was to ensure that the company was resourced with people who were appropriately motivated, skilled and experienced for a globally competitive company. At the same time, the company formed partnerships with the communities surrounding its operations, ensuring that all benefit from the company having been there.

In the planning, design and operation of its business, AGA pursued to promote sustainable development. At least achieving, then exceeding compliance with legislation was the primary target. While the company would at all times strived towards international best practice, it did so by taking cognisance of the needs and the specific circumstances of the countries, regions and communities in which it operated.

In 2011 the intention of the Sustainable Development Framework (SDF) was to rebuild the way in which work took place and related to key stakeholders, and host communities. In terms of this framework, increased focus was placed on developing projects in partnership with communities and governments, aiming to undertake community investment in a more consistent and coordinated way that enabled communities around the operations to reach their development goals (AGA 2011).

This approach required the company to engage with communities, governments, NGOs, other mining companies, suppliers and others to identify and co-design approaches to deliver on shared goals. To succeed, there was a need to build a new relationship based on trust and sustained contributions to the development of communities. Progress on delivering on objectives was to be measured by performance indicators that were developed with the partners.

The SDF aimed to take a holistic view of sustainability, understanding connections and the range of possible impacts on the operations. Sustainability in this sense was essential to the long-term viability of the business, and it was therefore critical that the strategy addressed issues from exploration, through projects, operations and closure. Clear long-term positive outcomes in line with the strategic intent, vision, mission and values were defined at each stage in the operation life cycle.

In 2012 the safety and health of employees was one of the most important business considerations and AGA were committed to creating the safest possible working environment for employees, and one in which the employees' well-being was safeguarded (AGA 2012). Sustainability remained intrinsic to the business. The sustainability framework laid the foundations for the development of the sustainability strategy. It was envisaged that the implementation of the strategy would provide a basis for competitive advantage through:

- Improved productivity and fewer disruptions;
- Stronger relationships with communities globally;
- Preferential access to resources, capital and talent;
- Opportunities to grow the business, and
- Enhanced company reputation.

The sustainability principles were embraced and adopted across all the operations to enable the support of effective knowledge management and foster cross learning between the different geographic areas and disciplines. The company defined the strategic sustainable development objectives and continued to make improvements across the business. A new Executive Vice President: Sustainable Development was appointed.

In 2013 despite the difficult external environment AGA remained committed to the strategy and the sustainability value proposition. AGA aimed to embed sustainability into all aspects of the business and value chain, from the initiation of exploration activities through to post closure activities. Through such an

approach AGA was better equipped to address the legacy issues, anticipate and manage current and future risks, and capitalise on opportunities. Achievement of these goals and the realisation of the value proposition contributed to AGA's business competitiveness and ensured that the social licence to operate was maintained (AGA 2013).

The identification, prioritisation and review of material issues continued to influence the sustainability strategy development. This allowed the identification of emerging issues and enabled it to inform and be factored into strategic goals, as well as guide the focus areas. Social, environmental and health legacy considerations featured as a specific strategic focus area in the strategy. The need to manage and meet internal and external expectations shaped the focal area to work on partnerships and engagement.

Meeting the goal of zero fatalities required significant effort, innovation and creativity. These goals were intimately linked to the product, gold, and the desire to create a better world that was characterised by mutual benefit, then and for future generations. During the year AGA focused on executing the sustainability strategy. The ten strategic focus areas were:

- Building capability to deliver on commitments;
- Managing the global sustainability talent pool within the organisation;
- Strengthening the integration of sustainability into business processes and activities;
- Strengthening the right systems and structures supporting execution, performance measurement and continuous improvement;
- Knowledge management and collaborative learning;
- Open innovation, involving external partners;
- Managing current and future sustainability risks and capitalising on opportunities;
- Addressing legacy challenges;

- Establishing partnerships and social models, managing expectations and co-designing solutions;
- Advocating and influencing sustainable policy development, and
- The systems to ensure compliance to all the standards and commitments still required improvements.

Implementation of the strategy based was expected to take five years. Progress was made in implementing the foundational aspects of the strategy including the establishment of the required sustainability structure, with the majority of appointments completed. Significant progress was made in streamlining the systems required to manage and report on sustainability as a discipline and the identification of the key sustainability performance metrics, targets and milestones was in hand.

In 2014 sustainability was a strategic, competitive and essential core ingredient of success in the mining industry and stakeholders no longer perceived sustainability as a 'soft' issue. It was clear that a growing number of investors recognised that a sound sustainability strategy was fundamental to the long-term success of the business. This became a bigger part of the dialogue with AGA's owners and potential shareholders, especially with those with a long-term investment horizon (AGA 2014).

Governments were focused on ensuring legacy and sustainability issues were properly identified and provided for, with a credible plan to deal with it over the life of an asset.

Extensive progress was made towards embedding the sustainability strategy in the business, engaging the organisation's leadership positively to achieve this and in improving many aspects of sustainability performance. The company continued to work towards addressing areas where the social license may come under pressure and to establishing clearer measures and targets for all aspects of sustainability performance. Areas of further focus included:

- Building the organisational capability with a continued focus on localization;
- Further improvement of the stakeholder engagement processes;
- Increasing, and greater demonstration of the value of the sustainability strategy's contribution to the business, and
- Continued to demonstrate how AGA had a positive impact on society, where able to achieve this.

In 2015 AGA progressed significantly in sustainable development by incorporating it as a core strategic focus area for the business. It was one of the most significant developments along the progression. It elevated the prominence and importance of sustainable development across the company and set up the team to deliver on the value proposition. The approach to building a solid foundation across the portfolio also enabled AGA to navigate the many external sustainable development challenges facing the company. It was planned to embed and infuse sustainable development into all parts of the business in future (AGA 2015).

AGA adopted a sustainable and long-term approach to the development of the business, the leadership and management of AGA. This approach demonstrated that AGA was conscious of being subjected to the discipline of the market and the need to deliver strong financial results. AGA was also sensitive to the company's historical legacies, its current successes and challenges, and its future opportunities.

AGA was driven by a broader purpose to be a thought leader in the industry as an ethical, compliant and responsible corporate citizen, contributing visibly to the advancement of communities in the jurisdictions of its footprint and diligently protecting and rehabilitating the environment for future generations. The approach to exploration, the mining process and closure after production had to be responsible, innovative and transformative.

The framing of the top material issues was done in a multi-disciplinary way, reinforcing the notion that sustainable development was everyone's business. The

way in which AGA respond to the challenges, ultimately securing and maintaining the social licence to operate, was a distinguishing factor for AGA as a mining company. AGA would be resilient as an organisation when sustainable development was the way to do business.

At the core of the sustainable development philosophy was a focus on improving the way people experienced AGA through positive engagement and development for mutual value. AGA invested in the wellbeing and development of the employees, focused on building a resilient company and contributed to the growth of economically, socially and physically healthy host communities and environments.

Business decisions affected not only the investors, but also the employees, governments and regulators in the operating jurisdictions, host communities and society at large. In the increasingly connected world, where social and environmental consciousness were on the rise, the sustainable development performance remained critical to growing the trust that many stakeholders place in the company. The extent to which the stakeholders could trust AGA, based on the company actions, was the very cornerstone of the social license to operate.

It also demanded that leading sustainable practices were embedded into the very fabric of the operations. It should define the way AGA employees conduct themselves and the manner in which engagement took place with the stakeholders, always striving to be ethical, inclusive and respectful. AGA continued to look for ways to improve in this regard.

In 2016 sustainable development was seen to be core business of exploring for and developing gold ore bodies. It was a cornerstone of the AGA strategy and was integrated into every aspect of the business processes. The focus was to ensure sustainable development principles became deeply embedded in the business value chain. AGA was implementing the strategy to become a resilient organisation. The economic value was accruing to the business through sustainable development performance in improved safety performance and harmonious relationships with communities and other stakeholders. The approach

guaranteed multiple benefits that were very significant in modern society where corporate consciousness, values and ethical conduct were considered positive elements for long term business success (AGA 2016).

AGA accepted that sustainable development was a core part of the business and success was measured in the extent to which sustainable development principles were integrated into business processes. A challenge for sustainable development was the ability of the disciplines to demonstrate commercial awareness and the contributions to the bottom line and equitable sharing of the benefits with all the stakeholders impacted by the business.

AGA continued to shift focus from just implementing a suite of sustainable development activities to understanding the impact of the organisation's efforts. The AGA social license to operate was enhanced through its quest to move toward a resilient company. This would in turn increase the company's ability to compete successfully in all aspects of the business.

3.4 Safety Transformation project

A Safety Blue Print for the business was developed following the launch in 2008 of "*Safety is our first value*" and the initiation of the Safety Transformation project. It included the Guiding Principles, which represented a global approach to developing a resilient safety culture and systems that created a common business platform and language for safety across the company. The concept of safety included occupational health and safety and the wellness of employees, contractors and host communities. It was aimed to ensure that no health or safety impact resulting from the operations affected the communities (AGA 2008).

The Safety Transformation project captured the stakeholder perspectives during in the project design. It was undertaken by a series of stakeholder workshops in which government, organised labour, employees and safety experts participated. Stakeholder engagement continued as the project developed and a dedicated stakeholder engagement plan, integral to the project, was compiled. The guiding principles were to:

- Set clear accountabilities for safety;
- Understand and manage hazards and risks, in an ongoing way;
- Engage the workforce in doing this;
- Make the solutions happen by providing resources;
- Have a relentless and broad commitment to safety, within and beyond the workplace, and
- Develop a learning culture to make all of these things happen in reality, not just words.

The global approach was designed taking cognisance of local regulatory requirements, unique cultural differences and site-specific characteristics to achieve four key objectives:

- Establish new and innovative ways to manage safety, support the effective execution of safety strategies, and eliminate inefficiencies;
- Establish a common safety management approach that had a structure and language that helped to bring the organisation together with a single and consistent safety framework;
- Ensure that safety was effectively integrated with other business strategies and objectives, in support of a stable operating platform, and
- Engage every employee to create conditions that encourage them to give of their best for their own benefit and that of the company.

A technology-based knowledge management system that encouraged higher levels of collaboration and cooperation across all business units was required to support the change. The strategic initiatives to instil a culture of care were effective across the group. It was supported by empowering people to take responsibility for their own safety and health and that of their colleagues and by recognising safety achievements.

The Safety Transformation project was created with the intent to move the company's safety maturity from a position of vulnerability to one of resilience. This required the integration of the 'Safety BluePrint' with the broader

organisational change initiative, known within the company as 'ONE'. It included implementation of a new people management system, the 'System for People' (SP), and a major programme for business process improvement.

The Safety BluePrint was to be reviewed every six months to ensure that safety strategies remained aligned with broader business strategies. The review was intended to ensure that:

- Activities contributed towards achievement of the stated safety vision;
- Endeavours had a material impact on the adoption of the safety values and guiding principles;
- Strategies were effectively implemented, and
- Successes were institutionalised through the implementation of safety management systems.

In 2010 the Safety Transformation project resulted in the development of a three-key component safety transformation approach. People and culture were vitally important in creating a safe working environment as compliance with rules and procedures alone could not address or mitigate all hazards and risks. A culture which fostered improvements in safety performance was built on people who thought for themselves about safety issues and who took ownership and accountability for creating a safe environment.

Building the right systems played a key role in influencing the work environment. AGA built robust systems that were specific to safety and ensuring that safety considerations were thoroughly integrated with other organisational systems that sustain safety such as knowledge management.

It was required to manage risks effectively by eliminating hazards where possible, and if it could not be eliminated, to manage the commensurate risks. It required broader thinking about hazards and risk, which would result in building more robust defences to protect people from harm, based on group-level, technical, administrative and individual controls (AGA 2010).

In 2011 the foundation for continued improvement in safety performance was the ongoing implementation of safety transformation into the operating system. The design and implementation of the safety transformation programme dealt with the concepts of physical injuries, health and wellbeing (AGA 2011).

The safety transformation initiative recognised that a safe and healthy business was a more productive one. The safety transformation was about valuing people and ensuring that priority was placed on people's lives, physical security, health and wellbeing. A maturation of the safety culture was required in order to achieve the safety and health goals. The envisaged safety culture was a culture where leaders set tone and direction, engaged and motivate people to give their best, and shaped organisational and safety systems, which enhanced the ability of employees to manage risk effectively. These were translated into action through the safety and health framework as shown in Figure 2.

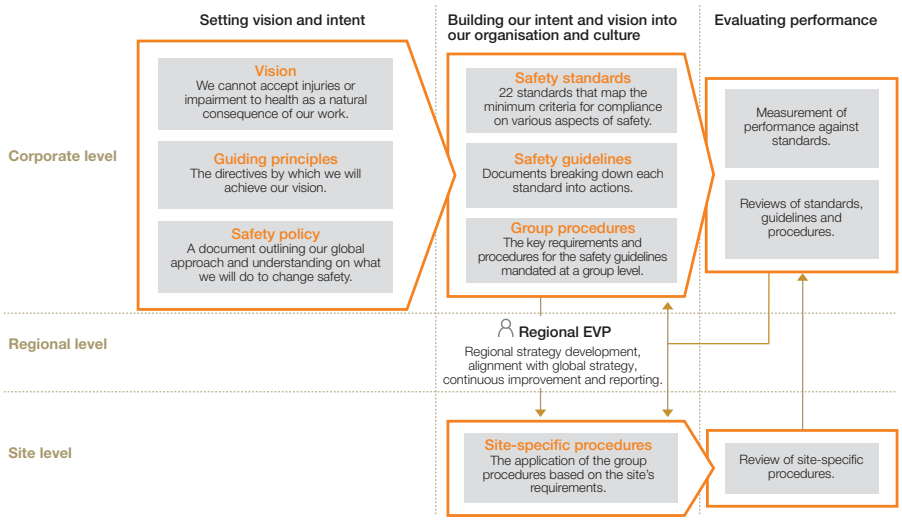


Figure 2 Safety and health transformation framework (AGA 2011).

The framework clarified the relationship between policy, strategies, standards, guidelines, procedures, regional and operational approach as well as the monitoring and measuring of performance in order to achieve continuous improvement in performance. The rationale for the approach was based on the understanding of how various industries evolved through embracing safety as a

business value. In their evolution, they went through four clear stages of leadership:

- Positioning safety as a business imperative;
- Managing processes to reduce variability and deliver consistent performance;
- Re-engineering processes to find better and safer ways to do work, and
- Introducing technical innovations to remove people from risk.

This path was consistent with the Project ONE organisational change initiative. It was important to ensure that all of the safety transformation components were made relevant to the business by integrating it into Project ONE. The safety component ensured that safety accountabilities for all employees were clear and appropriate capabilities developed to ensure support safe work. The approach was translated into a safety framework for the business, which was integrated into the broader operational model that had been developed through Project ONE. Implementation of the safety transformation framework through the operational model would enable the company to target and deliver on long-term and sustainable safety improvements.

3.5 Project ONE

It was guided by a steering committee chaired by the CEO and had two major components:

- The System for People (SP), which aimed to have the right person in the right role doing the right work.
- The Business Process Framework (BPF), with the goal of having the right work done at the right time and in the right way.

The discipline specific framework mapped the detailed design of functional areas of work, such as safety and was integrated into the SP and the BPF. The sustainability strategy supported and reflected the principles of Project ONE. The objective was to implement each element of the sustainability strategy through

Project ONE in order to ensure that it was made relevant to the business and became part of the way the company operated.

It included creating the right organisation structure where work was undertaken at the correct level, and the accountability and authority of a particular role clearly contributed towards achieving business objectives. The organisational structure placed priority on operational leadership, with functional roles acting in support of operations through effective cross-functional working relationships.

Another component of the strategy focussed on ensuring that the right people were in the right roles in that the continual matching of employee capability to role complexity. It was necessary for meeting immediate and future business needs and in line with employee career development plans.

The third component of the strategy was developing effective working relationships to ensure that employees across the organisation worked together effectively, whatever the differences in their internal and external working environments. Effective working relationships were facilitated when employees' behaviour and actions were in accordance with the managerial leadership practices and the company's values.

The approach to the implementation was that it should be undertaken in a top-down manner, engaging with all employees as far as this was possible, undertaken within the respective managerial accountability hierarchies and continually reinforced it until it became second nature within the business. A delivery framework was developed for the SP that clearly defined corporate and regional roles in the implementation process. A corporate team was established to be accountable for the process of designing and developing the SP material to be implemented throughout the company. The regional human resources teams were charged with planning, scheduling and resourcing activation of the programme in consultation with line management.

A global values survey, designed to offer all AGA employees an opportunity to participate in the identification of value-based behaviours and to gauge employee

engagement, was completed. It was envisaged to review the organisational mission, vision and values at regular intervals and maintain their relevance in a constantly changing environment. The surveys were subsequently analysed for trends and conclusions, and the results, which were integrated with other business processes and communications.

Project ONE had a ‘three-pillar’ safety strategy, which aimed to remove people from areas of risk, modify behaviour and attitudes to risk and to improve planning. The benefits were revealed in ongoing productivity improvements through face advance and mitigation of occasional shortages in certain underground mining skills.

Additional production crews were used to sustain production targets while training was conducted. The work of these teams was to maintain production, and also to prepare an up-to-standard workplace for the returning teams. The training focused on improving safety with regular inspections, observations of behaviour, group meetings, and frequent workplace risk assessments.

The SP was designed to facilitate an effective organisation structure and an accountability hierarchy that facilitated engagement and involvement at the right levels of the organisation, and efficient execution of work. An extensive amount of training on managerial leadership practices was in progress to provide line managers with tools to manage the outputs of their immediate reports and hold them accountable for their work.

The progress at the time confirmed that working towards having the right people in the right roles and focused on the right work, created both personal and organisational advantages. It was found that individual capability that was well matched to role complexity resulted in good performance, good decision-making at the appropriate level of work complexity, and employees who were sufficiently challenged and engaged.

The BPF in combination with the SP, promoted standard business processes across the company in order to ensure that the right people were in the right roles

and were working to ensure stable processes in order to deliver consistently exceptional results.

In 2013 the mining industry experienced downsizing as the global economic conditions including the struggling gold price and a rise in unemployment resulted in a freeze on recruitment unless the role was a mission-critical position, low or no increases and stricter measures from governments on the employment of local nationals. AGA continued to seek to build internal capability, retain key skills, develop diverse talent and had detailed succession plans, while embedding a culture of accountability within the business. Projects were initiated to optimise overheads, reduce costs and capital expenditure. These initiatives led to an organisational redesign that resulted in organisational retrenchments (AGA 2013).

A consequence of financial pressures experienced was that the executive management initiated a review of the composition and capabilities of the workforce at all operations. This included a close analysis of the skills and numbers required to perform core work functions. This process was underpinned by the principles of SP, in understanding the level of work and the resources required. The work for each discipline was broken down into transactional and knowledge-based, plotted against where the function was required, either at corporate, region or site level. The extensive work that went into this exercise allowed for an organisational restructure, which resulted in a reduction in headcount.

3.6 Organisational leadership

In 2016 leadership was an integral part of AGA's 'How we Work' people management philosophy. A leadership competency framework was developed to clearly outline the competencies and behaviours required by AGA leaders. A 360-degree leadership assessment was used to assess the progress of leadership practices and develop interventions to address identified gaps (AGA 2016).

The 'How we Work' practices were clearly set out and covered management practices that provided skills, tools and guidelines for effective leadership. The

management tool included the procedures and practices on employee engagement and development, hiring, retention and retirement. The people practices envisaged achieving a high-performance culture. Other planned outcomes included:

- To enable human resources to play a strategic role in the business;
- To enable managers to successfully execute their roles;
- To create a common culture;
- To create a highly engaged workforce;
- To enable the business to achieve its strategic objectives, and
- To become the recognised employer of choice.

3.7 Governance

3.7.1 Executive Committee

In 2009 the Executive Committee, chaired by the Chief Executive Officer, was responsible for overseeing the day-to-day management of the company and for executing the Board's decisions. The committee met at least monthly to review the company's safety performance, operational and exploration profiles and financial status. It also reviewed any social and environmental issues of concern to the company (AGA 2009).

The Executive Vice President: Business Sustainability was responsible for the overseeing of the sustainability functions in the business and presented issues to the executive committee. The EVP was accountable to design how to achieve sustainability goals working through the corporate sustainability team. Specific tasks included designing and supporting the implementation of the strategy to reduce the accident rates by 70% in five years, putting AGA on the road to operating sustainably through every employee.

Implementing the vision for safety transformation was achieved with the committed support of line management in order to make this target a reality. The focus areas included providing inspiration through safety leadership; clarifying individual and collective accountabilities for safety; establishing a common safety management framework; developing a knowledge-based approach to safety

management and integrating safety into the business strategies and the way AGA did work.

Management of sustainability issues at each operation was responsive to local needs and requirements. Managers of sustainability functions reported to the general managers of each mine who in turn reported into regional management structures.

3.7.2 Safety, Health and Sustainable Development Committee

In 2006 the AGA board appointed a Safety, Health and Sustainable Development Committee that had as its brief the evaluation of social, economic, environmental and health impacts of the company's operations on both local and global communities and to achieve a sustainable balance between economic and social development with due regard to the safety and health of its employees, and the impact of its operations on the environment (AGA 2006).

One of the stated primary objectives of this committee was to ensure the elimination of all work-related accidents and diseases, and the committee conducted on-site inspections on matters of serious concern. Representatives from Sustainable Development, Medical, Health, Safety, Environment and Community disciplines attended the meetings. Each meeting had as its focus on one of the specific disciplines with safety as a standard agenda item.

In the event of a fatal accident, mine management, with organised labour and the DMR, undertook a formal review. The DMR undertook *in loco* inspections immediately following a fatal accident, as well as an independent inquiry to which management and organised labour contributed. In addition, all fatal accidents within the group were the subject of an intensive internal investigation by a corporate office team, whose findings and recommendations were presented to, and considered by, the group’s executive team.

In 2010 the Safety, Health and Sustainable Development, Audit and Corporate Governance and Transformation as well as the Human Resources Development Committees of the Board were the bodies that continued to review sustainability

performance. The Board evaluation process was conducted by self-assessment on the basis of criteria developed jointly by the external party and AGA. The criteria for evaluating the performance of the Board included the ability to successfully assess, monitor and mitigate risk, including risks relating to sustainability issues (AGA 2010).

In 2013 the Social, Ethics and Transformation Committee Board subcommittee, which was established during 2012 under the leadership of a Non-Executive Director, developed a more intense oversight role. AGA also continued the engagement with the independent Sustainability Review Panel (AGA 2013).

In 2014 the committee ensured that the company complied with the laws and regulations of the countries in which it operated so as to guard and secure the social license to operate. By diligently focusing on sustainable development the committee demonstrated that good governance and undertaking the right actions for the right reasons generally led to positive financial, social, environmental and humane outcomes (AGA 2014).

AGA made considerable progress in the area of sustainable development and evidence could be found in the positive feedback the company received on the steps it took to improve the market performance. Safety remained a central strategic issue in the company, and work in the area of health also made a positive impact, not only on the health of employees but also to host communities.

The challenge of the Social, Ethics and Sustainability Committee was to be an effective custodian of the values, the people, the corporate citizenship, ethical behaviour, stakeholder management and the maintenance of the social, political, commercial and environmental license. It had a mandate to ensure that appropriate measures were taken when, for example, it observed that:

- Not enough was being done to ensure optimum safety on the mines;
- Not enough advancement of localisation and staff development in recruitment, selection and training activities, and

- If it noticed trends that compromise fair and ethical business practice and impact negatively on the social, health and environmental rights of the staff and communities.

3.7.3 Risk Management

Mining was a potentially high-risk activity and the operations were susceptible to numerous events that could have an adverse impact on the business. AGA had a comprehensive risk management process in place across the group in terms of which it was every manager's responsibility to identify and manage risks in his or her area.

In 2006 the board had ultimate responsibility for the total risk management process within AGA and reviewed and approved the risk strategy and policies that were formulated by the executive directors and senior management. Management was accountable to the board and had established a group-wide system of internal control to manage significant group risk. The risk management policies were communicated to all relevant employees (AGA 2006).

A full review of the risk, control and disclosure processes was undertaken annually to ensure that all additional requirements were incorporated into the system in the future. The systems were in place and the focus was on ensuring that the requirements of the King Code and the Sarbanes-Oxley Act were complied with timeously. The board considered the key findings from the ongoing monitoring and reporting process, management assertions and independent assurance in conducting its annual review of the effectiveness of risk management.

Risk assessments were conducted at both group and operational level, from the risks relating to the group as a whole to risks associated with specific working places, with the aim of understanding the potential safety and health risks that existed so that they may be eliminated or reduced to tolerable levels. Systems and processes were in place to ensure that risks were reported and managed by the Safety, Health, Environment and Sustainable Development committees.

Risk assessment were conducted by or with the assistance of external consultants, by the group's corporate office, by underwriters for insurance purposes or by the operations themselves. Risk assessment was extended to the rock face, with basic hazard identification skills being taught to front-line supervisors and employees.

In 2008 the executive directors and senior management reviewed the group's strategy and policies regarding risk. Significant emphasis was placed on the assessment, mitigation and management of risk, particularly regarding safety, health, environment and community-related risks (AGA 2008).

Management established a group-wide system of internal control to identify, evaluate and manage significant risks within the group. A full review of risk control and disclosure was undertaken twice a year and considered key findings from ongoing monitoring and reporting, management assertions and independent assurance reports. These were then reported to the Executive Committee and the Audit and Corporate Governance Committee. Risk assessments were undertaken using scientific data and methodologies in line with AGA's adoption of the ICMM Sustainable Development Principles and Framework.

The identification and mitigation of risk was a vital part of the company's operations and an integral part of the safety and health management process. Matters relating to safety and health were considered as part of the group's risk management strategy. Risk assessments were conducted regularly at both a group and operational level and were related to specific events or issues.

In 2009 the AGA Board adopted a more systematic approach to risk management at a group level, moving the discipline from an approach centred on compliance to one that focused on supporting business strategy. The change was made in anticipation of the King Committee on Governance 'Code of Governance Principles for South Africa 2009' (King III) and the ISO 31000 Risk Management Standard (AGA 2009).

Management was accountable to the Board and established a system of internal controls to manage significant group risk. Where risks were assessed as being

material, they were reviewed and reported to senior management, as well as the relevant Board committees.

A risk management policy was in place, with associated standards and guidance relating to the identification, assessment, evaluation, response, reporting and monitoring of risks to foster a risk-awareness culture within the business and inform business strategy.

The company made considerable progress on its approach to risk management through the implementation and roll out of a companywide risk management system. The system was the starting point for determining key sustainability issues for reporting and was a tool for ongoing management of the company's sustainability risks and performance. It highlighted the level of risk exposure, control measures and mitigation strategies for each risk.

The system was populated with information based on past performance and reporting and an ongoing programme of workshops conducted at operational, divisional and regional level. Discipline managers reviewed the risk information in the system at least quarterly while the executive committee and the Board reviewed it 6 monthly.

Risks were ranked using a common methodology and were recorded in the group risk register. The methodology required assessment of the potential impact on each of the values per risk. Risks were identified that have the potential to impact corporate and regional strategies, financial viability, delivery on business plans, and also specific objectives. Identified risks were assessed for materiality both in terms of stakeholder concerns and expectations, as well as the company's pertinent business concerns.

A dedicated risk management team was accountable for risk management processes under the oversight of the Risk and Information Integrity Committee of the Board. The risk management team operated within the requirements of group risk management policy statement and standards and was under the oversight of the Audit and Corporate Governance Committee and the Board. The Board

approved the formation of the Risk and Information Integrity Committee for oversight. The committee reviewed and approved the risk management strategy and policy as formulated by the executive directors and senior management.

4 Systemise activities required to achieve ‘Zero Harm’

4.1 Health and safety management system

In 2006 the Occupational Health and Safety Assessment Series, OHSAS 18001, an internationally applied standard for occupational health and safety management systems, was put in place to demonstrate the company’s occupational health and safety performance. AGA selected OHSAS 18001 as the standard safety specification across the group. It provided both a framework for identifying business risks associated with safety, health and environment, and guidelines for implementation and achieving certification (AGA 2006). Individual regions and operations were encouraged to develop their own safety management systems, consistent with the company policy and OHSAS 18001 specification.

In 2007 an OHSAS 18001 gap analyses was conducted, and action plans compiled. The need for a common platform for safety reviews across the company was identified which formed part of the rationale for the adoption of OHSAS 18001 (AGA 2007).

In 2008 the roll-out of the OHSAS 18001 continued. A safety and health systems and practice assessment protocol consistent with OHSAS 18001 was developed and implemented at all operations. All relevant role-players were familiarised with its requirements and the majority of the preliminary assessments was completed and an occupational health and safety system and practices protocol was developed (AGA 2008).

In 2009 all operations maintained OHSAS 18001 certification however, much work was still required to ensure the effective application of the systems in place to enable further maturation of the safety culture (AGA 2009).

There was a close correlation between systemic efficacy and maturity and safety performance and various leading and lagging indicators were used to track performance. Information from this analysis was used to develop strategies addressing issues relating to safety performance.

In 2015 it was envisaged that enhancing the organisational systems would help to get the basics right all the time, such as the way to lead and manage people, as well as the way to plan, undertake and manage work. Compliance with standards, systems, work methods and legal requirements was key in this regard. The streamlined safety management system was continuously being integrated into the organisational systems to enhance the effectiveness (AGA 2015).

In 2016 management systems and compliance to the Safety Standards were validated using the Safety Systems and Practices Protocol that measured the level of safety cultural maturity at an operating site level (AGA 2016).

4.1.1 Risk Management

The identification and mitigation of risk was a vital part of the company's operations and an integral part of the safety and health management process. Matters relating to safety and health were considered as part of the group's risk management strategy. Risk assessments were conducted regularly at both a group and operational level and were related to specific events or issues.

In 2003 a simple technically sound approach to enterprise-wide risk management process was instituted. 'Risk owners' for each risk were identified and were following a structured approach to identifying risks facilitated by each operation's risk manager. The aim was to be able to assess risk controls through a continuous pro-active management process, which would bring together all assessments, inspections and observations giving a clear indication of the risk status (AGA 2004).

This process was continually being improved and it was envisaged that the OHSAS 18001 system would be adopted within the region's risk management process. Audits were already being conducted and would eventually be used in OHSAS 18001 certification audits.

In 2004 risk assessments were conducted at both group and operational level, right down to working places. This was to understand the potential safety and health risks that exist so that it may be removed or reduced to tolerable levels. An

important development that took place had been the extension of basic hazard identification into the front line supervisory ranks and to employees themselves (AGA 2004).

In 2006 the traditional approach to risk management, whereby risks were assigned a score in terms of their impact and the statistical probability of their occurrence became problematic in the risk assessment of highly unlikely but potentially catastrophic events. To counter this, all health and safety related risks that were analysed within AGA from an impact perspective only. More than 1 400 risks were identified, most of which were operation rather than company specific and detailed disaster recovery plans were put in place to eliminate or mitigate these. It was important to incorporate risk management as a critical aspect of management of the operations (AGA 2004).

In 2007 the Integrated Risk Management System (IRMS) was reviewed for suitability. The system in itself had excellent capabilities but it was not always applied correctly. It was decided to develop a new system that would include both occupational health as well as safety indicators (AGA 2004).

In 2012 AGA launched a multi-tiered Hazard and Risk Management (H&RM) system. The tiered H&RM training programme catered for all organisational levels from personal risk assessments for front-line workers to and included enterprise risk assessments at the executive level (AGA 2012).

Risk analysis was a key component in building and executing the business strategy, including the sustainability strategy. Risk identification, assessment and management were considered at every step in the business planning process, from:

- Setting forth the business strategy, expectations and performance targets;
- Developing production and service strategies;
- Planning and scheduling work through to task execution;
- Employee safety and health, in particular mine fatalities associated with deep-level underground mining, as well as legacy health issues, and
- The threat of individual claims or class action lawsuits.

AGA was committed to continuous improvement of its sustainability performance and used a structured process to identify sustainability priorities for the business. The priorities were based on the views of external stakeholders, as well as on a real understanding of business and shareholder imperatives.

In 2013 ultra-deep underground conventional mining and the processing of ore had inherent hazards, which had to be understood, respected, and effectively managed to eliminate or minimise risk of injury or harm to personnel. Traumatic injury and chronic exposure to occupational health hazards remained significant areas of focus across the industry. Common causes of fatal injury included rock falls, vehicle accidents, incidents involving equipment and heavy machinery, inrushes and inundation, fall from height and electrocution. Less common causes of fatal injury included underground fires, entrapment, handling of hazardous materials including explosives, drowning and shaft-related accidents. Common occupational health hazards included noise-induced hearing loss, respiratory disease, heat stress, and ergonomic related musculoskeletal disorders (AGA 2013).

The systematic application of risk management techniques coupled with tactical focus in specific areas contributed to a substantial decline in occupational injury and illness frequency rates across the industry. Further improvement was necessary for workplaces to be free of occupational injuries, incidents and illnesses and to attain ‘Zero Harm’.

In 2014/15 a great deal of emphasis was placed on understanding how risks materialised at the operations and the sequences of events that resulted in safety incidents. This helped to understand what controls were necessary, and most effective in managing major hazards (AGA 2014 -15).

In 2015 the focus on managing major hazards remained a critical part of the strategy to eliminate unwanted events. Work continued to prioritise engineering control solutions where feasible and to ensure full compliance with all critical controls. Examples of engineering controls introduced included electronic fatigue monitoring systems and vehicle-to-vehicle proximity detection devices.

The work done in this area was aligned with the critical control management guideline issued by the International Council on Mining and Metals and the control framework was based on the internationally recognised hierarchy of controls (AGA 2015).

In 2016 engineering control solutions were prioritised to reduce reliance on administrative controls. Strengthening engineering controls was incorporated into the business planning and budgeting process. AGA focused on embedding major hazard management into work processes and continued to strengthen technical and engineering controls. The active management and review of operational safety profiles continued to serve as a basis for prioritising major hazard management activities (AGA 2016).

4.1.2 BowTie risk model.

AGA used the BowTie (BTA) risk model to thoroughly analyse all major hazards with fatal consequence potential using bow-tie risk models. The model visually portrayed threat and consequence pathways to and from a major event in the characteristic shape of a bow-tie. It assisted to visualize along each pathway intervening preventative and mitigating controls were depicted. Vulnerabilities, both in layers of control and control robustness, were quickly identified and addressed.

The models took the assessment process one step further and crucially linked critical controls to management systems through the assignment of tasks, procedures processes, and accountabilities in a critical control register.

The BTA approach, as shown in Figure 3, showed the links between the potential causes, preventative and mitigating controls and consequences of a major accident. Once completed, a BTA risk model revealed vulnerabilities and highlighted the importance of having multiple layers of controls, including higher order controls such as engineered controls, and of routinely monitoring control effectiveness (AGA 2012).

In 2012 factors leading to fatal incidents differed from those which resulted in less severe incidents. AGA commenced with a process to thoroughly analyse all major hazards with fatal consequence potential using bow-tie risk models. The model visually portrayed threat and consequence pathways to and from a major event in the characteristic shape of a bow-tie.

Intervening preventative and mitigating controls were depicted along each pathway. Vulnerabilities, both in layers of control and control robustness, were identified and addressed. The models linked critical controls to management systems through the assignment of tasks, procedures, processes, and accountabilities in a critical control register.



Figure 3 Bow-tie analysis (AGA, 2012).

The Bow-tie analysis for two of the 22 fatal risks was facilitated as part of the global roll-out.

Appendix B: AngloGold Ashanti

In 2015 an analysis of incidents showed that there was no significant statistical correlation between the occurrence of low and high consequence incidents. Low consequence incidents were commonly associated with personal safety failures (e.g. slips and trips), whereas high consequence incidents were more commonly associated with several failures in the work process. The hazard and risk management strategy therefore focused on both personal and process safety risks (AGA 2015).

Process safety risk management required detailed assessment of material unwanted events to ensure a thorough understanding of the event complexity, causation pathways, and the approach to institute a critical control management programme. AGA identified 19 major hazards, which, should it materialise, had the potential to result in single or multiple fatalities. 4 Priority major hazards were identified that accounted for 80% of high consequence incidents and fatalities.

The top two underground major hazards related to ground control and rail-bound transport activities. For these specifically, engineering controls were prioritised to reduce the dependence on controls relying solely on human intervention. It was anticipated that this would significantly improve the safety performance.

In 2016 the development of the BTA to analyse risks for major hazards continued at an operational level as part of implementing the Major Hazard Standard (AGA 2016).

4.1.3 Major Hazard Control Standards

A suite of Major Hazard Control Standards was developed which concisely defined mandatory controls aimed at eliminating or minimising the risk of fatalities, injuries or incidents arising from the uncontrolled release of the associated hazard.

The Control standards encompassed 20 risk areas were developed and were intended for global implementation. It included risk areas such as ground control, working at height, and fire prevention.

In 2011 AGA pursued further development of the safety transformation framework, including 22 Global Safety Standards that made up the robust safety management system. Compliance to these standards was assessed through an annual self-assessment process and a bi-annual corporate-led combined assurance process (AGA 2011). The Safety Standards included:

- Strategic planning, goals and targets;
- Corporate Governance, legal and other requirements;
- Safety leadership and accountabilities;
- Co-design and conversations;
- Awareness, training and competence;
- Health, wellbeing and fitness to work & Occupational Environment;
- Change management;
- Contractor, supplier and partner selection and management;
- Knowledge management;
- Learning from experience;
- Safety compliance with a process focus;
- Design, construction, commissioning, de-commissioning and closure;
- Procurement and disposal;
- Operational and asset integrity;
- Work planning;
- Safe work practices;
- Hazard and risk management;
- Incident management;
- Emergency response, crisis management and business continuity;
- Technology, research and development, and
- Performance measurement.

In 2012 a suite of Major Hazard Control Standards was developed which concisely defined mandatory controls aimed at eliminating or minimising the risk of fatalities, injuries or incidents arising from the uncontrolled release of the associated hazard. The Control standards encompassed 20 risk areas, which were

developed intended for global implementation early in 2013. It included risk areas such as ground control, working at height, and fire prevention (AGA 2012).

In 2015 the major hazard critical control management process was simplified and systematised. This involved bringing all data to a common platform for easy analysis, decision-making and implementation. Additional Major Hazard Standards were developed during the year. All operating areas completed a gap analysis in relation to the standards and implemented processes to address gaps identified (AGA 2015).

AGA operations globally monitored, on aggregate, over 100 000 critical controls monthly. Some of these were administrative or procedural in nature whereas others required engineering measures to be taken, such as placing nets and bolts in working areas or replacing manual techniques with mechanised underground development.

By monitoring control effectiveness, AGA could focus on underlying issues and took proactive measures to prevent major incidents from developing. AGA worked aggressively on adopting this methodology at all the operations and a significant effort remained in the implementation of this approach fully.

In 2016 the monitoring of the adequacy and effectiveness of critical controls took place, with an increasing focus on the introduction of engineering controls. The common application of the system for the critical control monitoring was being piloted at sites in AGA (AGA 2016).

4.2 Compliance

It was important to ensure strict compliance for the standards, systems, processes and work methods in order for it to be effective. AGA identified the individuals responsible for verifying control effectiveness, the means used for verification of the control and the required frequency of compliance checks.

Data from critical control monitoring was then used as a leading indicator to address emerging risks. This was done by determining the underlying issues and by taking proactive measures to prevent major incidents from developing.

In 2016 AGA's tool for self-assessment and evaluating compliance to standards was revised and simplified. The tool focused on the 20 company safety standards and was also used to establish the level of safety cultural maturity at an operating level. The results were reviewed and validated by the group safety team as part of the combined assurance process. The reporting of high potential incidents focused on building an open reporting culture, enhancing organisational learning, and institutionalising change (AGA 2016).

The review of legal compliance and supporting processes continued as well as the evaluation of any non-compliance and the implementation of any required remedial action. The focus on compliance was used to establish a platform for continuous improvement.

In 2016 the assessment of compliance and effectiveness would continue to be monitored to identifying improvement opportunities. The system to share learnings across the organisation continued to mature with increasing openness and transparency in reporting. The learning from past incidents and reaffirmation that corrective actions were effective was reviewed on the commemoration of the first-year anniversary of employees lost to occupational injuries (AGA 2016).

4.3 Audits

In 2007 a specialised internal safety and health audit team was established to carry out comprehensive audits of all mine workplaces to enable risks identification before incidents could occur. The desired outcome remained the identification and timely correction of safety process deficiencies before these could result in an incident. Audits began during the second half of 2007 and were scheduled to cover the principal risks in an 18-month cycle (AGA 2007).

In 2015 AGA introduced the '5Teen' audit process, which was an intervention, aimed at improving the safety performance of teams with previously poor safety

performance records. The process included formal communication sessions with identified teams, focusing on the reason for their selection, the process to be followed and the intent of the process and follow-up inspections. The initiative progressed well, and indicators reflected improved safety performance from the participating teams (AGA 2015).

4.4 Integrated Global Incident Reporting System

The company developed a system to formalise the reporting of incidents into a common portal available to all AGA sites around the globe. AGA expanded the scope of the global reporting platform to include high potential incidents (HPI) in an effort to enhance organisational learning and to establish a broader basket of leading and lagging safety performance indicators.

HPIs were incidents with major loss potential, but with minimal to no actual consequence having materialised. These incidents were used as learning opportunities to improve the safety management systems. It also served as a leading indicator for significant incidents. The long-term objectives of the system were to affect a decrease in repeat incidents, and to provide timeous and accurate information across a broad range of categories.

In 2008 incidents took place across a broad range of disciplines including safety, health, security, community and the environment in a global company. The company developed a system to formalise the reporting of incidents into a common portal available to all AGA sites around the globe. It was used to distribute the details of these incidents across the company and share learning points arising from these incidents globally. The long-term objectives of the system were to affect a decrease in repeat incidents, and to provide timeous and accurate information across a broad range of categories (AGA 2008).

In 2011 the AGA incident investigation protocol was developed and deployed. Incident management and tracking system was developed, and the global pilot programme commenced (AGA 2011).

In 2012 further enhancements were done to the AGA global reporting system to facilitate improved performance monitoring through transparent, real-time performance reporting, diagnostics, and analytics. This allowed for it to be more responsive and to deploy critical resources strategically where needed. Incident reporting was instantaneous and key performance indicators were reported automatically on a more frequent weekly basis, allowing for the monitor of performance more closely (AGA 2012).

In 2014 AGA ensured that incidents were reported and investigated in an open and transparent manner and actions were taken to prevent recurrence. This was achieved by specific and comprehensive standards, guidelines, and procedures addressing incident reporting and record keeping. Reporting, classifying, and recording of occupational injuries and illness was performed in accordance with legal requirements and was consistent with provisions referenced in the International Labour Organization code of practice (AGA 2014).

In 2015 reporting of high potential incidents was encouraged as these were used to heighten awareness, facilitate organisational learning, and affect more robust controls. A formal process for incident notifications was established and implemented. AGA embraced the lessons from high potential incidents and extensive work was done to understand the root causes in order to prevent repeat incidents (AGA 2004).

4.5 Incident Investigation Process

In 2011 AGA developed and deployed a new incident investigation process based on a model widely regarded as best practice in various industries. The objective of this system was to enable the organisation to learn from incidents and manage it proactively (AGA 2011).

The system included modules relating to incident investigation and analysis. The revised incident investigation procedure was put in place reflecting the view that incidents generally had multiple and sometimes complex contributing factors at an individual, workplace and organisational level. The incident management

system was a programme that fostered heightened hazard awareness and provided management a tool to record observations and monitor their progress toward resolution.

In 2012 a crucial step in preventing incidents and associated injuries was to understand the immediate, fundamental, and contributing causes. An incident investigation process was developed and implemented based upon James Reason's Organizational Accident Model, which was widely recognised as best practice (AGA 2012).

Over 500 individuals from various disciplines in each business unit participated in a three or five-day custom developed training course. This equipped them with the tools and interpersonal skills to facilitate comprehensive incident investigations aimed at rooting out immediate causes, under lying individual, workplace and organisational factors which may have contributed to the incident. Preventative and corrective actions were taken to ensure incidents did not recur. Organisational capability enhancement included the structured methods of incident investigation.

In 2016 the Chief Executive and Chief Operating Officers set the organisational tone to strengthen the safety culture and demonstrated leadership commitment to safety. They formally reviewed all fatal and significant high-potential incidents, which included analysis of underlying contributing factors for each actual or potential significant incident at the individual, workplace and organisational level (AGA 2016).

4.6 Wellness in the workplace

The 'Wellness in the workplace' thrust recognised that safety and health were integrally related. This thrust would primarily address the working environment, health care and medically affected employee programmes so as to enhance employee management. Wellness in the workplace embraced the following:

- Recruitment and selection;
- Dust management;

- Noise management;
- Thermal management;
- Radiation management;
- HIV/AIDS workplace initiatives, and
- TB control.

Although the 'Wellness in the workplace' formed a major part of the efforts by AGA to ensure a healthy and productive workforce, the detail was not further elaborated upon in this case study.

4.7 Fatal accident reviews

In 2004 AGA had a policy of investigating all fatal accidents independently of mine-based and statutory investigations using a team convened by the corporate office and followed up by a formal executive review conducted at the corporate office. The group believed that this methodology not only indicated the seriousness with which the board and executive viewed fatal accidents but revealed important risk issues and lessons learnt (AGA 2004).

4.8 Safety management responsibilities

In 2004 the management of safety and health issues at an operational level fell under the auspices of the Chief Operating Officer, who was supported by line management. Responsibility for safety and health had been devolved to operational line management, down to the level of first line supervisor. The actual operational structure varied from operation to operation (AGA 2004).

In 2006 the safety and health performance of the company was overseen at a corporate level, with strategies for specific issues being driven at this level including protocols for auditing (AGA 2006).

In 2007 safety representatives and their committees would have the necessary responsibility, authority and support to effectively perform their functions, including ensuring compliance with the safety and operating standards. Managers and supervisors would lead by demonstrating their own adherence to safe work

practices and require everyone working or visiting their respective areas to follow those agreed operating standards (AGA 2007).

All would follow the agreed safety standards and practices and would not take or allow shortcuts on any safe working practice. All employees would either fix or cause action to be taken immediately to rectify any identified significant hazards before proceeding with any other activity.

In 2008 the management of safety and health was the responsibility of line management, with the General Manager of each operation ultimately being accountable for performance. Specialist safety and health personnel at corporate, regional and operational levels in turn, supported him or her (AGA 2008).

In 2009 management teams were to ensure that the necessary resources were made available, particularly in areas such as engagement with the stakeholders and social partners, supporting community initiatives, rehabilitation and closure, and pollution prevention (AGA 2009).

In 2016 the adequacy of the safety discipline to support operators in performing work safely was reviewed against the Health of Discipline Framework. This included appropriateness of safety organisational structures, required skills within the structure, capability of staff, assessment of the talent pool and review of succession plans. The review of the health of the group safety discipline was ongoing and safety capability training across the organisation would continue according to a three-year plan (AGA 2016).

4.9 Health and safety agreements

In 2004 the South Africa region had safety and health agreements and policies in place at all mines and business units that had been negotiated with representative unions as prescribed by the Mine Health and Safety Act (AGA 2004).

In 2006 each operation in South Africa had its own health and safety agreement with the union representative of the majority of employees, the National Union of Mineworkers (NUM). These agreements were extended to all the unions

represented in the company. Joint health and safety committees were in place at every operation and all working places were covered by such agreements (AGA 2006).

4.10 Tripartite health and safety committee

In 2009 AGA established a tripartite health and safety committee. The purpose of the committee was to bring together management, organised labour and government representatives on matters of safety and health so as to create consistency of standards, to ensure clear roles and responsibilities, and to establish a mechanism for the monitoring and evaluation of compliance. The committee operated independently of the company's operational mine-based health and safety structures (AGA 2009).

4.11 Emergency preparedness

Emergency preparedness plans were in place at all operations and were reviewed regularly and regular training undertaken. Communities were involved in emergency preparations where communities were located in close proximity to operations.

4.12 Safety Indicators

A range of leading and lagging indicators were monitored throughout the group. Some of the leading indicators were site-specific. The primary lagging indicators reported for the group as a whole were the Fatality Injury Frequency Rate, the Lost Time Injury Frequency Rate and the days lost per lost-time injury, which indicated the severity of lost-time injuries.

In 2012 AGA expanded the scope of the global reporting platform to include high potential incidents (HPIs). This was done to enhance organisational learning and establish a broader basket of leading and lagging safety performance indicators. HPIs were incidents with major loss potential, but with minimal to no actual consequence having materialised. These incidents were used as learning opportunities to improve the safety management systems. Over 100 incidents

were recorded during 2012 which also served as a leading indicator for significant incidents (AGA 2012).

In 2016 AGA instituted a number of additional key performance measurements for safety performance (AGA 2016). High-potential incidents were used as a leading indicator for low frequency, high consequence events. Reporting of high-potential incidents included:

- Surface operations incidents reported were mostly related to light vehicles and heavy mobile equipment;
- The underground operations incidents reported falls of ground and rail-bound transport incidents.

5 Humanise the business systems to enable the achievement of 'Zero Harm'

5.1 Safety Culture

AGA developed a greater understanding of how people work, what motivates them and what motivates them to change. The desired outcome was that 'safety is our priority' and it needed to be shared and be evident in behaviour.

The company actively pursued the development of a safety culture since the introduction of the DuPont behaviour-based safety programme in 2002. A phased and structured behaviour change process was put in place to gradually change individual, team, section and ultimately the entire operation's mindset. All employees upwards from the team leader category were trained in behaviour auditing techniques and principles.

By 2004 ninety percent of employees down to team leader category were trained in behaviour auditing techniques and principles (AGA 2004).

In 2007 seventy percent of the fatal accidents were associated with contraventions of standards. It was believed that a great opportunity existed in the way of leading and managing the company and the way in which other stakeholders were engaged with in making safety improvements. The company actively pursued the development of a safety culture and it needed to be shared and evident in behaviour. A safety culture survey was completed through assessment by peers, managers and subordinates of safety leadership across the company to augment the existing behavioural safety programme (AGA 2007).

Other initiatives included reviewing and updating of all training modules and programmes within the company, to ensure the full integration of safety and health aspects. Investigations were conducted into ways of elevating the role of the health and safety representatives at mine level.

In 2008 good progress was made in inculcating a safety and health culture with an emphasis on safe work practices at all levels. The Occupational Safety and Health

Leadership Transformation Project was initiated to develop a global occupational health and safety blueprint which was aligned with broader business transformation initiatives (AGA 2008).

Safety was the AGA's first value was defined and led from the top and key to the transformation of the safety and health culture. Safety was seen as a concurrent process and was about how people though and operated within and around everything that was said and done. It set the context for leadership messages, guided leadership behaviours and the definition of work practices in the workplaces. The introduction of hazard assessment and reviewing work processes reinforced the focus on how work was done through from a safety perspective and associated risk management actions.

The 'Care' initiative, an organisational change approach focusing on the way in which all employees value and respect the aspirations, capacities and needs of one another, and those of the company was implementation. It involved the development of individual and team-based agreements of expectations, and delivery against it. The employees were empowered to stop working in places that they felt unsafe.

AGA pursued the notion to treat each other with dignity and respect and manage every activity as though it was a part of a family. Safety was seen as the most important indicator whether the company was creating a sustainable and continually improving business for employees.

In 2009 AGA had a global approach to developing a resilient safety culture and systems that would create a common business platform and language for safety across the company. The concept of safety included occupational health and safety, and the wellness of employees, contractors and host communities (AGA 2009).

In 2011 AGA continued with initiatives to strengthen the safety culture (AGA 2011).

In 2015 the leadership imperatives introduced included the expectation that leaders lead by good personal example and that their conduct reflected living the company values. It was believed that prioritising communication with employees at all levels and being available to engage in face-to-face conversation would be the most powerful driver of behaviour change to create organisational capacity and resilience (AGA 2015).

In 2016 AGA determined the leadership behaviours required to strengthen the safety culture through work routines reviews and reinforced to support consistent safety performance. Mechanisms to review and report on safety leadership behaviours were being developed (AGA 2016).

5.2 Training

In 2004 the occupational environment as well as health and safety training was a particular priority for the company and was incorporated into all technical training programmes and learning material with reference to the workplace and work-related hazards for each and every occupation and associated tasks (AGA 2004).

There were changes to legislation that facilitated the empowerment of first line supervisors, both in examining and making safe their work areas, and in withdrawing from working areas should these be thought to be unsafe.

In 2005 AGA continued with specialised training, which included:

- Risk assessment level 1, designed for and presented to all non-supervisor categories. The focus was on hazard identification;
- Risk assessment level 2, designed for and presented to supervisory categories – miner/artisan level. The focus was on hazard identification and includes practical exercises on observation and inspections;
- Risk assessment level 3, designed for and presented to supervisory employees. The focus was on issue-based risk assessment;
- Enterprise-wide risk management designed for and presented to supervisory employees;

- Advanced principles of safety management, designed for and presented to safety practitioners, learner officials and management trainees;
- Safety representative course designed for and presented to all safety representatives, and
- Hazard identification techniques were needs based (AGA 2005).

In 2006 AGA recognised that the provision of appropriate training was essential to ensure that employees were competent to carry out both their duties and their responsibilities safely. A wide range of safety training initiatives was undertaken including specific training requirements that were provided for in terms of laws and regulations (AGA 2006).

In 2008 a wide range of safety and health training initiatives were undertaken at the various operations throughout the year. Training with an emphasis safety and health were prioritised to ensure that the employees were competent to carry out their duties and their responsibilities safely and to identify and deal with hazards in the workplace (AGA 2008).

In 2011 the operations were provided with defined safety technical training, which incorporated the new approaches and clarified the context and application (AGA 2011).

In 2012 AGA continued with Safety Leadership training programmes. The Safety Leadership Programme introduced tools and techniques to assist leaders in engaging employees in safety conversations, interactions, and interventions. It created an understanding that a number of factors influence the safety performance of an organisation (AGA 2012).

In 2015 enhancing organisational capability remained an area of focus for AGA. Keeping safety top of mind for all people strengthened levels of compliance with existing systems, which could in turn make those controls more effective in mitigating risk. This include regular training on safety protocols and compliance was provided for employees across the company (AGA 2015).

Three broad-based safety training programmes were designed to build organisational capability and capacity across the portfolio and focused on safety leadership, hazard and risk management, and incident management, were developed and implemented.

The hazard and risk management (HRM) training programme specifically focused on four levels of training:

- HRM4: This was aimed at executives and focused on a broad understanding of hazards and risks to guide strategy;
- HRM3: This course focused on regional and operational management and was extensive in both scope and detail;
- HRM2: This was aimed at the supervisory level. It was designed to help supervisors understand what they need to do in the execution of their day-to-day work and to ensure that hazards and risks were understood and managed. Specific tools and techniques were also introduced which supervisors learnt to apply, and
- HRM1: This was for everyone at operational level. It created awareness in individuals of what had to be done before starting a task and encouraged a culture of risk awareness. The acronym SLAM encapsulated the essence of this approach. Stop and think; Look; Assess the situation; Manage the hazard.

In 2016 annual safety training targets for different organisational tiers and work categories were established at the beginning of the year and delivery of training units was tracked against the Key Performance Indicators (KPIs). The design of the training programmes included integration of safety aspects and requirements into work routines (AGA 2016).

5.3 Employee involvement and communications

In 2006 the involvement of employees and employee representatives in the area of safety and health was crucial to success. It created awareness and commitment to standards and best practices and kept employees fully informed of their rights and responsibilities in respect of safety and health (AGA 2006).

All operations had safety and health communications programmes in place and a number of the different campaigns were undertaken. Communication tools include meetings, notices and signage, the intranet, mine-based newsletters, safety newsletters, launches and other events, industrial theatre, posters, videos and induction procedures.

In 2007 the company committed itself to improving safety at all its operations. AGA embarked on a consultative process where more than 1 000 employee representatives, management and government attended the tripartite meeting held in November 2007 to review the company's mission, vision and values. The process was built on the launch of the 'Safety is our first value' campaign with the collective resolution that safety was the most important value and that no business priority would be put before safety. It was developed further through interactions between executive management and employees in a range of different interventions over the following months (AGA 2007).

A communication strategy was developed for the values roll-out which was designed to ensure that the message reached all employees and that it was well understood. As part of the communication at mine level, 'White flag' days indicating that no accidents took place in the preceding 24 hours, was introduced and reported centrally. The intent was to reinforce the belief that accident-free mining was possible. Green, orange and red flags denoting dressing cases, reportable injuries and serious injuries respectively were also highlighted. Briefs, posters, safety newsletters and numerous other employee communication channels remained in place.

In 2008 emphasis was placed on the involvement of employees in both safety and health strategy and performance in line with the group's overall commitment to collective bargaining and employee participation. This was reflected in the design of the safety and health transformation process (AGA 2008).

Agreements governing the management of safety and health, which were negotiated with representative organised labour or were developed with the co-operation of employees, were put in place at all operations. It was estimated that

at least 90% of the total workforce were represented in formal joint management-employee safety and health committees. Their role was to monitor and advise on occupational safety and health programmes and consequently participated in the management of safety and health through forums created specifically for this purpose.

In 2009 it was essential to ensure that stakeholder perspectives were captured in the Safety Transformation project. This was undertaken by organising a series of stakeholder workshops in which government, organised labour, employees and safety experts participated (AGA 2009). Stakeholder engagement continued as the project developed and a dedicated stakeholder engagement plan was compiled. The Guiding principles were:

- Set clear accountabilities for safety;
- Understand and manage hazards and risks, in an ongoing way;
- Engage the workforce in doing this;
- Make the solutions happen by providing resources;
- Have a relentless and broad commitment to safety, within and beyond the workplace, and
- Develop a learning culture to make all of these things happen in reality, not just words.

The approach was designed taking cognisance of local regulatory requirements, unique cultural differences and site-specific characteristics. It aimed to achieve four key objectives:

- Establish new and innovative ways to manage safety, support the effective execution of safety strategies, and eliminate inefficiencies;
- Establish a common safety management approach that had a structure and language that helps bring the organisation together with a single and consistent safety framework;
- Ensure that safety was effectively integrated with other business strategies and objectives, in support of a stable operating platform, and

- Engage every employee to create conditions that encourage them to give of their best for their own benefit and that of the company.

A technology-based knowledge management system was developed to support the safety transformation initiative. It encouraged higher levels of collaboration and cooperation across all business units.

In 2014 AGA put the guiding principles into practice on engagement, specifically the approach to engagement with employees. The CEO chaired mass meetings along with the COO, which covered most of the 26 056 employees in the South African operations. The CEO spoke individually to many colleagues. These engagements were undertaken partly in response to a call from the workforce to receive more frequent and direct dialogue with the company's management and a strong desire on AGA's part to communicate directly with the employees on a range of matters. The issued discussed included safety, employee indebtedness, bonus and pay structures, challenges faced by the industry and how all can work together to ensure long-term sustainability. In each case management listened to the areas of concern and suggestions for improvement, while also highlighting the good work under way by the management team to address key issues (AGA 2014).

5.4 Removing employees from risk in the workplace

In 2007 there was a need to fundamentally review the way in which AGA worked. The vision was to, as far as possible to remove employees from high-risk areas and activities over a five to 10-year time horizon. A steering committee was appointed to drive the project. Ideas and suggestions were being canvassed from employees, and the committee surveyed industry best practice (AGA 2007).

It was a priority to get a better understanding of people and the way they work and the way in which to change the way that work was done. An attempt had to be made to ensure that there was a better understanding that a safe working place was a productive working place in the long run. It was thought at the time that to over-

emphasise the risks associated with depth was more important than the risks associated with behaviour.

A second need was to make fundamental advancements in technology resulting in a number of new technologies being explored, focusing initially on the rock breaking, transport and processing sectors. If it was envisaged to use current or similar mining infrastructure, then it was a requirement to remove people from those areas know present the greatest potential risk, particularly stopes and near shaft pillars. It was concluded that the only way in which it could be sustained was to radically change the way mining was done, probably using technology that would assist in mining remotely from the area of potential danger.

A third need was to better understand the wellness of the workforce and working places as it had an impact on the safety performance. The workforce was older than it had ever been, and less physically fit, with illness and fatigues a factor. It was estimated at the time that up to 30% of the workforce was infected with HIV. Conventional mining tasks make for arduous work for the well and physically fit. It was questioned how much more onerous the tasks were for those who were not well and physically fit.

It was concluded that knowing and accepting these facts was an important driver in the development of in-stope conditions that were more comfortable and manageable, and ensuring that the jobs that people do were less onerous and physical demanding. Technology such as improving ventilation, cooling systems, transports to the working places, and lighter and more mechanical processes were to play a role.

The associated bonus systems had to ensure that there was a good balance between the need for and role of production incentives and the incentives for safety, at all levels. Simply scrapping bonuses was not the answer (AGA 2007).

5.5 Fatigue management

In 2007 sleep disturbance and sleep deprivation, and the resultant fatigue, were health risks associated with long working hours or shift work and clearly could have negative consequences for occupational safety (AGA 2007).

An expert on fatigue management was retained to assist the understanding of the issue. Several underground workplaces and a number of residences were visited. All workplaces were analysed in terms of empirically determined fatigue factors. Factors analysed included nature of work, travel distance, degree of physical strain and workplace temperature. The analysis was envisaged to be an ongoing process, as working places and conditions changed continuously during mining operations. Employees were also individually assessed to determine whether they resided in a mine hostel or local community, wellness and lifestyle factors.

A comprehensive suite of training material focusing on understanding the causes and effects of fatigue and on appropriate management practices was prepared. It was distributed to all managerial and supervisory employees and formed part of the induction programme for all new employees and those returning from annual leave.

5.6 Retention of skills

In 2007 AGA experienced increased labour turnover in first-line supervisory occupations, such as miners and artisans. The staff turnover rates ranged from 10% to 55% and varied by operation and occupation. Skills were lost to other mining companies, engineering and construction projects. The net result was the appointment of inexperienced, insufficiently trained people in posts at first-line supervisor levels. A comprehensive programme, designed to address the skills challenge in the short, medium and long-term was developed (AGA 2007). It included:

- Attitude surveys were conducted to probe reasons for exit;
- Improved screening and induction processes were established;
- A comprehensive review of training materials and programmes was done, and

- Reviewed job gradings and conditions of employment.

5.7 'Zero Harm' Awards

In 2015 a 'Zero Harm Awards' was presented for the first time as a way of encouraging and recognising innovation in the discipline of safety (AGA 2015).

6 Operationalise the safety management system

6.1 Seismicity and fall of ground management

Seismic activity was of particular concern to the gold mining industry in South Africa as it was a major cause for fatalities. AGA adopted a holistic approach to the management of seismicity at its deep level mining operations in the South Africa region. Sophisticated seismic and rock mechanics technologies were used to understand and manage this risk. Modifications to mine layouts and support technology were part of the effort to minimising the incidence and impact of seismic activity, that could cause employee injury and death as well as substantial damage to AGA's operations.

It was a requirement to remove people from those areas know present the greatest potential risk, particularly stopes and near shaft pillars. The only way in which it could be sustained was to radically change the way mining was done. Consideration was given to use technology that would assist in mining remotely from the area of potential danger.

In 2002 AGA's fall-of-ground management (FOGM) system was developed and implemented at all its South African deep level mines to manage mining induced seismicity and rockbursts. Further research was conducted into rock-related injuries in relation to the depth at which it occurred. The delegation of relevant fall of ground management components to each level in the mining organisational ranks was being considered (AGA 2001/2). The FOGM elements included:

- FOGM 1 - Design of mine layout. Mine-wide, the design of mine layouts to prevent adverse rock conditions: the aim was to reduce the occurrence of mining-induced seismicity and rock-bursting as well as unfavourable stress concentrations and fracture orientations;
- FOGM 2 - Design of support systems. Locally, the design of support systems to protect against adverse rock conditions and hazards. Careful attention was given to the design of standards to cater for both rockfall and rockburst conditions;

- FOGM 3 - Human factors involved in falls of ground. Training and communication to prevent accidents;
- FOGM 4 - Monitoring systems, verifying sufficiency of designs and implementation. Monitoring the effectiveness of layout and support system designs, and
- FOGM 5 - Problem solving and technological development. Problem solving by means of research and technology development: AGA participated actively in industry research initiatives (SIMRAC) and both motivated and guided research projects (AGA 2002).

AGA also conducted its own research through the Technology and Innovation Fund which focused on developing and implementing knowledge, rather than on fundamental research, on issues, which were specific to operations in the South Africa region. This research and development were over and above that undertaken by the industry as a whole and government. Rock engineering related projects overseen by the fund included:

- Investigation into the development of support systems that could be transported by pipeline, e.g. packs superfill and shotcrete;
- Development of technology for the rapid dissemination of seismic data via the intranet;
- Optimisation of the daily seismic hazard rating system;
- Development of a testing and quality assurance programme for support, and
- Integration of rock engineering audit data into the integrated risk management system (IRMS).

The five elements of fall of ground management system had been audited on a regular basis since 2003 to identify where remedial action needed to be taken, and positive results were noted during fall of ground management analysis as a result. Further research was being conducted into rock-related injuries in relation to the depth at which they occur. The delegation of relevant fall of ground management components to each level in the mining ranks was being considered (AGA 2004).

The AGA mines were equipped with state-of-the-art seismic monitoring systems. These varied from mine-to-mine, depending on the extent of the seismic problem. ISS International, a leader in the development and manufacture of seismic systems as well as seismic research and analysis, ran the seismic networks on a contract basis and provided a round-the-clock service in terms of network management and analysis. Seismic information was used in terms of short, medium and long-term seismic hazard assessment as well as for back-analysing the effectiveness of different mine designs and layouts. The performance of different support types was also monitored (AGA 2004).

At Mponeng Mine mining took place down to a depth of 3 800m. In around 2004 the mine implemented several strategies to reduce the incidence and effects of seismicity. These resulted in a 70% reduction in the number of potentially damaging seismic events per square metre mined since 1996 and a 75% reduction in the seismic-related lost-time injury rate since 1998. The strategies adopted consisted of three main areas: mine design (prevention), support design (protection) and monitoring.

Prevention included the adoption of smaller mining spans between dip-stabilising pillars and the reintroduction of backfill. Better quality extraction sequences and the control of inter-panel leads and lags were implemented.

Protection included the introduction of a more dense, elongate-based support system to improve ground conditions.

Monitoring consisted of the strata control auditing system that ‘closed the loop’ between design and implementation, ensuring better compliance with support standards and layout rules. The system involved up to eight auditors visiting stopes daily to measure support spacing and monitor other potential hazard indicators. This information was entered into a database and supervisors were informed immediately of sub-standard implementation to enable corrective measures to be taken as speedily as possible. Follow-up audits ensured that all hazards were dealt with (AGA 2004).

In 2006 falls of ground accounted for 78% of fatalities in AGA's South African operations. In response to this, a sixth element, dealing with process, was added to the existing five-point strategy. The new initiatives included an emphasis on leading indicators, focus on identifying and mitigating risk before the occurrence of an event, and detailed workplace condition analysis to monitor adherence to standards (AGA 2006).

In 2007 seismic and gravity-related falls of ground were separated to ensure appropriate focus, (AGA 2007). In 2011 the VCR shaft pillar and ore pass development at Tau Tona Mine were abandoned due to a change in the mine plan resulting from safety-related concerns following seismic activity (AGA 2013).

6.2 Other initiatives

AGA had since 2012 installed in-stope hangingwall nets and welded mesh in gullies across all operations in order to reduce fall of ground incidents. Work teams were reluctant to install in-stope netting initially, as it presented an additional workload in a challenging environment, but they were convinced of its benefits during seismic incidents three months after installation when the nets contained falls of ground. However, since introducing in-stope netting, there had been a decrease in accidents (AGA 2012).

The company starting to install in-stope bolts in the hanging wall of the panels where a remarkable improvement in hanging wall conditions was observed. It was also observed that the bolting improved the installation of the hanging wall nets.

Drill rigs, which were controlled from a platform or cab at a distance from the rock face, were used in development ends since 2012 (AGA 2013).

6.3 Horisontal and vertical transport.

In 2004 a competition to motivate safety performance in horisontal and vertical transport was initiated and to create increased awareness. The implementation of a quarterly report on horizontal and vertical transport issues using a causational

model to identify leading indicators as well as a report on lagging indicators increased this awareness even more and was yielding positive results and much interest (AGA 2004).

In 2006 AGA developed a comprehensive strategy to manage safety in horizontal and vertical transport. A number of new initiatives involved improved employee selection, operator training, and equipment monitoring and update. Through various computer-based simulation models, employees would experience a close approximation of the work environment during training, facilitating clear illustration of good and bad safety practices and their consequences. Much was also done in the assessment, upgrading and maintenance of critical winding plant and shaft infrastructure (AGA 2006).

Off-the-shelf technologies were installed on horizontal transport vehicles to take people further away from the risk of injury during transport activities. These technologies included:

- Automatic couplers which enable “hands-free” coupling of hoppers and locomotives;
- Electronic signalling between locomotive drivers and guards, and
- Front-driven trains (AGA 2006).

6.4 AGA Technology Innovation Consortium

AGA established the AGA Technology Innovation Consortium (ATIC) as a vehicle for developing innovative technologies and management processes to improve safety and enhance efficiencies.

The ATIC brought together a number of key players from around the world, all leading innovators in their fields. Tools were developed to enhance communication opportunities between participants, using an open innovation model that brought not only diversity but also speed and a proven track record to the innovation process. Social networking capability supported the collaboration

amongst team members who were working on different continents and unable to meet regularly in person.

AGA believed that it would have a sustainable future by transforming the way mining took place underground. The ATIC demonstrated that, through effective investment in research and development and innovative use of technology, the following could be achieved:

- Unlock future potential, both in terms of production and improve the working environment;
- Removal of people from harm, and
- Skills training and improving capability.

In the longer term, the ATIC was to develop mine designs that used automated equipment in the stopes.

In 2011 as AGA was mining at depths of close to 4000m in some areas, safety would be a major consideration in mining deeper underground and it would require new solutions to the operating challenges. In anticipating these challenges, the group identified two strategic areas of work, technology innovation and the interlinked area of socio-economic development. In taking the first steps towards this 'new mining paradigm', the consortium investigated projects that would enable AGA to mine without blasting, remove people from high-risk tasks, operate continuously, and using technology to drive this change (AGA 2011).

This initiative had a three-stage approach which focused on working towards no drilling and blasting and removing people from the stope over a period of three to five years. This was to be followed by moving to 'intelligent mining' through automation and information communication technology which was anticipated to be a five to 10-year horizon. The ultimate vision was to deliver 'gold on tap' using autonomous machines, with the ultimate goal of 'SAFELY mining all the Gold, Just the Gold, all the time'.

Whilst automation of the mines would address issues of safety and improve productivity and efficiency, this new approach to mining would have a high impact on the employees and on job creation opportunities in the medium-to long-term. It remained a very sensitive issue.

There was also a need to strengthen the socio-economic development strategy to find solutions to the threat that arose from the continued decrease in production nationally. It should also address the potential job losses, which would in all likelihood arise as a result of the transition to a technology-driven model. AGA pursued this issue and the related objectives of compliance with regulatory reporting obligations, strengthening community and stakeholder engagement, and continuing with initiatives aimed at facilitating the creation of employment in the host communities.

In 2013 ATIC continued to develop the technology that would enable AGA to mine safely, all the time, and at greater depths than current operations, through the development of safe and reliable technologies and approaching the mining process as an end-to-end solution (AGA 2013).

Progress included the establishing of a test site at TauTona Mine where the development of the reef-boring application and the inclusion of Ultra-High Strength Back fill (UHSB) were tested to evolve the mechanical mining method into an engineered, end-to-end system. By the end of 2013 18 reef-bored holes were drilled and filled with UHSB. The development of the backfill product and delivery system produced the desired strengths for small scale applications. The reef boring was technically feasible with the development of a suitable drill head for the initial production sites.

The successful development of this UHSB, together with the reef-boring technology, created the potential for changing conventional mining methods to a mechanical reef boring method for the extraction of the gold-bearing reefs. These initial developments would allow AGA to start deploying production units in limited capacities, starting with mining opportunities that were not currently available for mining using conventional practices. The key focus areas were to

speed up drilling rates, to drill holes ever closer together, and to continue developing the UHSB system for larger-scale applications.

In 2014 AGA engaged positively with internal and external stakeholders to co-design solutions for mutual value and embrace innovation in designing solutions for the future. The technological innovation extended to implementing new mining methods to create the potential to extract otherwise sterilised gold reserves from support pillars and enable mining beyond current depths of about 4000m (AGA 2014).

In 2016 AGA did not want to continue to mine with people in the stopes as it could potentially expose an entire crew when there was a seismic event. Longer-term plans were developed to ultimately move people out of the stopes. Progress was made in the first phase of the ATIC projects, which identified and defined opportunities for advanced safety measures in collaboration with proven technology providers, research institutions and entrepreneurs.

The consortium was unique in the partners it involved and how these partnerships were structured for a win-win in the long term for all involved. Consideration was given to how this would affect the current workforce and what was to be done to manage the situation, and work with both unions and employees to discover potential and create future value.

The ATIC demonstrated that the answers would lie beyond the mining industry. It included:

- Knowledge and exploration of the orebody, by means of reverse or circulation drilling;
- The first prototype raise-bore machine (Amtek R2) was used to complete test reef holes using a double-pass technique;
- Surface tests for the reef-boring application, the pump ability and the strength of the ultimate heat sink backfill, were concluded, and

- Planning was in progress to construct a small-scale underground plant within the reef boring test site infrastructure so that underground trials could begin (AGA 2016).

6.5 Production flexibility

In 2007 production flexibility depended on the availability of enough face length. It was to ensure that sufficient working panels were available to allow for adequate equipping and the availability of replacement panels when required. All the South African operations, with the exception of Mponeng, had a reduction in available face length since 2005, which resulted in reduced production flexibility. There was not a quick fix solution available, which would result in available face length (AGA 2007).

Projects commenced at the effected mines to plan for adequate development, which would ultimately in the creation of additional face length. Closer integration with mineral resources management forums was to be pursued.

7 Safety performance

During the decade 2007-2016 105 employees were fatally injured in the AGA South African operations as shown in Figure 4.

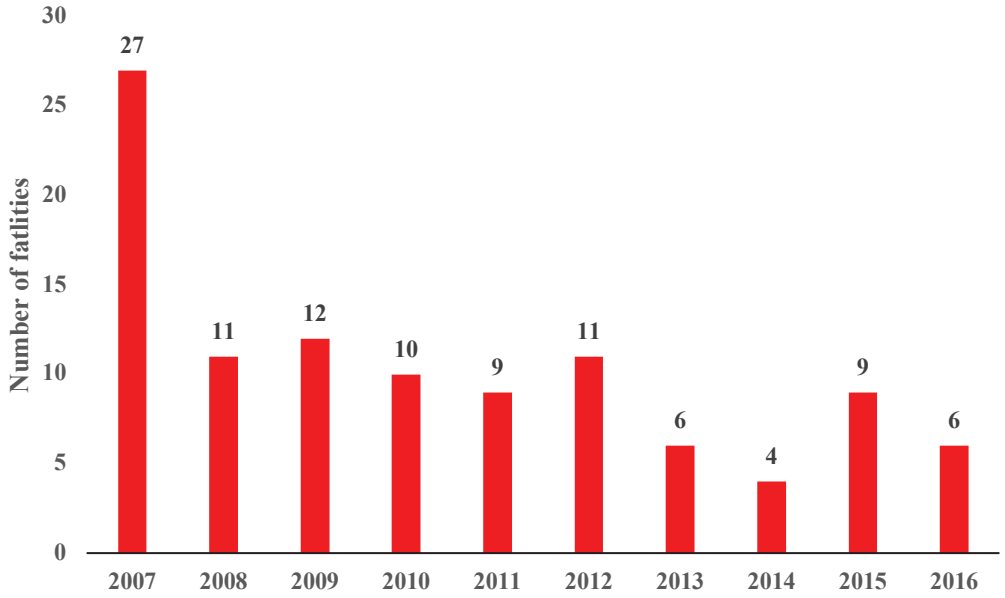
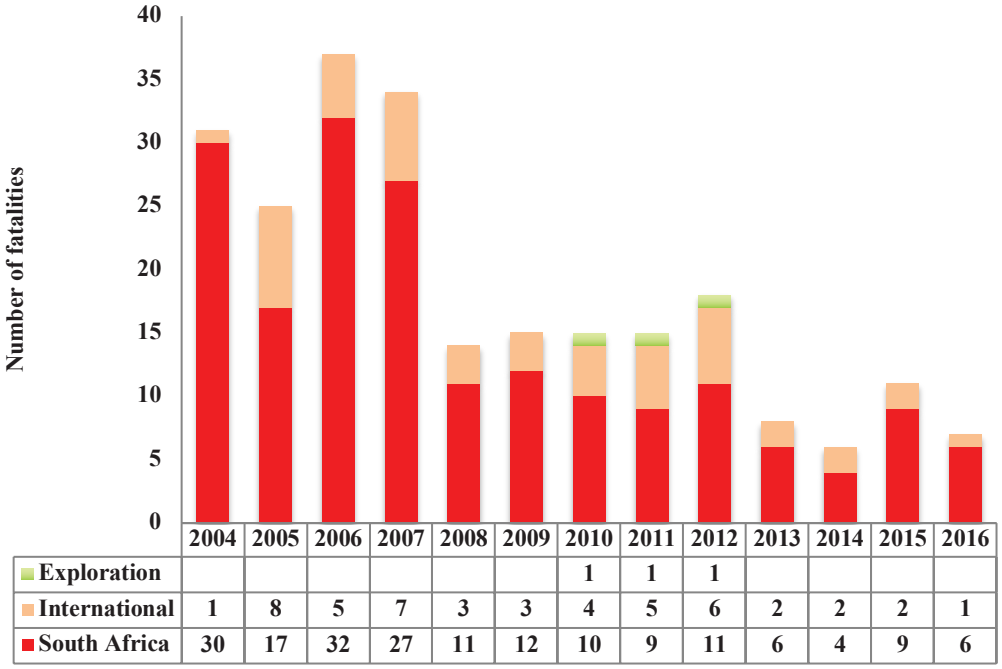


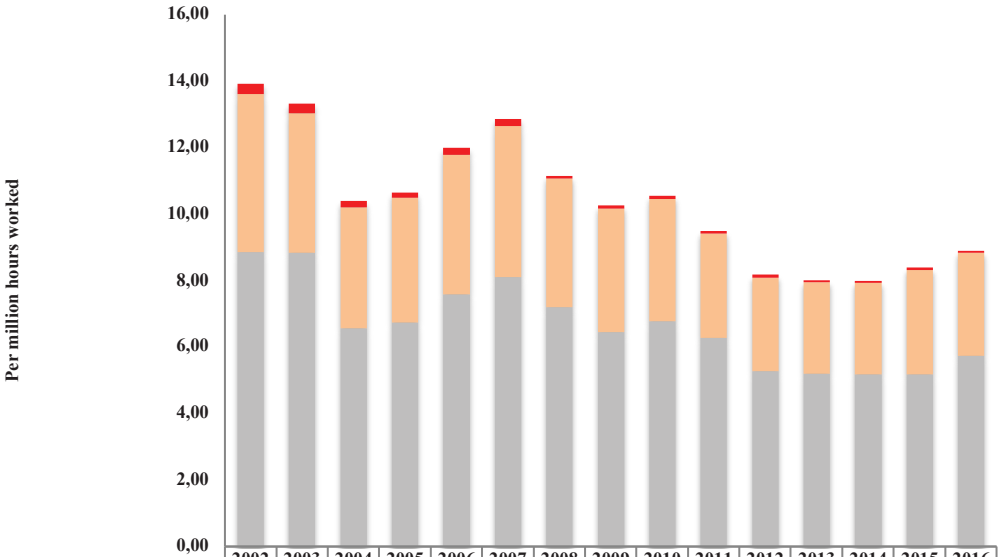
Figure 4 105 Fatalities in AGA South Africa region, 2007-2016 (AGA 2007-2016).

AGA had 32 fatalities in 2006 in the South African region, as shown in Figure 5, which prompted the commencement of a renewed drive to reduce fatalities. During the next 10 years the company and its stakeholders relentlessly pursued the quest for 'Zero Harm', which resulted a reduction of fatalities to 7 in 2016, 6 of which occurred in the South African Operations. Although the target of zero fatalities had not yet been reached there was a significant improvement of 83% between 2006 and 2016. (AGA 2006-2016). 'Zero Harm' was an ongoing journey of continual improvement.



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Exploration							1	1	1				
International	1	8	5	7	3	3	4	5	6	2	2	2	1
South Africa	30	17	32	27	11	12	10	9	11	6	4	9	6

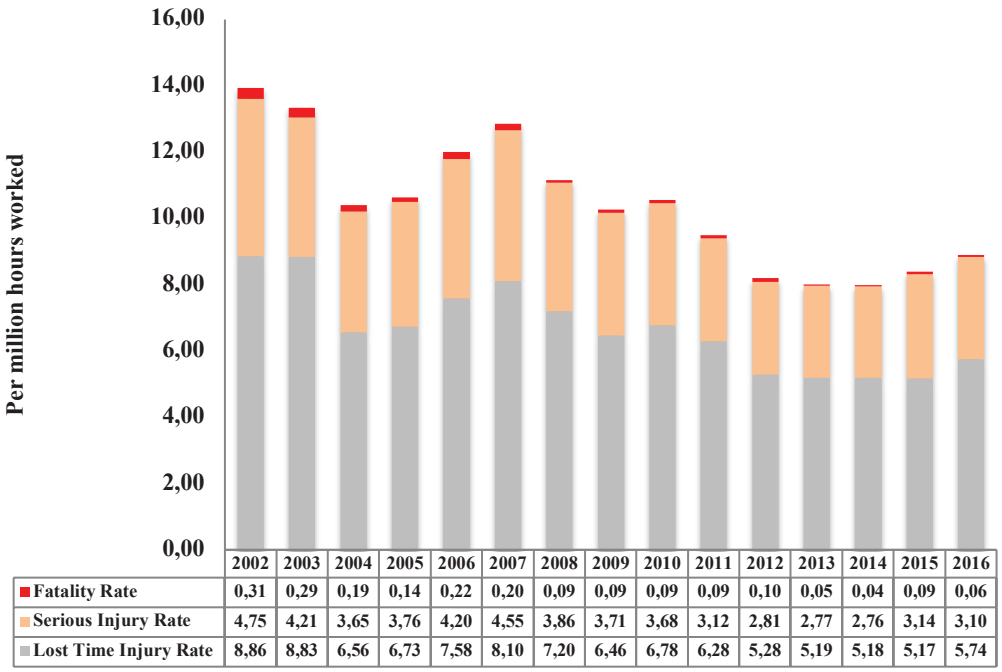
Figure 5 Fatalities per annum, AGA South Africa vs. rest of AGA, 2006-2016 (AGA 2004-2016).



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fatality Rate	0,31	0,29	0,19	0,14	0,22	0,20	0,09	0,09	0,09	0,09	0,10	0,05	0,04	0,09	0,06
Serious Injury Rate	4,75	4,21	3,65	3,76	4,20	4,55	3,86	3,71	3,68	3,12	2,81	2,77	2,76	3,14	3,10
Lost Time Injury Rate	8,86	8,83	6,56	6,73	7,58	8,10	7,20	6,46	6,78	6,28	5,28	5,19	5,18	5,17	5,74

Figure 6 AGA injury rates, 2006-2016 (AGA 2001/2-2016).

The injury rates similarly reduced significantly as shown in Figure 6 over the period 2006/16. The improvement in injury rates reached a plateau since 2012.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fatality Rate	0,31	0,29	0,19	0,14	0,22	0,20	0,09	0,09	0,09	0,09	0,10	0,05	0,04	0,09	0,06
Serious Injury Rate	4,75	4,21	3,65	3,76	4,20	4,55	3,86	3,71	3,68	3,12	2,81	2,77	2,76	3,14	3,10
Lost Time Injury Rate	8,86	8,83	6,56	6,73	7,58	8,10	7,20	6,46	6,78	6,28	5,28	5,19	5,18	5,17	5,74

Figure 7 Injury rates excluding the dressing case rate, 2006 to 2016 (AGA 2001/2-2016).

However, during this period, the dressing case rate improved by about 22 % whereas the lost time injuries rate increased by about 9% as is shown in Figure 6 and 7 while the serious injury rate increased by about 10%. This could mean that either the dressing cases were not reported or that the injuries became more severe.

The severity remained similar since 2006. The average rate was at 302, the lowest of 247 in 2013 and the highest rate of 366 in 2013. However, there has been 17% deterioration in the severity rate from 267 in 2012 to 313 in 2016 as is shown in Figure 8 (AGA 2006-16).

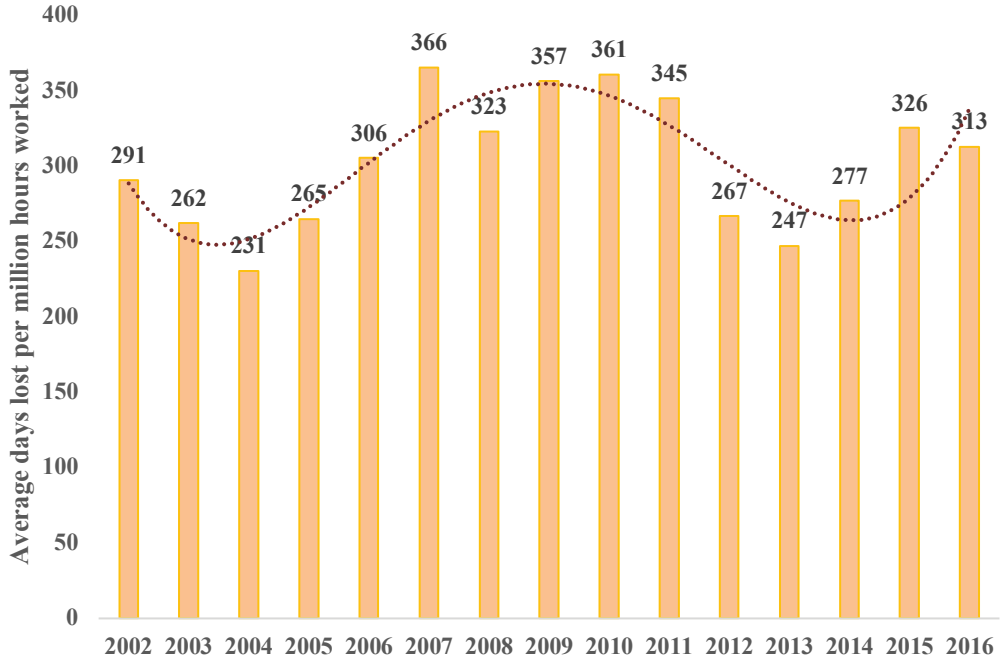


Figure 8 AGA injury severity rate, 2006-2016. (Trend line - polynomial 4th order) (AGA 2006-2016).

8 Summary

AngloGold Ashanti joined the ICMM in 2001 and embarked on behavioural safety initiatives in 2002. In 2004 AGA registered as an organisational stakeholder of the Global Reporting Initiative (GRI) and was committed to reporting in accordance with GRI's principles. A Safety Summit was held in 2004 where five strategic thrusts for the South African safety programme were identified (AGA 2004).

In 2006 AGA was a leading global producer of gold and uranium and had a varied portfolio of surface, open-pit and underground operations (22 in total) in 10 countries (Argentina, Australia, Brazil, Ghana, the Republic of Guinea, Mali, Namibia, South Africa, Tanzania and the USA). AGA remained committed to eliminating accidents at work and was determined to achieve significant improvements in the years ahead.

In 2007 the company renewed its Safety Leadership focus and the principle was adopted that safety comes before production and improved safety would

ultimately lead to productivity improvements as well. In 2008 an extensive safety initiative commenced to ensure that this value was both understood by all and put into practice at all levels within the group.

A Safety Transformation Journey was devised in 2009 which provided a solid theoretic foundation, which was operationalised by the AGA regions, and six Strategic Focus Areas were developed and implemented during 2011. Project ONE was launched as a business change initiative to improve performance levels across all areas of its business operations through consistent management and systems (AGA 2009).

In 2010 AGA rebuilt the business to ensure realising its full potential designed to deliver long-term sustainable value for all its business and social stakeholders.

In 2011 the foundation for continued improvement in safety performance was the ongoing implementation of safety transformation into the operating system. AGA pursued further development of the safety transformation framework, including 22 Global Safety Standards that made up the robust safety management system.

In 2012 technological interventions were in various stages of implementation across the AGA South African region.

In 2013 AGA reiterated that ultra-deep underground conventional mining and the processing of ore had inherent hazards which had to be understood, respected, and effectively managed to eliminate or minimise risk of injury or harm to personnel.

In 2014 data on safety incidents showed that AGA consistently experienced a higher frequency of incidents in South Africa, with the greatest safety risk areas being fall of ground incidents and vertical and horizontal transport.

Strategic Safety Imperatives were developed in 2015 with the aim of further improving group safety maturity on path to zero fatalities and harm from 2016 onwards.

AGA was a strong supporter of robust and constructive safety regulation however, in 2016 AGA elected to challenge a MHSA Section 54 stoppage notice, as it was

believed that the sanction levied by the regulator was disproportionate to the safety threat identified (AGA 2016).

In 2017 AngloGold Ashanti sold most of their deep level mining assets to Harmony and was only left with Mponeng mine in South Africa. It resulted in a significant reduction in risk exposure to mature deep level mining operations.

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Appendix C

The Harmony safety journey between 2007 and 2016 case study.

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1. HARMONY COMPANY BACKGROUND

In 2006 Harmony, a South African gold mining company, acquired in excess of 20 companies and shafts, mostly marginal mines, from 1st tier gold companies. Harmony built up the diverse portfolio in an attempt to achieve critical mass and unlock value. The company was restructured to produce 2.4Moz of gold with approximately 44 000 people (HAR 2006).

In 2016 Harmony had operations in South Africa and in Papua New Guinea and was the third largest gold producer in South Africa and the twelfth largest in the world. Harmony operated nine underground mines, one open-pit mine and several surface operations, which accounted for 93% of total production of 1.08Moz. Harmony employed 30 547 people in total, 25 861 employees and 4 580 contractors in South Africa (HAR 2016).

1.1. SCOPE OF THE CASE STUDY

Only issues affecting the Harmony South African operations, within the context of the global Harmony were addressed in the case study. Significant interventions on occupational health, HIV Aids and other medical conditions affecting the wellness of the workforce were not addressed in this case study. All the information contained in this case study was obtained from Harmony annual reports between 2005 to 2016.

2. EXTERNAL SAFETY ADVOCACY

2.1. INTERNATIONAL COUNCIL ON MINING AND METALS

In 2007 Harmony was accepted as a signatory to the International Council on Mining and Metals (ICMM). The ICMM represented many of the world's leading mining and metals companies as well as regional, national and commodity associations. ICMM members were committed to the responsible production of the minerals and metals society needs (HAR 2007-1).

In 2012 Harmony based their Sustainable Development Framework on the governing principles of the ICMM and expressed it in various Harmony policies and position statements (HAR 2012-1).

2.2. GLOBAL REPORTING INITIATIVE

In 2013 Harmony measured its performances against the guidelines from the Global Reporting Initiative (GRI) and the ICMM Principles (HAR 2013-1).

2.3. UNITED NATIONS GLOBAL COMPACT.

In 2015 Harmony complied voluntarily with the principles of the United Nations Global Compact (HAR 2015).

2.4. DEPARTMENT OF MINERAL RESOURCES

In 2009 Harmony took heed of the greater application of Section 54 stoppages by the Department of Mineral Resources (DMR) for safety violations, which included mine and partial closures (HAR 2009-1).

In 2010/11 the DMR was vigilant in its approach to ensure compliance with safety legislation. According to Harmony the DMR had in some instances, imposed stoppages for minor administrative reasons, which negatively affected production and could have been resolved either immediately or in a short space of time (HAR 2010 - 2011).

Harmony was working closely with the DMR to resolve these issues, so to minimise safety stoppages, and to ensure that all safety standards were adhered to and implemented at all its operations. The South African mining industry firmly supported the government's drive for greater safety and solid progress was made in recent years. It was however, required to find an appropriate balance between stopping operations after a fatal incident or violation of safety standards, and for more minor reasons given that the build-up required to return any mine to full production was twice as long as the actual stoppage. A tripartite team including the government, organised labour and mining sector were investigating the protocol for issuing stoppage notices to determine whether these were being overzealously applied.

Between 2012 and 2015 the DMR imposed Section 54 stoppages which increased significantly to 229 per annum, mainly as a result of the continuous and increased focus by the DMR. No operation was completely stopped as a result of these audits, except for the operations where fatalities and major incidents occurred (HAR 2012-15).

In 2016 the number of Section 54/55 instructions decreased to 182. Harmony increased their engagement with the South African government on policy, often through the Chamber of Mines. This was done, given the importance of public policy and to maintain the licence to operate (HAR 2016).

2.5. CHAMBER OF MINES OF SOUTH AFRICA

In 2011 Harmony was highly influenced by public policy both locally and internationally. The company continuously provided input on public policy development, especially legislative issues that affected or governed the mining industry through the Chamber of Mines (COM) (HAR 2011-1).

In 2012 Harmony's safety initiatives were aligned with the culture transformation framework agreed between industry stakeholders, DMR, COM and organised labour (HAR 2012-1).

In 2014 many mining industry occupational safety and health initiatives were put in place at the operations. Harmony participated as part of a safety community to learn from others and employed the services of an external party to further strengthen the strategy and operational controls. Introduced external best practices were adapted to suit the needs of the operations (HAR 2014).

In 2015 Harmony continued to participate in stakeholder and community forums that seeked to address the challenges that the gold industry faced with community members, employees, government and the COM (HAR 2015).

In 2016 the Chief Executive Officer and executive managers continuously engaged with the greater industry through the COM and various forums/meetings (HAR 2016).

2.5.1. MINING OCCUPATIONAL SAFETY AND HEALTH

In 2011 Harmony was developing an integrated plan for rock-breaking machinery and rolling stock, aligned with the COM Mining Occupational Safety and Health (MOSH) project (HAR 2011-1).

In 2014/15/16 external safety initiatives, or leading practices suggested by MOSH were reviewed and implemented. ‘Champions’ were nominated for each aspect of leading practice for mining industry occupational safety and health leading practice. Each champion had to attend all industry meetings and ensure that all relevant information was disseminated to the operations (HAR 2014-2016).

3. INSTITUTIONALISE 'ZERO HARM' AS A BUSINESS IMPERATIVE

3.1. INTERNAL SAFETY ADVOCACY TO ACHIEVE 'ZERO HARM'

In 2006 no accident was acceptable, and Harmony would continue to aim to improve safety. The company leadership internalised stakeholder expectations by articulating the strategic safety intent of 'Zero Harm' at Board and management level. The Chief Executive Officer gave his personal support to the safety and health programme and would hold managers accountable for safety performance (HAR 2006-1).

The safety performance was not satisfactory during 2006 which undermined the steady improvements that were achieved in recent years. Harmony concluded that no immediate trends were identified responsible for this regression. However, an immediate high-level response was put in place to address safety and health issues, in particular the behavioural aspects related to safety.

In 2007 the provision of safe and healthy workplaces was one of Harmony's key priorities, and the elimination of all workplace injuries was a strategic focus area. The company's target was to achieve zero fatalities and to improve lost-time injury frequency rates by at least 10% per year per individual operation. The safety improvement experienced in 2007 was a result of a concerted effort by management in whom a disciplined approach to safety was instilled (HAR 2007-1).

In 2008 the company reflected extensively on the Elandsrand incident, which occurred on 3 October 2007 when more than 3 000 people were stranded underground following the fall of a compressed air column into the shaft. Not a single person was hurt in this incident. There was an unprecedented level of co-operation amongst management, employees, unions and government in getting people out of the mine as quickly and safely as possible and subsequently, much attention was paid to analysing the cause of the incident. The incident's focus on safety was seen as significant by the mining industry, government, unions and others (HAR 2008-1).

Safety enjoyed priority status and there was no room for complacency. Not a single safety accident was acceptable to Harmony. The provision of safe and healthy workplaces as well as the elimination of all workplace injuries remained a key priority for Harmony. There had been a significant amount of attention dedicated to safety initiatives at Harmony during the year. These initiatives were a key part of the company's restructuring and refocusing initiative, and also part of the broader transformation of the workplace.

The emphasis placed on productivity was inclusive of good safety performance and not an add-on. The commitment to zero fatalities reached to every level of the company with a persistent, deliberate and consistent safety awareness effort. Safety was a priority, every day. It was not something considered only after an incident. It was important to celebrate and learn from all of those days, weeks and months that no incidents were experienced. A significant amount of attention was directed towards safety management, with some positive outcomes being delivered and there was more effective management and control of the operations.

In 2009 the number of fatalities was of great concern and the company continued focus to improve safety. There was an improvement in other safety leading indicators. It was believed that the resultant introspection at the operations, together with the continued application of campaigns, particularly in the area of behavioural change, would deliver further improvements in safety in future (HAR 2009-1).

Employee safety and eliminating fatal accidents was a priority for all senior and operational management. Harmony was confident that mining safely without accidents was possible was committed to achieving this. The commitment to zero fatalities was communicated to employees on a regular basis, at every level of the company, with a persistent, deliberate and consistent safety awareness effort.

Substantial progress was made in continuing to boost the depth of management at the operations, particularly in the technical and engineering disciplines. The management team was restructured to have a formidable executive and

management team who was experienced, empowered, motivated, focused and cohesive. Several leadership appointments were made that included:

- Executive: Risk Management and Engineering;
- Executive: Legal and Compliance;
- Executive: Environmental Management, and
- Four new General Managers.

The leadership team was personally involved in driving the programme to eliminate accidents in the workplaces, through the adoption of and adherence to standards and changing of a mindset at all levels that accidents in deep level underground mining were inevitable. Overcoming these issues required the partnership and co-operation of management, employees and the regulators.

The safety non-negotiable principles were identified and communicated to management and employees alike. The Chief Executive Officer and operational executives played a significant role in setting safety objectives and in developing safety strategies that continue to focus on:

- Management to lead by example;
- Continuous verbal communication with all team members;
- Reward and recognition safety achievements;
- Involvement of all stakeholders;
- Compliance with standards and the auditing thereof;
- Behaviour-based campaigns and initiatives, and
- In situ training, particularly in hazard identification and risk assessment.

In 2010 every fatality was one fatality too many. Harmony remained determined in their efforts to continuously improve safety standards and records, and the target of zero fatalities remained steadfast. Every effort was made to ensure that stringent safety procedures were implemented at all operations and that adherence to these procedures was so ingrained as to become second nature to every employee. Despite the fatalities experienced, there was a glimmer of hope in that

many of the leading safety indicators were moving in the right direction (HAR 2010-1).

Harmony was committed to working safely. Ensuring the safety, health and well-being of the employees was a primary area of focus for Harmony and continued to strive for zero fatalities. Active steps were taken to ensure that the only acceptable production was safe production.

In 2011 Harmony was perceived to be a significantly better company than a few years ago. The progress on safety was a notable highlight of the year. The mining industry made significant progress in improving the safety performance in South Africa as evidenced by a further decline in the industry number of fatalities. In the past decade, fatalities declined by almost 40% despite working at greater operational depths. This commendable progress reflected the commitment of all stakeholders to mine safely. There was a long way to go before reaching the stated goal of an injury-free workplace (HAR 2011-1).

Safety was the main priority no matter what the circumstances were. The ultimate target was to have zero fatalities and to significantly reduce injuries. The safety and health of all employees remained Harmony's foremost priority and the target was an injury-free workplace. Harmony would not rest until it reached the goal of zero fatalities. Each death was one too many. Safe behaviour was required in everything that was done. 'Zero Harm', zero accidents, zero fatalities'.

Given the high-risk nature of many of the deep level operations, the safety, health and well-being of the employees was the foremost priority. Safety was a key performance indicator for management and a key component of performance reward for the employees. The workforce comprised the people whose skills underpinned the success of every operation and the sustainability as an industry. The sustainability of the company and the mining sector as a whole depended on the skills and expertise of the workforce.

An experienced Executive was appointed to spearhead the safety strategy, using an analytical approach to address critical issues.

In 2012 Harmony believed that ‘Zero Harm’ was possible, and that mining could take place without accidents and occupational illnesses as proved by individual sections and even whole operations. Harmony could be one of the safest mining companies globally and the challenge was to transform the mindset of every employee into believing the same. In the short term it was believed that Harmony’s safety performance could be improved by 50%. The most common risk in the work environment was rocks, moving machines, dust and noise (HAR 2012-1).

Ever changing underground conditions were caused by the dynamic nature of mining processes and the rock mass surrounding the workplace. The way these risks were managed associated with these changes often determined the outcome from a health and safety point of view. Accidents mostly happen when something unexpected happened. Changes cannot be prevented from happening, but it can be managed by assessing the associated risks and possible consequences. This would enable proactive actions to be instituted to prevent or mitigate these risks.

In 2013 Harmony was committed to global best practices in relation to sustainable development. The safety and health of all the employees, as well as the protection and conservation of the environment and the commitment to benefit all stakeholders was an integral part of the company’s culture in the way mines operated. Safety and health was a moral obligation and it contributed to the bottom line by improving productivity and creating a sustainable business for all shareholders, including employees. Harmony’s aim was to eliminate all work-related injuries and illness and safety was a priority (HAR 2013-1).

The lost-time injury and fatality frequency rates were around 50% lower than five years ago which reflected a disciplined, proactive approach and a group-wide commitment to safety, which remained the most important corporate value. The focused effort was a direct result of a company-wide safety initiative planned and implemented over recent years to improve safety.

In 2014 safety remained a central priority for Harmony and continued to be dedicated to mining safely and improving the lost-time injuries. The number of

fatalities at the operations reduced significantly over the past 10 years. However, 22 employees lost their lives at the operations during the year, including nine people at Doornkop in February 2014 in which nine men lost their lives attempting to flee an underground fire and associated falls of ground.This tragedy had a devastating impact on the company.

Management focused on the prevention a similar incident in the future. Post the Doornkop incident all operations were suspended for a period of 24 hours to refocus the attention of each and every Harmony manager and employee on safety. The entire management team undertook site visits, inspections and training on the ground. A significant improvement in safety awareness and attitude was observed subsequently (HAR 2014).

In 2015 the most positive development was that there were no fatalities at the operations during the second quarter. The safety record for the year as a whole in terms of fatalities was the best in more than a decade. Harmony's safety performance improved during the year and the company continued to strengthen the resolve to make mines accident free. Harmony remained committed to zero fatalities and the aim was to eliminate all work-related injuries and illnesses. The safety and health of everyone was the primary concern and the efforts to address and consistently improve safety standards were on-going.

The most important aspects of the internal environment remained the safety and well-being of the employees, and the integrity and sustainability of the assets. The internal environment was shaped largely by factors which affect the employees or on which the employees had an impact. The environment and mining processes, combined with the behaviour of people, brought with it certain risks to the employees (HAR 2015).

In 2016 the safety and health of all employees was the primary concern and the objective remained that the people were able to work without any harm to their safety or to their health (HAR 2016).

3.2. SUSTAINABILITY FRAMEWORK TO ACHIEVE 'ZERO HARM'

In 2011 the cooperative health and safety management framework was guided by the occupational health and safety policy. It involved the active participation of management, unions and DMR representatives at all levels, and was aligned with the Mine Health and Safety Act of 1996.

In 2012 Harmony reviewed the sustainable development framework and set targets for the short, medium and long term to 2018 (HAR 2012-1). This framework fully considered the myriad of challenges faced by a global mining company in the 21st century, including:

- Reducing fatalities and internalising the required behavioural changes to adhere to good safety practice;
- Meeting community needs and expectations within the broader socio-political landscape;
- Increasingly stringent legislation, and
- The impact on business of implementing carbon balances and carbon taxes.

Harmony's governance framework for responsible mining to contribute to sustainability was based on global principles, as shown in Figure 1. The focus was on ensuring that Harmony made a positive contribution to the greater well-being of society and remained a responsible steward of the environment in which it operated (HAR 2011-1).

In 2014 Harmony's aim was to eliminate all work-related injuries and illnesses. It was guided by the occupational health and safety policy, which was developed over the years and was based on leading safety practices, at all the operations. The inclusive and co-operative health and safety management framework involved the active participation of management, unions and the government (HAR 2014).

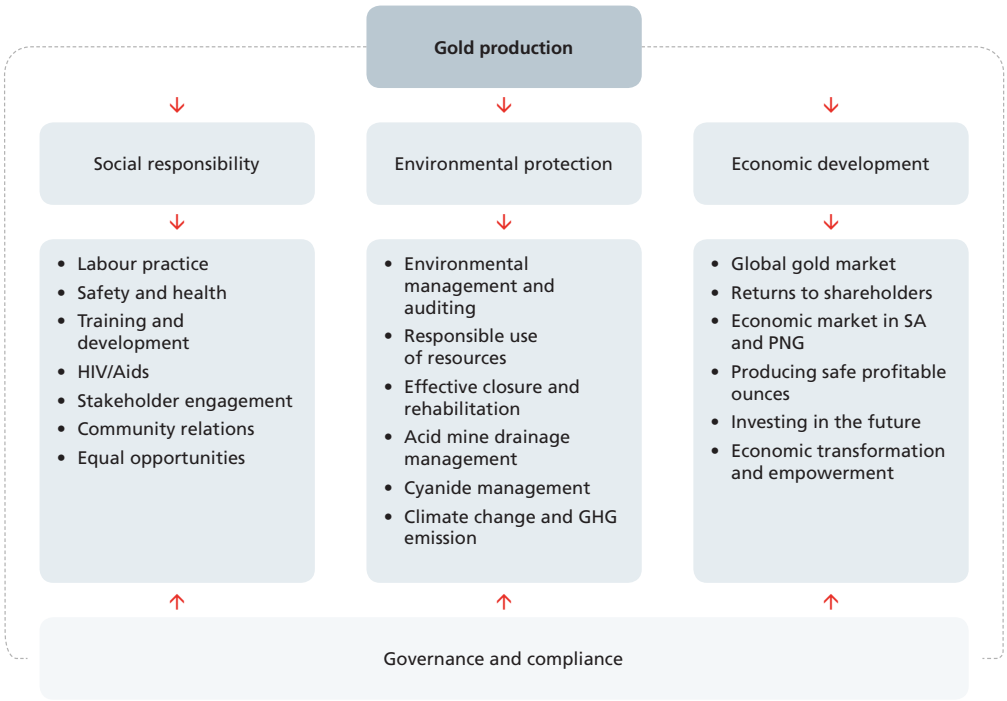


Figure 1 Harmony's sustainability framework (HAR 2014).

Delivering long-term value was a process of interlocking elements, which included financial and non-financial aspects. Harmony acknowledged that while corporate citizenship was a moral responsibility, this duty rested on the link between profitability and sustainable development. The company strived to balance economic development with environmental protection and social responsibility within a robust governance framework in order to secure Harmony's future for the benefit of all stakeholders. The framework included aspects such as:

- Value creation;
- Skills development;
- Education and training;
- Economic upliftment;
- Job creation;
- Poverty alleviation;
- Corporate social investment;

Appendix C: Harmony

- Local economic development;
- Social and economic transformation, and
- Infrastructure development.

3.3. GOVERNANCE

In 2008 Harmony had seven board sub-committees to enable the board to properly discharge its responsibilities and duties, certain responsibilities of the board were delegated to the committees including the Audit Committee; Empowerment Committee; Investment Committee; Nomination Committee; Remuneration Committee; Sustainable Development Committee and the Technical Committee (HAR 2008-1).

3.3.1. SUSTAINABLE DEVELOPMENT COMMITTEE

In 2006 the Sustainable Development Committee (SDC) of the Board was responsible for supporting, advising and providing guidance to management on issues pertaining to sustainable development, particularly health and safety, HIV/Aids, social investment and environmental management (HAR 2006-1).

Three non-executive directors made up the SDC which committee met on a quarterly basis. The objective of the SDC was to assist the Board in ensuring that the company remained socially responsible. The committee's role was to:

- Guide management in developing the framework, policies and guidelines for safety, health, social investment, HIV/Aids and environmental management;
- Review the policies and performance in respect of sustainable development of the company, its divisions and its managed subsidiaries, and the progressive implementation of its policies;
- Monitor key indicators on accidents and incidents and, where appropriate, ensure that they were communicated to other companies managed by or associated with the company;
- Consider material national and international regulatory and technical developments in the fields of safety, health, social, HIV/Aids and environmental management, and

- Support management's facilitated participation, co-operation and consultation on safety, health, social, HIV/Aids and environmental matters with government, industry, national and international organisations and institutions.

In 2008 the SDC had specific oversight of the company's strategy and performance in respect of sustainable development. The SDC provided oversight of safety performance and high-level setting of targets. The Chief Executive Officer and members of the Executive Management Committee were invited to attend all meetings (HAR 2008-1).

3.3.2. SOCIAL AND ETHICS COMMITTEE

In 2011 the SDC was reconstituted and renamed as the Social and Ethics Committee. Some new appointments were made resulting in the new committee comprise of six non-executive directors, five of whom were independent. The Chief Executive Officer and executive managers were invited to attend all meetings (HAR 2011-1).

Harmony's commitment to sustainable development was real and increasingly measurable because it was understood that corporate citizenship went beyond securing a social licence to operate as it was a moral responsibility**.**

In 2012 the Social and Ethics Committee of the Board oversaw policy and strategies on:

- Safety;
- Occupational health;
- Environmental management;
- Employee health and well-being;
- Corporate social responsibility, and
- Human resources and ethics (HAR 2012-1).

Responsibility for implementing these policies vested with the management team and specific executives for each discipline. Discipline-specific policies were

supported by a series of guidelines and the standards underpinned the development of site-specific management systems.

In 2013 sustainable development practices were embedded in the business strategy, reflecting the belief that corporate citizenship was both a moral responsibility and a condition of the mining licenses. This duty rested on the link between profitability and sustainability. Sustainable development was woven into the way business was done, infusing the organisational practices. The leadership approach and business processes to embed these in the culture and values of Harmony included ISO systems, group standards for environment and safety, and common procedures and definitions (HAR 2013-1).

In 2014 sustainability was the crux of Harmony's objective to leave lasting legacies for employees, host communities and for the country. The committee assisted the Board in ensuring that Harmony remained a committed, responsible corporate citizen that created lasting value for its stakeholders.

The committee oversaw the company's policies and activities in social and economic development, in partnership with the many teams who worked with and within Harmony. The management teams were responsible for the safety, health, social investment and environmental portfolios. Safety remained a critical concern for the committee and invested considerable time in learning from the Doornkop incident (HAR 2014).

In 2015 it was decided that the Public Safety would be monitored and the Social and Ethics Committee would receive and review quarterly reports on public safety from management (HAR 2015).

3.3.3. ENTERPRISE RISK MANAGEMENT COMMITTEE

In 2005 an Enterprise Risk Management Committee was established that reported their findings to the Audit Committee. The committee consists of the financial director, the chief risk officer, the company secretary, the group engineer and the treasurer who was responsible for insurance. The committee met quarterly to

discuss the various risks detected by the risk registers and. Action plans were developed and prioritised to minimise the risks in Harmony to an acceptable level.

Effective risk management was imperative to an organisation with Harmony's risk profile. The realisation of the company's business strategy depended on it being able to take calculated risks in a way that did not jeopardise the direct interests of stakeholders. Sound management of risk through Harmony's Enterprise Risk Management System enabled the company to anticipate and respond to changes in the business environment, as well as taking informed decisions in conditions of uncertainty.

Risk registers were rolled out at most of the operations, making it easier for the identification of the various risks and opportunities within Harmony. The risk management was included as an agenda item for management meetings (HAR 2005).

In 2006 it was Harmony's policy to manage all categories of risk associated with its business operations through the development and maintenance of a formal Risk Policy Framework that was aligned to the principles of the King II Report.

Harmony recognised that risk in business was a complex and diverse concept, and that there were many parts of the organisation working at managing risk exposures. These parts worked together in a consistent and integrated manner with the overall objective of reducing risk as far as was reasonably practicable.

Different risk-related or assurance-provider functions aligned the various goals and reporting processes into one cohesive and structured framework. All of the organisation's business, financial, technological, legal and operational risk exposures, whether they were insurable or not, were identified, assessed and appropriately managed.

Harmony's risk strategy considered various risk functions as it determined aspects such as risk tolerance limits and capital allocation processes. All risk management efforts were focused on supporting the group's business objectives. It ensured compliance with relevant legislation, and fulfilled the expectations of employees,

communities, shareholders and other stakeholders in terms of corporate governance (HAR 2006).

In 2007 the Board Audit committee, in conjunction with the Risk Management Committee facilitated risk assessments to determine the material risks to which the company may be exposed and to evaluate the strategy for managing those risks. It used the risk management strategy to prioritise and direct the audit effort and to determine the skills required to manage these risks.

Due to the nature of mining and the type of gold mines it operated, Harmony faced a material risk of liability, delays and increased cash costs of production from environmental and industrial accidents and pollution. Gold mining involved significant risks and hazards, including environmental hazards and industrial accidents (HAR 2007). The hazards associated with underground mining included:

- Rockbursts;
- Seismic events;
- Underground fires;
- Cave-ins or falls of ground;
- Discharges of gases and toxic chemicals;
- Release of radioactive hazards;
- Flooding;
- Accidents, and
- Other conditions resulting from drilling, blasting and the removal and processing of material from a deep-level mine.

In 2014 the risk management process was guided by the requirements of various regulations and legislation and was championed internally by the Chief Executive Officer. The Audit and Risk Committee played an oversight role, while management was responsible for implementation and compliance.

The risk management process was built to accommodate engagement, from conversations between management and the Board regarding risk to discussions

with various stakeholders to ensure that the right risks were addressed. It identified risks and opportunities, which were benchmarked against peers to ensure that the risks also covered industry challenges. The Executive Committee and the audit risk committee examined the risks and discussed any changes in their importance or mitigation for formal reporting to the Board, on a quarterly basis.

The input was based on experiences at operations feedback from key stakeholders. external factors and management meetings. Various teams within the company addressed risk on a regular basis in the day-to-day roles. This created a constant conversation about risk at different levels, allowing any changes to be captured on an on-going basis (HAR 2014).

3.3.4. TECHNICAL COMMITTEE

In 2008 the Technical Committee was formed to provide a platform for the Chief Executive Officer to discuss the company's strategy, its performance against targets, its operational results and projects. The committee comprised of three independent, non-executive directors. The chairman was not independent, but it was appointed due to his vast knowledge of the company's assets and his years of mining experience. The Chief Executive Officer and Executive Managers were all invited to attend meetings (HAR 2008-1).

The Technical Committee kept the Board informed of the developments, progress and challenges facing the company's operations. It had the following duties:

- Strategic plans were considered by the Technical Committee and recommended for approval to the Investment Committee and the Board;
- Provided guidance and support to management to ensure that the company remained sustainable and successful;
- Reviewed the performance of the company and the Chief Executive Officer;
- Reviewed the company's performance targets and its projects on an annual basis, and

- Reported to the Board on the developments, progress and challenges facing the company's operations on a quarterly basis.

In 2011 the Board oversight of safety was moved from the Social and Ethics Committee into the Technical Committee (HAR 2011-1).

In 2013 the Technical Committee as well as the Social and Ethics Committee monitored safety progress against targets (HAR 2013-1).

In 2016 the Technical Committee monitored operational and safety specific risks and interrogated the company's continued efforts to improve employee safety. It was also responsible for approving and monitoring compliance with the safety and health policy. The Technical Committee fully informed the Social and Ethics Committee regarding policy interventions underpinning the safety strategy was comfortable that this robust strategy would continue to deliver the expected improvements in safety across the group (HAR 2016).

3.3.5. AUDIT AND RISK COMMITTEE

In 2014 risk was a standard item on the agenda of the Audit and Risk Committee who was responsible to oversee the identification, prioritisation, management and monitoring of risk at Harmony. The committee reviewed the risk management policy and process, methodology and planning, formal risk assessment, internal controls, assurance process, risk appetite, tolerance, and responses to risks.

The risk management process was integrated and was reflected as such in its approach to business. The committee considered all risks affecting the strategy, however, it was the responsibility of the executive management and their teams to ensure that controls were constantly applied in the day-to-day management actions. The Audit and Risk Committee took its findings from these reviews to the Board where the top ten risks and mitigating factors were reported on a quarterly basis (HAR 2014).

In 2016 the Executive Committee and the Audit and Risk Committee met quarterly to examine the risks and discussed any changes in their relative

importance or in their mitigation. The Audit and Risk Committee's review was supplemented by feedback from the various Board sub-committees and reviews of specific risks falling within the ambit of their responsibilities. Each quarterly examination was based on experiences at the operations, feedback from key stakeholders, external factors and management meetings. Their reports were submitted to the Board of Harmony (HAR 2016).

3.4. SAFETY STRATEGY

In 2007 a new safety strategy and philosophy was communicated and implemented and in future focus was to be on continued emphasis on safety, with aim of achieving 'Zero Harm'. The **'Back to Basics'** approach and focus on disciplined mining should have management and the workforce concentrating on reversing the downward trend in the production and the upward trend in costs. Harmony was aware that good management and intensive cost controls would enhance the company's prospects. Productivity improvements were expected from each and every employee throughout the company. It was important to align the company objectives with those of the employees, particularly middle management (HAR 2007-1).

In August 2007 Harmony embarked upon a three-phase, three-component strategy to 2012 and beyond. The first phase of the strategy aimed to stabilise the company and its operations. The stabilisation phase was implemented over a five-month period which included the focused implementation of the first component 'Back-to-Basics.' It continued into the early months of the second 18-month Recovery Phase. The Back-to-Basics component of Harmony's strategy was designed to stabilise and kick-start recovery, comprised four primary objectives, which included disciplined mining, cost control, ore reserve management and efficiency (HAR 2007-1). The drivers of 'Back-to-Basics' included:

- Non-negotiable safety;
- Operation-specific, target-directed plans, 'owned' by focused management teams;
- Accurate ore reserve management;

- Accelerated development;
- Operational consistency;
- Cost control;
- Increased productivity, and
- Proactive maintenance.

The commitment to 'Zero Harm' initiated at top management, filtered to every level through a deliberate and programmed effort. The company embarked on comprehensive safety auditing. Agreement was reached on key non-negotiable principles, which included:

- Management leading by example;
- Continuous verbal communication with all team members;
- Visible creation of awareness of safety related issues;
- Recognition of and rewarding for safety achievements, and
- Involving all stakeholders.

Management focused on improving the underground conditions, in particular in areas deemed to be of the highest potential risk such as the shaft infrastructure and the underground workplaces. Management teams were empowered and established small, multi-disciplinary, focused teams for planning and implementing improvements at the operations. Each management team developed an operational plan to attain the set goals. The Executive Committee did regular review of results focused on maximising productivity by structuring of operations so that 60% of the workforce was directly engaged in production mining.

The Back-to-Basics component, which lasted until the end of 2009 became a guiding philosophy for the overall strategy. As Back-to-Basics was bedded down and began to deliver the desired results, the second component of the strategy, known as Organic Growth, was launched.

A +36-month Growth Phase as shown in Figure 2 was planned to extend to June 2012 and beyond. Harmony's organic growth strategy focused on extracting high-quality ounces by developing and operating the company's long-life mines.

As the Organic Growth component of the strategy bedded down and delivered results, the third and final Organic/Acquisition component would be initiated.

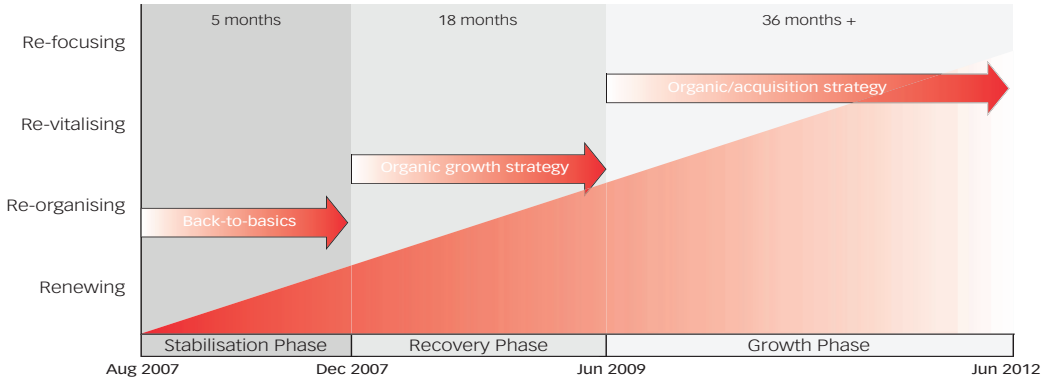


Figure 2 The three-phase, three-component strategy (HAR 2007).

In 2008 the group experienced significant change with the focus on going 'Back to Basics' and in 2009 Harmony started to reap the rewards of the first, 'back-to-basics' component of the strategy. Internal and external benchmarking were bedded down and was starting to deliver on expectations (HAR 2008).

The three-phase, three-component strategy served Harmony in good stead. This was particularly encouraging, considering the changes beyond the company's influence that continued to take place in the South African mining sector and the national and global economies.

3.5. THE NEW HARMONY

In August 2010 the New Harmony strategy was unveiled. Harmony's plans were clear and had confidence that targets would be achieved regarding improving productivity, commissioning projects, increasing production, and undertaking successful exploration (HAR 2010).

Each shaft had its own business plan in place, designed in accordance with its own specific requirements. Together they provided a firm handle on the business, with the ability to address and pro-actively overcome challenges that may arise.

The Harmony Executives and management teams held a Health and Safety Strategic workshop with employee participation. Various safety aspects were identified which were to be implemented in 2011 which included:

- Fall of ground prevention;
- Trucks and tramming;
- Occupational health and hygiene;
- Metallurgical plants, and
- Environmental management/occupational health and safety management systems (HAR 2011-1).

Safety management and performance targets were set in compliance with Harmony's 2013 safety milestones and were included in the performance parameters at each operation.

In 2011 the company continued with the identified specific safety aspects for implementation and aimed for systemic improvement that would blend behaviour based metrics with operational controls. The elimination of accidents could be achieved by managing risk and ensuring appropriate structures, systems and training were in place. Lessons learned were shared throughout the company (HAR 2011-1).

The approach to safety was comprehensive and included training, auditing, communication, specific management interventions and programmes, and ongoing campaigns. Harmony perceived that implementing world-class safety systems/standards was a straightforward task and that safety was more about attitude than equipment. It was the company's view that investigations proved the impact of a casual error on the most sophisticated systems. Managers were required to remain responsible for minimising human error by ensuring people were well trained, in good health and working in environments conducive to safe practices as safety was about attitudes and mindsets.

Harmony renewed the focus on implementing, communicating and reinforcing safety in the workplace and on transforming the values-based safety approach

from being reactive to proactive. A leading global risk management solutions provider on safety, health, environment and quality conducted a number of audits to establish the reasons behind in view of the notable safety improvements made recently and the increased focus on safety. A project plan was developed to rectify identified shortcomings and move the company from a reactive to a proactive approach. It was believed that safety in the workplace could be addressed only through a cooperative approach that ensured the right infrastructure was in place.

In 2012 the 'New Harmony' values and would guide the performance in future and the company was well-positioned to deliver on its strategy of creating a global gold mining and exploration company (HAR 2011). This included:

- Leading in safety, health and our environmental responsibilities;
- Making a meaningful contribution to a sustainable society;
- Operational excellence;
- Committed workforce;
- Investing in people through education, training and community upliftment;
- Living the values;
- Company-changing exploration;
- Building world-class mines;
- Growing relationships, leadership, gold production, reserves and profits, and
- Committed to measure up and deliver.

Harmony concentrated on embedding sustainable development practices in the business strategy, understanding that corporate citizenship was both a moral responsibility and a condition of mining licenses. This duty rested on the link between profitability and sustainability which was integrated into organisational business processes and practices as part of the way business was conducted. The Harmony leadership approach embedded the culture and values through management systems, which included group standards for safety, standardized processes and definitions. The cornerstone of Harmony's global expansion was integrating sustainable development into the business strategy, and good practice

into the operating standards. The marketplace measured Harmony against robust world-class standards.

Harmony recorded notable successes in recent years in realising the vision of ‘Zero Harm’ to people and the environment while enabling and empowering the societies within which operations were conducted and guided by the sustainable development vision. The safety strategic approach was that production lost would not be recovered at the expense of safety. The eliminating of accidents by managing risk and ensuring the appropriate structures, systems and training were in place. It was a priority for Harmony to provide safe and healthy workplaces, and to focus on the eliminating of workplace injuries and work-related ill health.

The company objective was to eliminate all work-related injuries and illness. This vision was to be achieved by means of a safety strategy that included behavioural aspects, competency training and development as well as research and new technologies. It was believed that safety in the workplace could only be addressed through a cooperative approach that ensured that the right infrastructure was in place, systems and planning as well as communication and training.

Management and employees accepted joint responsibility for their actions. It was therefore imperative that the working environment empowered people, management, supervisors, workers and union representatives to stop work and withdraw from the mining area when they felt unsafe or prevent others from acting in an unsafe way.

Each operation was monitored monthly using a formal review system, while major safety issues were reviewed annually during the health and safety workshop. Harmony adopted a journey mode, as shown in Figure 3, as part of the long-term strategy to achieve 'Zero Harm'. The objective was to improve Harmony's health and safety management systems to a fully proactive level of maturity through the revised approach to safety.

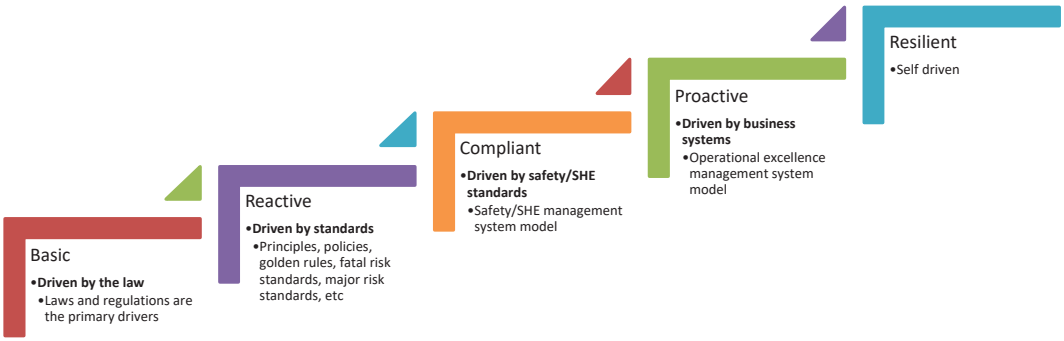


Figure 3 'Zero Harm' journey model (HAR 2011-1).

The company ensured that management led by example and created the enabling environment for driving continuous improvement. High safety exposures were managed through focused strategies, including fall-of-ground, and trucks and tramming activities. A behavioural shift was affected to make safety foremost among the people, both on and off the job.

In 2013 Harmony instituted a focused and multifaceted drive to catapult Harmony from a reactive to proactive approach by improving the safety culture across all operations (HAR 2013-1). Elements of this approach included:

- High-level internal health and safety reviews;
- Adopting leading health and safety practices;
- Improving the Harmony safety risk management system;
- Integrating proactive key performance measures in incentive schemes;
- Continuously improving standards and procedures;
- Implementation of e-learning to improve safety-related training;
- Harmony culture alignment programme was implemented, and

- Integrating safety management standards and safety culture initiatives to function as a single strategy.

The results of a significant change in this approach towards safety were evident however, there was still some way to go in closing the gap between the safety performance, the 2013 industry milestones and the goal of ‘Zero Harm’.

In 2013 Harmony’s improved safety performance reflected both the effectiveness of the revised approach and commitment to achieving the safety goals. It was believed that focusing on leading indicators would result in a better safety environment supporting the policy of ‘Zero Harm’. Safety was about attitudes and mindsets and the focus was on implementing, communicating and reinforcing safety in the workplace (HAR 2013-1).

In 2014 Harmony lived its values and it guided actions to ensure the achievements of the strategic goals. The values were ingrained in training initiatives and decision-making processes, ensuring that they were at the forefront of employees’ minds and actions. The values extended beyond Harmony’s gates as it guided interaction with external stakeholders, from shareholders and the media to local communities and those from which the employees were drawn. It was expected that through a commitment to the values Harmony could be a company which people wanted to be associated with and would generate shared values into the future (HAR 2014).

Harmony understood that long-term value was about more than the gold produced and the profits made. These were fundamental to the ability to create value in the broadest sense, but the value was better reflected in the impact that was made on the lives of people, then and in the future.

Safety was viewed as an opportunity to engage with many key stakeholders, particularly the employees and to entrench values. It was integral to the sustainability of the business and featured in Harmony’s values, material issues and the strategy. Additionally, it helped foster relationship with employees, maintain stable production and retain the licence to operate.

It was appreciated that deep level mining brought with it inherent safety risks and therefore safety was prioritised primarily to protect the employees. Safety had an effect on the employees' mindsets, productivity and it also had the potential to impact the reputation, stop production, lead to litigation and decrease the overall value of Harmony.

In 2014 Harmony made great strides in safety during previous years but there was always more to do. A number of 'daily' adjustments were made to improve safety performance at the mines (HAR 2014). These included:

- Regular underground visits by the executive management;
- Clearly defining leading safety practices at all operations;
- Holding regular safety meetings at all levels;
- Increasing safety messaging and training, and
- Doing a baseline risk assessment.

The people were the cornerstone of the business, making their safety central to what was done, was one of the company values work towards 'Zero Harm' was to be continued. Harmony was seeking the most effective ways of keeping the employees safe at work and was in the process of embedding proactive management with a particular focus on empowering the leaders to speak of safety as the first priority at Harmony.

External professionals reviewed the Harmony Health and Safety strategy to ensure it was on the right track. Harmony's strategy was to be a globally competitive gold mining company that delivered true long-term benefits to a broad range of stakeholders. A continuous improvement in safety and health was a primary overriding imperative, and crucial to the ability to care for people and optimise the operations. It was important for the company to have experienced, skilled teams who lived the values and maintained stakeholder relationships in order to achieve maintain a sustainable company.

The internal environment was shaped largely by factors which had an impact on the employees or on which the employees had an impact. These included the

environment, processes of mining, and the behaviour of people, brought with it certain risks to the employees, which was to be avoided, mitigated or managed. Although Harmony achieved significant safety improvements the company remained committed to further improvement in keeping the employees safe and healthy. Emphasis on open communication allowed Harmony to understand any emerging issues and to deal with it before it escalated (HAR 2015).

In 2015 Sustainable Development was woven into the way business was done at Harmony. The company worked to leave lasting legacies, tangible impacts that extend beyond the lives of the mines and that were aligned with the legitimate expectations of the stakeholders (HAR 2015).

Harmony lived its values, which were safety, being accountable, achievement and being connected and honest. These were the compass points for actions, ensuring that, in addition to achieving the strategic goals, Harmony aimed to make the right decisions and support the members of the teams in doing so. These values were ingrained in the training initiatives and decision-making processes, ensuring that it was at the front of employees' minds and actions. The values extended beyond the operations' gates. It guided interactions with external stakeholders, from shareholders and the media to local communities and those from which employees were drawn. It was hoped that through a commitment to these values, Harmony could build a company with which people wanted to be associated with, and which would generate shared value into the future.

The long-term value was more than the gold produced and the profits made. These were fundamental to the ability to create value in the broadest sense, but Harmony's worth was better reflected in the impact it had on the lives of people, then and into the future.

The safety strategy was divided into short, medium and long-term components. The short-term strategy comprised visible felt leadership, communication and report reviews. The medium-term strategy involved the implementation of the fatal risk management system, whereas the long-term strategy focused on industry leading practices, which included:

- Separating the employee from the risk or hazard through more extensive barrier controls;
- Focusing on embedding a safety-conscious culture;
- Ensuring that people were committed to the values, and
- Sharing of information and the adoption of best proven pro-active safety measures.

In 2016 Harmony intensified the focus on safety through the appointment of a Chief Operations Officer, a former Regional General Manager, with specific responsibility for, among other aspects, safety who would:

- Refine the safety strategy to institutionalise risk management;
- Promote a culture of continuous improvement;
- Create genuine care for safety whilst providing safety leadership;
- Visit different mining houses and companies to investigate best practice in safety and health strategies and structures, and
- Be responsible for adopting and implementing world best practice in safety and health strategies (HAR 2016).

Senior engineering capacity and safety management were enhanced in order to combat and prevent infrastructure and equipment failures.

4. SYSTEMISE ACTIVITIES REQUIRED TO ACHIEVE 'ZERO HARM'

4.1. SAFETY AND HEALTH MANAGEMENT SYSTEM

In 2008 the implementation of the OHSAS 18001 Occupational Health and Safety Management Standard was progressing well and was planned to have the full implementation by 2010 (HAR 2008-1). All occupational hygienists were trained under the OHSAS 18001 standard as 'Accredited Lead Auditors'.

In 2010 the implementation OHSAS 18001 standard was postponed to 2011. A gap analysis commenced to determine whether it could be implemented on an integrated basis (HAR 2010-1).

In 2011 a number of operations were certified to integrated OHSAS 18000/ISO 14001 and ISO 9000 standards. Good progress was made in installing standardised systems to accurately monitor and measure a number of performance indicators, including safety to global best practice levels (HAR 2011-1).

The occupational health and safety management system was reviewed and improved to meet international best practice in parallel with the improvement of the safety behaviour and culture of Harmony employees. The modules for occupational health and radiation were in place, while scoping was under way for safety, health and environmental management modules. The individual health and safety committees were consulted to ensure their full cooperation.

A high-level audit team consisting of internal mining and safety experts was established to verify physical conditions in fatal risk areas at Harmony's operations. Additionally, the team was required to assess the effectiveness of management systems used to ensure the safety of workers at these areas and the level of implementation of strategic health and safety programmes and standards at all operations. Nine operations received total scores above 80%, and five received three or four-star ratings by international standards. Common critical shortcomings in safety management identified during the audit were:

- Quality of issue-based and continuous risk assessments;

- Managing change;
- Technical planning in terms of risk;
- Managing close-out actions, and
- Leadership controls.

Following the review, an improved safety framework for Harmony was developed aligned to OHSAS 18001. It was planned to roll this out over the next 12 to 18 months in tandem with the appropriate training.

In 2012 a high-level internal safety audit team of mining and safety experts verified conditions in risk areas over a six-month period to ensure the safety of employees. The team also reviewed the progress of the strategic health and safety programmes implementation and to establish the effectiveness of existing management systems (HAR 2012-1).

An external gap audit, against global standards, identified critical shortcomings in safety and health management. Remedies were incorporated into an improved safety and health management framework, which would be aligned to the OHSAS 18001 standard. Expert task teams were established to review and finalise this framework. The Chief Executive Officer reviewed each audit report to ensure that gaps identified were addressed effectively.

In 2013 the trial phase of an integrated safety management system to manage risks was being implemented. This R23-million project was a significant part of the strategy to become proactive in managing safety (HAR 2013-1).

In 2014 the company emphasised the implementation of safety management systems and standards that align the policies and procedures with internal and external best practice (HAR 2014).

4.2. RISK MANAGEMENT

In 2015 the risk-based safety management system was integrated into the daily work philosophy and was continuously adopted to the industry's leading safety practices. Risk assessments were performed before any work was done and a

change management procedure was being aggressively implemented. Operational risk management was improved through focused weekly risk reviews and two additional appointed senior engineering managers at a regional level (HAR 2015).

Harmony employed an external company to conduct risk assessments, and to undertake baseline risk assessment revisions on seven mines and seven plants. The objective was to determine the major risks to which each operation was exposed, identify critical tasks in order to appropriately address the associated risks.

Various teams within the company addressed risk on a regular basis as part of their day-to-day roles. This created an ongoing conversation about risk at different levels, allowing any changes to be captured on a continuing basis. While risk management was included in the day-to-day processes, management teams at the operations undertook formal weekly risk reviews. This was done in order, to identify and prioritise specific high-risk issues at an operational level. These operational and safety risk reviews were reported to the respective Regional General Managers. The operations' committees had additional oversight.

Eight fatal risks were identified and for which fatal risk standards with measurable critical controls were drawn up and signed off by the operational committee. The rolled these standards out across the company which included:

- Fall of ground;
- Underground tramming;
- Electricity;
- Working at heights;
- Winches;
- Mud-rush and inundation;
- Fire prevention, and
- Explosives.

Mining and engineering committees were established to ensure compliance to company standards on various mining and engineering work were compiled,

approved and distributed to operations. Shaft management met weekly to discuss and document operational and business risks. Remedial action plans were then drafted to mitigate the risks identified.

In 2016 the General Managers reviewed the top five safety risks weekly. The reports were reviewed with the relevant supervisors and actions were shared with the mining teams. The General Managers also reviewed repetitive A-hazards, which had the potential to cause harm, weekly. If an A-hazard was noticed, it required immediate remedial action including stop, fix or barricade. Exception reports from the various services departments on A-hazards were submitted daily to all General Managers for action (HAR 2016).

The senior management team conducted monthly, formal safety reviews to assess all major safety risks at the operations. Each operation provided information on the relevant controls introduced and action plans to address risks identified to ensure lessons learned were implemented throughout the company.

All employees were trained and encouraged to conduct pre-work risk assessments before any work was done. Operational risk management was integral to the business, and to optimise the gold mining value chain, it was essential to have in place a risk management plan to ensure that all supporting systems were functioning efficiently.

Managing risks effectively while working safely and being proactive were core to the success. Safety hazards and operational business risks were identified and dealt with continuously at each of the operations.

4.2.1. PIVOT SAFETY MANAGEMENT SYSTEM

The PIVOT safety management system was a tool, which enabled all operations to identify risks on a daily basis through various disciplines. Once these deviations were captured, the system identified and highlighted hotspot working places through a risk ranking system which enabled management to focus immediately on the correct areas. It entailed that certain reports would be escalated to a higher level, depending on the risk ranking. The actions manager

module ensured that all deviations were assigned to a responsible person for corrective action and follow up.

The system would also ensure effective data analysis and remedial action implementation. It provided functionality to capture the following at each Harmony operation:

- Baseline risk assessments;
- Issue based risk assessments;
- Critical task assessments;
- Continuous risk assessments;
- Inspections;
- Audits;
- Task observations;
- Shift boss and engineering foreman logbooks, and
- Accident and incident reporting and investigations.

In 2014 the second phase of PIVOT was rolled out at the first pilot site. Comprehensive safety reporting allowed the tracking of incidents, measure safety performance, and reported back to mines on performance (HAR 2014).

In 2015 an external company was contracted to review, revise and re-implement the existing occupational health and safety management system. Harmony trained 1 050 users for this phase and the system was actively being used. A super-user workgroup, which consisted of a specialised user per operation, was established to assist all operations with support. Comprehensive safety reporting using PIVOT was used to track incidents, measure safety performance and to report back to mines on safety performance (HAR 2015). The next phase of the project commenced and the modules to be implemented included:

- Management and administration;
- Procedures, code of practice, managerial instructions;
- Occupational health and safety training;
- Personal protective equipment;

- Purchasing and contractor management;
- Communication, and
- Emergency preparedness.

In 2016 the implementation of phase two of the PIVOT system was implemented as part of the short-term safety strategy. The system made safety analyses and trends more readily available to the organisation, enabling more informed decision making and quicker, more pro-active responses to exposures and risks. The PIVOT system was used at all operations as a management tool to improve safety by analysing safety data and trends, enabling more informed decision-making and quicker, more proactive responses to exposures and risks. Data sourced from all workplace inspections by safety officers were recorded on the system and statistics were captured daily (HAR 2016).

The deliverables for the safety, health, environment, risk and quality Intranet Portal document control management system was completed. Comprehensive safety reports allowed the tracking of incidents, measure safety performance and reported back to mines on performance.

4.3. FATAL RISK MANAGEMENT PROCESS.

In 2016 Harmony introduced the fatal risk management process and established steering committees to ensure and oversee the implementation of the standards were completed at all operations. Standards training for all management teams, safety trainers, line supervisors down to team leader level were completed. The safety trainers would play a key role in the roll out of the fatal risk management standards to the applicable employees at the work face (HAR 2016).

4.4. COMPLIANCE AUDITS

The company's safety performance was disappointing during 2006. The safety function reviewed the accidents and analysed the various pitfalls encountered. It became clear that the company had not fully explored all the avenues of a safety service and embarked on a clearer, more intense auditing function (HAR 2006).

Four auditors were appointed, along with four additional safety personnel to support a new avenue of safety management focused on compliance with standards. The auditing service would provide the General Managers with an ongoing and more accurate insight into legal compliance within their area of responsibility. It would quantify the different aspects of legal compliance and measure these against the application of the standards and procedures in the work place. Every shaft and surface area would be audited three to four times per year which would not only indicate legal compliance but also physical conditions underground and the degree of adherence to standards. The rationale of the auditing protocol was that the process was based on pre-set checklists, as well as a photographic record of the inspections carried out during the audit.

The initial audit would provide the General Managers and their teams with a baseline from which they could set their objectives for improvement. Subsequent audits based on the initial baseline would provide feedback on the improvement/regression achieved by the teams. This would ensure that the operations would be set on a path of continuous improvement.

In 2007 Harmony recruited additional qualified personnel to staff the safety management service which was focused on compliance. This high-level audit team provided a service to the operations in support to identify workplaces that had poor safety results and conditions. The audit team assessed working places, systems in place and relevant documentation. Workplaces were identified as safe for normal work, at low risk or at high risk. Only the legal compliance officer or member of the management team could restart work once a workplace was stopped to rectify conditions. Workplace teams carried the concept forward (HAR 2007-1).

In 2008 the safety audits were intensified, and the application of safety standards was not negotiable (HAR 2008-1). The second round of a comprehensive safety auditing programme was completed which included:

- Physical workplace audits;
- Fall of ground regulations audits;

- Shaft audits, and
- Metallurgical audits, specifically in relation to compliance with the Cyanide Code.

In 2009 each operation was monitored on a monthly basis using a formal review system per operation. A review of the major safety issues was carried out annually during the Health and Safety Workshop. Safety performance was a parameter in all management and employee incentive schemes. The third round of a comprehensive safety auditing programme was completed (HAR 2009-1).

In 2011 internal audits were conducted at operations recording unacceptably high fall-of-ground injury frequency rates (HAR 2011-1).

In 2013 the high-level internal audit team of mining and safety experts verified conditions in high-risk areas at the operations. They established the effectiveness of existing management systems to ensure the safety of employees. The level of implementation of strategic health and safety programmes and standards were reviewed. The Chief Executive Officer and Executives reviewed the audits reports which included the actions implemented by management to ensure gaps were effectively addressed. The Chief Executive Officer accompanied the audit team once each month (HAR 2013-1).

Each operation was monitored monthly using a formal review system in order to accelerate the execution of the safety and health strategy and continually improve safety performance. Major safety issues were reviewed annually.

In 2014 the company had its own safety audits in place, led by the Chief Executive Officer and senior management themselves inspecting underground working areas regularly. Harmony continually improved the safety performances, and each operation was monitored monthly, using a formal review system. Audits and controls were central to the safety processes at Harmony. A central audit team evaluated compliance and opportunities to improve safety throughout the group. Standardised auditing and reporting of physical conditions at workplaces took place which allowed Harmony to standardise safety practices across the

organisation. A third party did engineering audits at selected mines and a considerable amount of time was spent on the maintenance of infrastructure to proactively address any potential problems (HAR 2014-1).

4.5. CORPORATE SAFETY TEAM REVIEWS

In 2007 the corporate safety team investigated each fatal accident and serious or potentially serious incident, and the findings of the investigations were shared with all management teams in order to create awareness throughout the company. These investigations were then the subject of several reviews where each responsible management team put forward its plan to the Board of fatalities for assessment and in order to develop company policy in response to these investigations (HAR 2007-1).

The reviews were then shared with all management teams to assist them with the compliance required in terms of the Board's resolutions. The Sustainable Development Committee reviewed all fatalities and the central corporate safety team reviewed safety performance.

In 2010 extensive back analysis was done to determine the root causes of accidents, what could have been done to prevent them, and what could be done to prevent a re-occurrence. There was rarely a single, identifiable cause of an accident, even in the case of a fall of ground. It was often a combination of causes and the approach in dealing with safety was holistic (HAR 2010-1).

In 2011 a centralised safety function was created to coordinate initiatives between regions and shafts. The corporate safety and health professionals monitored group-wide performance and developed initiatives to address common issues. Each operation was monitored monthly using a formal review system, while major safety issues were reviewed annually during the health and safety workshop (HAR 2011-1).

In 2013 the operations continued to be supported by the centralised safety function which coordinated initiatives between regions and mines (HAR 2013-1).

In 2014 an independent expert was used to undertake a thorough audit of Safety and health systems, training, equipment and behaviour. The outcomes indicated that the correct systems and procedures were in place. Harmony needed to be more proactive in some areas and to continue being intolerant of non-adherence to safety standards (HAR 2014).

In 2015 each operation was monitored monthly through a formal review system in order to drive the continual improve of the safety performance (HAR 2015).

In 2016 the causes of fatal accidents were investigated, and lessons learnt resulted in revised procedures and the introduction of a central safety assurance team (HAR 2016).

5. HUMANISE THE BUSINESS SYSTEMS TO ENABLE THE ACHIEVEMENT OF 'ZERO HARM'

5.1. SAFETY CULTURE

In 2006 Harmony concluded that 70% of the causes of workplace accidents could be attributed to behavioural issues. It ranged from neglecting to inspect workplace support before starting work or not wearing personal protective equipment (HAR 2006-1).

The Sindile Mosha behavioural-based safety programme was introduced at Harmony by using an industrial theatre concept. It was envisaged that the Sindile Mosha and the newly established corporate safety auditing function would complement the Harmony Risk Management System, providing tools that could be used by everybody in the working place. The behaviour-based safety methodology placed a great deal of emphasis on and empowered the individual and had as its basis the fundamental view that production targets could be achieved within a safe environment.

Sindile Mosha meant 'safety' and 'mongoose' in the local vernacular. The mongoose was chosen due to their behaviour in nature of mongoose groups as a 'safety observer' is placed in a prominent spot to oversee the activity of the community while they carry on with their normal daily activities. This individual mongoose's sole responsibility was to look out for predators or potential dangers and warn the community so that they can take cover. Harmony wanted to reinforce this mindset in the workplace. The slogan 'I am committed to looking after my buddy' became one of the cornerstones of the campaign. The Sindile Mosha concept consisted of four pillars, which included:

- Leadership commitment to and support for safety;
- Engagement and training of the workforce;
- Teams taking ownership of the process, and
- Effective communication through consultation.

In 2007 Harmony believed that Sindile Mosha contributed significantly in safety improvements and it was integrated with the characteristics of a world-class safety culture. Unions and associations were fully involved in the process and teams at mine level were given a great deal of freedom in how they implemented the concept. Harmony's approach to behaviour-based safety involved:

- Employees defining the ways in which they were most likely to be injured;
- Pursued their involvement and obtaining their buy-in, through their own behaviour, and
- Observation of their co-workers, in reducing and ultimately eliminating at-risk behaviour.

Harmony believed that 'at-risk behaviour' could be reduced or eliminated through a proactive approach of communication, consultation and education. Once the unsafe behaviour resulted in an accident, of whatever severity, the process of identifying causes and eliminating repetition became a reactive one. Behaviour-based safety was part of a broad philosophy of managing risk so that accidents could be prevented, rather than analysed after the event. Individual responsibility, empowerment and actively caring for one another became part of workplace culture. Safety norms became part of all employees' values. Everyone was willing, able and enabled to 'go beyond the call of duty' to ensure compliance with safety standards.

Harmony initiated a 'people transformation project', in co-operation with the National Union of Mineworkers, to improve productivity. Employee rights and duties regarding workplace safety, as set out in the Mine Health and Safety Act were reinforced through comprehensive team briefings and discussions (HAR 2007-1).

In 2008 it was concluded by the Harmony leadership that some of the fundamentals were no longer being done in the company. It included 'walking the talk' and not just talking about it and instilling this philosophy back into the culture was important**.** Placing safety above production was a non-negotiable.

Harmony introduced a culture of ‘Zero Harm’ in the workplaces, based on the elimination of injuries and on an improvement in occupational health.

It was envisaged that much had to be done and that greater understanding would come about through face-to-face communication with all levels within the organisation, which needed improvement. Communicating meaningfully with the employees to ensure that it was understood how jobs should be performed and assessed was a requirement. The committed buy-in from the people who actually controlled the destiny of the company was necessary (HAR 2008-1).

In 2009 it was believed that the behaviour-based safety programmes resulted in improved safety performance of the company as it focussed on increasing awareness and effecting the necessary behaviour changes. The company focused on further instilling a culture and mindset of safety through the emphasis on behaviour-based safety initiatives and on service-related disciplines. Progress was made in reducing incidents in high-risk stoping and development environment, but less so for the lower-risk, non-mining working environment. An analysis of the fatal accidents that occurred during the year showed a high degree of non-compliance with standards and an increasing proportion of accidents in non-mining related occupations (HAR 2009-1).

The employees and their representatives supported the ‘reward and discipline’ approach to safety. The company continued to encourage a commitment to safety at all levels and Management was also prescriptive when deemed necessary. The lessons learnt of bonuses earned or lost due to safety targets achieved or missed, and of the rigorous application of discipline at all levels for safety infringements including dismissal were not lost.

In 2010 the company introduced safe behaviour in metallurgical plants what should be the low-risk (HAR 2011-1).

In 2011 it was required for Harmony to operate safely and competitively in order to generate the cash flows that would finance sustainable organic and acquisitive growth and pay dividends to the shareholders. Cognisance was taken of the

challenges that could prevent the teams from achieving the safety and production targets. This required a holistic view of both the company and the people.

People were engaged in every level of the organisation to get a bottom-up commitment to common goals, based on a negotiated value system that would underpin sustainable progress for the benefit of all. By investing in the technical processes and expertise to manage these, people would be equipped to achieve the safety and production goals on which the strategy rested. The focus was to entrench the cultural alignment underpinning the new values and their golden thread of safety.

A cultural alignment survey was conducted in which employees were asked which values supported their activities at Harmony on a day-to-day basis. The feedback was used to prepare a cultural change programme. The key issues that would underpin sustainability therefore included transforming attitudes to safety from reactive to proactive. This produced encouraging results as evidenced by the drop in the number of injuries.

A comprehensive safety initiative was rolled out across the company's mines with encouraging results. The task of changing attitudes was widely acknowledged as being the most important element in successfully managing the process of creating a safe working environment in the mining sector. An important element of this initiative was effectively communicating that safety was at the heart of every action and that the consequences of unsafe behaviour permeated the company, from the operational impact of each safety stoppage, to the impact on the morale and safety of all employees. Management continued to ensure that a safety culture was entrenched at all operations through group wide behaviour based safety programmes. The improved safety rates reflected the focus on company-specific risks and behaviour-based training (HAR 2011-1).

Harmony launched a three-year culture alignment programme. The key purpose was to create one Harmony culture that supported the strategic requirement to improve productivity and safety performance, and indirectly improve share performance. It included launching the coaching leadership style 'BreakThrough'

programme and 360° measurements for the top tier of leadership, empowering them to set an example by living the Harmony values and to coach the supporting leadership behaviours. The culture alignment programme comprised of three phases:

- Phase 1: Leadership shaping: Executive and senior leadership defining a desired Harmony culture and brand strategy in support of the company's standardisation strategy and defining an employee value proposition;
- Phase 2: Leadership empowerment: Empowering executive, senior and mid-level leadership with coaching skills to build a common Harmony culture. It was important to measure leadership growth against the New Harmony values through a 360° assessment process, and
- Phase 3: Staff engagement: Communicating and engaging with all Harmony employees to improve alignment and bottom-up participation.

In 2012 Harmony believed that the safety initiatives under way and targets could be achieved with the correct attitude. Every employee could contribute by truly making safety the first priority to create a culture where everyone takes responsibility for their own and their fellow workers' safety and health (HAR 2012-1).

A group-wide culture survey done in 2011 collectively defined the New Harmony values. A representative sample of 1 972 employees participated in the survey which was followed up in a series of feedback workshops. The culture survey results were used to engage all key stakeholders including organised labour, so that the Harmony values belonged to everyone.

A refreshed brand strategy was developed which aligned internal employee engagement to external stakeholder engagement. Additionally, the employee value proposition defined the expectations and responsibilities of being a Harmony employee while the staff engagement strategy motivated behaviour aligned to the Harmony values.

Harmony announced the values through multiple communication channels and implemented employee workgroup programme to enable all the employees to contribute to and engage on how to create value for all stakeholders of the business. This initiative was aligned to the COM MOSH culture transformation charter requirements.

Harmony recorded steady improvement on all safety indicators since 2008 but the pace of improvement needed to be accelerated to achieve the short and long-term objectives. The gap between the 2012 safety performance, 2013 industry milestones and the goal of 'Zero Harm' required a step change in the safety approach.

The revised Harmony occupational health and safety strategy, as shown in Figure 4, focused on ensuring the foundation for a healthy and safe environment was in place. It recognised the importance of leadership and employee attitudes towards health and safety. The strategy and focus areas to achieve a culture where health and safety was the first priority and 'Zero Harm' the goal. The foundation of the strategy was the basics and stemmed from an in-depth understanding of the operational health and safety risks at every Harmony site. Risks were controlled through:

- Mine design and planning processes;
- Implementing standards, codes of practice and procedures;
- Ensure standards were effectively implemented, employees undergone skills training and workplace competency assessments, and
- Underground supervision and audits ensured these standards were firmly in place.

Harmony instituted a focused and multifaceted drive to catapult the company from a reactive to proactive approach by improving the safety culture across all operations. It included a high-level internal review and gap audit with field verification that resulted in a short-term action plan. The culture alignment programme was being implemented which integrated both the safety management standards and safety culture initiatives to function as a single strategy.

Appendix C: Harmony

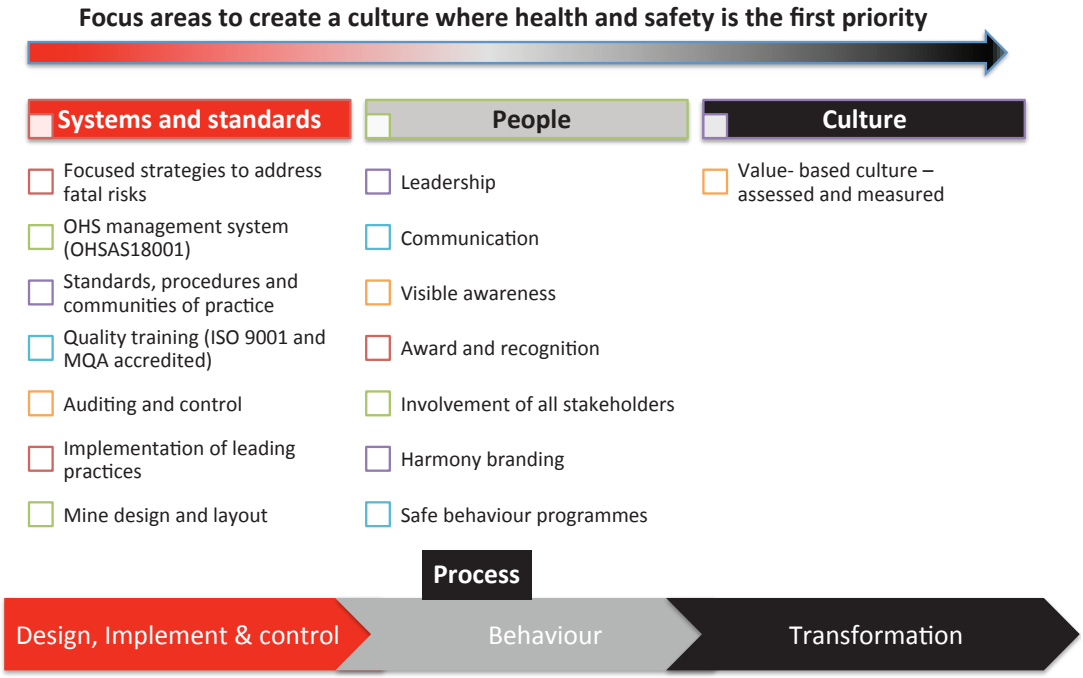


Figure 4 Safety strategy and focus areas (HAR 2012-1).

In 2013 the revised occupational health and safety strategy focus was to achieve a culture where health and safety were the first priorities and 'Zero Harm' goal on. It included entrenching the foundation for a healthy and safe environment as well as recognising the importance of leadership, and employee attitudes towards health and safety (HAR 2013-1).

The basics were the foundation of the strategy and stemmed from an in-depth understanding of the operational health and safety risks at every Harmony site. Risks were controlled through mine design and planning processes, implementing standards, Codes of Practice and procedures.

Employees received skills training and workplace competency assessments were done to ensure that standards were effectively implemented. Underground supervision and audits were firmly in place to ensure these standards were applied.

In 2014 Harmony embedded the ‘Safety First’ culture that established shared values throughout the organisational structure, as well as systems to support safety conscious behaviour (HAR 2014).

In 2015 visible felt leadership based on the commitment to safety as a priority was enforced at all levels and was embedded in the organisational culture in order to achieve ‘Zero Harm’. Initiatives were implemented at the operations to encourage safer behaviour throughout the company. Emphasis on health and safety campaigns was reinforced and regular underground visits underground by senior management with focus on training and coaching (HAR 2015).

In 2016 Harmony believed that a healthy workforce coupled with a healthy workplace culture was integral to sustaining the productivity and profitability. Harmony’s culture gave priority to safety and health. The company committed R100 million to a proactive healthcare strategy, which in its 3rd year of implementation it already reduced absenteeism by 13%, which translated to a thousand more people at work each day (HAR 2016).

The company was committed to creating a culture where safety and health was the first priority. The cultural alignment programme continued with management employees completing the training. The aim of this programme was to achieve cultural cohesion throughout the company by shaping leadership, and empowering and engaging employees.

Performance improvement in terms of production and safety was beginning to show as a result of this cultural alignment programme. Safety was a standard agenda item at all meetings throughout the company. Safety awareness was improved through pro-active communication at weekly team leader workgroups meetings with the General Manager at each mine. On-going safety messages were broadcast on strategically placed televisions throughout the operations surface and underground. Weekly communication meetings were held between the General Manager and safety representatives. Each General Manager attended monthly safety mass meetings at their operation.

The company ensured that employees felt part of the Harmony family through the value of "connectedness". The Chief Executive Officer communicated regularly with employees by e-mail, at meetings, and during internal roadshows. Internal communications were a continuous interactive process and included:

- Regular meetings with heads of departments;
- Work groups and General Manager engagement platforms;
- Mass meetings and quarterly productivity meetings;
- Posters, internal newsletters, memos and flyers, and
- Mine television, intranet, website and text messaging, social media.

For employees to be committed, productive and conscientious in their jobs, it was believed that they should feel valued. Harmony ensured that the employees understood their roles within the company and what was happening at the company and in the industry. They were the first to hear important news. Regular employee engagement involved communication both to and from employees. Suggestions made by employees were taken seriously and if necessary were acted upon (HAR 2016).

5.2. SAFETY MANAGEMENT RESPONSIBILITIES

In 2008 the management of safety was a line management responsibility, undertaken within the framework of a co-operative health and safety management system. It was supported in terms of strategy by corporate safety and health personnel. The systems were aligned with the Mine Health and Safety Act and involved the active participation of management, unions and representatives of the DMR at all levels (HAR 2008-1).

In 2009 the Chief Executive Officer and Chief Operating Officers were responsible for safety strategy and management at the operations. They then, in turn, delegated responsibility to the relevant general and plant managers for implementation and monitoring as each operation had a unique risk profile. Management ensured that a safety culture continued to be instilled at all

operations through the implementation of behaviour-based safety programmes (HAR 2009-1).

In 2011 management and employees accepted joint responsibility for their actions and therefore it was imperative that the working environment empowered people to stop work and withdraw from the mining area when they feel it was unsafe or prevent others from acting in an unsafe way (HAR 2011-1).

In 2014/16 safety roles and accountabilities were clearly defined in job descriptions and used to measure the performance of teams to ensure that all employees understood how they could work safely. It ensured that every person at Harmony understood how he or she could work safely (HAR 2014-2016).

5.3. HEALTH AND SAFETY COMMITTEES

Employees were actively involved in the management of health and safety through the appointment of health and safety representatives and the establishment of health and safety committees at all mines. Health and safety committees consisted of both management and elected employee representatives, were in place at all operations in keeping with the Mine Health and Safety Act.

In 2007 committees were in place representing 100% of eligible employees (HAR 2007-1). Health and safety topics, within the terms of reference of the committees, included:

- Personal Protective Equipment;
- Committee management;
- Participation of worker representatives in safety audits and investigations;
- Training and education;
- Complaint mechanisms;
- The right to refuse unsafe work;
- Problem solving arrangements, and
- Commitment to targets and performance.

In 2009 formal health and safety agreements were place at all operations. More than 90% of the group's South African workforce participated in formal joint management-worker health and safety committees that participated in occupational health and safety programmes (HAR 2009-1).

In 2010 all safety representatives received additional training, in line with the revisions made by the Mining Qualifications Authority (HAR 2010-1).

In 2011 Harmony had healthy relationships with its unions and employees. Considerable effort was devoted to continually strengthening these relationships to ensure all stakeholders worked together in adopting leading global practices (HAR 2011-1).

5.4. TRAINING

In 2008 Harmony embarked upon improving the required leadership skills with the implementation of leadership and training programmes at other levels in the organisation, with the aim of sharing the vision for Harmony. It was important to improve employee morale as it was under threat in an organisation undergoing change (HAR 2008-1). Key non-negotiable principles included:

- Management to lead by example;
- Continuous verbal communication with all team members;
- Visible creation of awareness of safety-related issues;
- Award and recognition of safety achievements, and
- The involvement of all stakeholders.

In 2011 safety literacy was previously identified as a material issue. An e-learning programme was subsequently rolled out and approximately 16 000 employees completed the programme (HAR 2011-1).

Most operations were retraining production crews on safe-making practices, with intensified supervision. Some supervisors completed hazard identification and treatment training through the e-learning medium as part of developing leading practice. Harmony invested in a virtual training system that offered the benefit of

familiarising managers and workers with high-risk conditions and training them in the required steps to keep their colleagues safe without physically being exposed to potential falls of ground.

In 2013 the Mining Charter target of training 2% of the workforce annually as health and safety representatives was achieved. E-learning programmes, which included safety and refresher training, were in place at five operations to improve safety awareness. Virtual reality training was implemented to improve risk identification as part of e-learning. Pictorial briefs were also used at shaft level to communicate mine accidents and other safety messages (HAR 2013-1).

Harmony's ground-control strategy was converted into draft e-learning format and all blasting certificate holders were earmarked for this training at the different facilities. A trail version of the e-learning material was installed and demonstrated, and it was planned to be implemented at all training centres in future.

In 2014 the level of skills amongst employees and prospective employees remained of great concern. High levels of illiteracy, often combined with relatively low levels of skills, limited the opportunity for growth and development amongst employees and their progression within the company. Extensive training and development programmes, were offered in adult basic education training, portable skills training and on-the-job training (HAR 2014).

Apart from the everyday safety procedures in place engagement took place with employees regularly on the topic through training sessions and open discussions. Management spent a great deal of time in the work place coaching employees on ways to work safely. These conversations were shaped by messages agreed on by management with union involvement.

In 2015 Harmony had a number of skills to mine narrow, deep-level and low-grade reefs, which would serve the industry well for some decades to come (HAR 2015).

In 2016 the company leadership was expected to conduct at least two underground/workplace visits per week, including irregular shifts. Visits to high-risk workplaces were prioritized where training and coaching were the guiding principles during the visits. Management continued to coach employees on how to work safely. These conversations were shaped by messages agreed by management in consultation with the unions, safety structures/representatives.

A formal visible felt safety leadership coaching programme was rolled out to Managers and Superintendents to optimise safety engagement with subordinates to drive positive changes in behaviours (HAR 2016).

5.5. INCENTIVES

In 2010 remuneration was linked to safety performance at all levels of the organisation (HAR 2010).

In 2012 safety performance was a parameter in all management and employee incentive schemes. The safety incentive structures were reviewed to focus on rewarding proactive safe behaviour, as opposed to reactive processes (HAR 2012-1).

In 2013 new safety incentive scheme, which measured leading indicators and lagging indicators, was introduced for Management teams and Production team bonuses. In 2014/5, safety was a key performance indicator and a key component of performance reward (HAR 2013-2015).

In 2016 safety performance was monitored to determine remuneration in terms of the safety related bonuses to be paid. Safety performance was applied as an adjustment in the calculation of the short-term incentive bonuses (HAR 2016).

The company's lost-time injury frequency rate for the total business plan was used to measure Harmony's safety performance. If the planned safety target was achieved, 10% would be added to the overall percentage bonus paid. If the company did not achieve its safety target, up to 10% would be deducted from the overall percentage bonus paid as per the gradation scale.

5.1. WHITE FLAG DAYS

In 2012 Harmony introduced ‘white flag’ days at individual operations, marking shifts free from injury as part of the proactive safety focus (HAR 2012-1).

6. OPERATIONALISE THE SAFETY MANAGEMENT SYSTEM

6.1. IMPROVING THE WORKING ENVIRONMENT

In 2007 management paid greater attention to ensure that everything that a stope team needed to have in place was actually in place. It included logistics, systems and people, appropriate environmental conditions and attending to employees' wellbeing. Better transport was provided for employees, right up to the place where they worked (HAR 2007-1).

In 2008 while the workforce was motivated to become involved in taking responsibility for their own safety and that of their colleagues, a key management focus was to improve underground conditions. Emphasis was being placed on those areas that were deemed to be of the highest potential risk, which included shaft infrastructure and physical conditions in the workplace. The focus was on compliance with standards, the monitoring and management of ground conditions and improving logistics to and from the workplace (HAR 2008-1).

In 2014 physical barriers were in place to eliminate risk and exposure to harm at the operations. Fatal risk control protocols were being developed and implemented, especially for rail-bound equipment and falls of ground (HAR 2014).

In 2016 infrastructure and equipment maintenance remained a daily focus at all the mines (HAR 2016).

6.2. TECHNOLOGY

In 2007 Harmony's approach towards the use of technology included the use of lighter machinery. Hilti electric rock drills were partially introduced which had greater penetration rates and produced lower noise levels.

The Harmony Improvement Zone, a virtual notice Board of ideas was used to ensure that these innovations were shared and implemented throughout the company (HAR 2007).

6.3. RAIL BOUND EQUIPMENT

In 2010 the preventing of trucks and tramming accidents was a focus area. Some technology initiatives included the developed safer locomotives and anti-collision devices. In 2011 Harmony developied an integrated plan for rock-breaking machinery and rolling stock, aligned with the COM MOSH project (HAR 2010-1).

In 2012/13 tail-bound equipment (RBE) audits were conducted at eight operations during the year. These audits verified compliance to the RBE code of practice, and specifically focused on locomotive conversions and rail conditions to comply with SANS 10339 specifications. Harmony commenced installing a proximity detection system, which was an electronic device, fitted to mobile machinery that detected other mobile machinery nearby. The operator would receive a visual and audible warning signal to which he could react if another vehicle approached. The Guardcom system incorporated a handheld unit that allowed the guard to electronically signal the driver and stop the train by activating an emergency stop button in an emergency. The unit also had a tilting device that stopped the locomotive automatically if it exceeded a certain angle. Implementation was to be phased over 18 months as it involved much training, changing behaviour, amending infrastructure and fitting units to locomotives. It was though that this initiative would put Harmony in the forefront of this safety area in the South African gold mining industry (HAR 2012-2013).

6.4. MINING METHODOLOGY

In 2007 Harmony established a task team who investigated the detailed implementation of ‘continuous mining operations’ on a shaft- by-shaft basis. They had to identify best practice, assess and analyse the systems in place and subsequently moved from shaft to shaft to ensure that the implementation of the improvements at the other operations (HAR 2007).

Many of the challenges faced in respect of continuous operations had to do with people and resistance to change. Harmony was sought to understand the

challenges better in order to overcome them. At the time, the system had not fulfilled its potential to improve production in the way that it should have.

6.5. GROUND CONTROL STRATEGY

In 2007 the continued risk-based management of falls of ground was a focus area. Although there were many dimensions to safety in the workplace mine design, mine support standards and seismic monitoring for example, it was accepted by Harmony that human behaviour played a critical role (HAR 2007-1).

In 2010 Harmony continued with fall of ground prevention initiatives. Trials commenced with support netting in development ends to prevent falls of ground (HAR 2010-1).

In 2011 falls of ground accounted for a large portion of all lost-time injuries in Harmony. The development of a holistic strategy to minimise injuries caused by falls of ground was prioritised following the 2010 company safety workshop. It consolidated efforts to prevent fall-of-ground incidents and accidents. The Harmony ground control strategy was divided into two main components, ground behaviour and ground control (HAR 2011-1).

Ground behaviour dealt with the strategic aspects of mine design to prevent or minimise damage to rock around mining excavations. Knowledge of the mining environment and ground stability, together with an understanding of in-situ and induced stress regimes, guided the ideal plan for each condition. Integral to this plan was integrating support systems in the overall mine design and monitoring rock mass response.

Ground control dealt with the operational aspects of the mine to protect personnel and equipment from fall-of-ground incidents. This was the hazard identification and treatment system where support elements, layout standards and procedures were implemented by means of training, supervision and management systems that addressed all requirements. Central to this approach were components that deal with:

- Behavioural aspects;
- Competency training;
- Development;
- Research, and
- New technologies.

The fall-of-ground strategy was developed, refined for each workplace and signed off. The combination of netting in selected spaces with better control and better awareness resulted in a 75% improvement in gravity-related falls of ground from 12 in 2010 to three in 2011. Two seismic fall-of-ground fatalities occurred during this period (HAR 2011-1).

A pilot site for a triggered accident response plan (TARP) which was a systematic process where fall-of-ground related hazards were identified, escalated if necessary and treated by the correct level of supervision was trailed in conjunction with the COM MOSH initiative. The potential rock fall hazards were identified and catalogued, and a reference book was developed to assist underground supervisors in hazard identification.

The COM MOSH adoption process on early morning examinations and ‘making safe’ procedures were adopted at all operations. The early results were encouraging. The demonstration stage of in-stope bolting and netting was completed and the industry-wide roll-out workshop with 150 participants representing all major and junior mining groups.

In 2013 all the operations implemented the entry examination, bolting and netting, and making-safe leading practice developed by MOSH. Bolted netting in stopes and development faces was rolled out as a leading practice at all underground operations. A minimum standard for nets was developed and implemented through the procurement department (HAR 2013-1).

The TARP demonstration mine proved very successful and all operations adopted this leading practice in 2014 (HAR 2014).

6.5.1. MONITORING SEISMIC ACTIVITY

In 2008 the company was committed to ensuring a safe working environment for all employees and placed the utmost importance on the monitoring and pro-active management of seismicity in an effort to reduce seismic activity, injury and damaged caused by seismic events. The incidence of seismic activity declined during the year and could be attributed to the reduction in the mining of more stressed areas following final extraction as well as the implementation of pro-active seismic interpretations (HAR 2008-1).

Harmony put in place systems to enable the monitoring of seismic activity at its operations. Seismometers that registered ground motion were strategically positioned underground at all seismically active mines. The high-level of quality control on seismic data acquisition and a diligent and reporting database assisted greatly with the pro-active management of seismicity. The seismic activity monitoring system was upgraded on a continuous basis to ensure that it was kept abreast of emerging technology. The system and the seismic data it produced were frequently audited to ensure absolute effectiveness and accuracy.

All seismicity recorded by the seismometers was processed and analysed daily after which detailed reports were produced and sent to rock engineers and management on these mines to assist with planning. Routine seismic monitoring enabled seismicity to be quantified and provided a tool to assist in the control of potential rock mass instabilities that could follow as a result of seismicity. When undertaking risk assessments at potential future mining sites, seismic monitoring was an essential component of Harmony's production planning and risk management strategy. The emphasis was on ensuring the safety of the employees. Each mine was rated according to the number of potentially hazardous events recorded as well as the severity of damage experienced during the previous year.

In 2013 Harmony initiated a three-year grant totalling R4,7 million to the University of Pretoria to establish a Chair in Rock Engineering and numerical modelling in the mining industry. This focused research on a safer working environment in the hard-rock mining industry offers benefits for all stakeholders

and would strengthen the partnership between academic institutions and the mining industry in developing further safety improvements (HAR 2013-1).

In 2014 an increase in seismicity in one section of the Unisel necessitated a change to the regional support layout, resulting in reduced face length. At Steyn 2 shaft, mining terminated in March 2014 six months earlier than the planned, due to the increased risk of seismicity (HAR 2014).

7. HARMONY SAFETY PERFORMANCE

During the period 2006 to 2016 Harmony had fatalities 202 as shown in Figure 5.

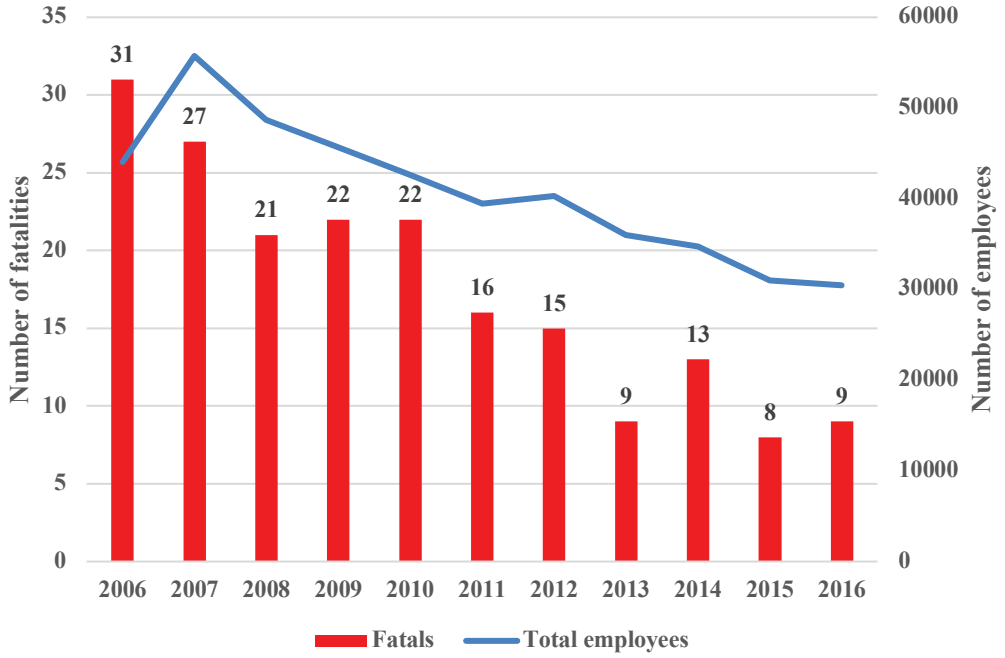


Figure 5 Number of fatalities vs number of employees, 2006-2016 (HAR 2006-2016).

The correlation coefficient R^2 between the number of employees and the number of accident is 0,754, which is a significant correlation. If the incident where 9 fatalities occurred due to a fire in 2014 are excluded in order to normalize the relationship then the R^2 is 0,84, which is very strong. This means that the number of fatalities reduced essentially because the number of people exposed to risk reduced but that the actual risk did not reduce concomitantly.

Since 2008 the top four energy sources causing of 88% of the fatalities were:

- 37% due to falls of ground, gravity;
- 27% due to trucks and tramming;
- 12% due to falls of ground, seismicity, and
- 12% due to gasses.

There were 23 different energy sources for fatalities between 2006 and 2006 as shown in Table 1. There was significant randomness of the energy sources and it is possibly due to insufficient issue-based risk assessments or behavioural issues.

Causes of fatal accidents	08	09	10	11	12	13	14	15	16
Explosions				33%		33%	5%		
Falls of ground: Gravity	38%	27%	56%	20%	13%	11%	14%	38%	22%
Caught between equipment		18%							
Falls of ground: Seismicity	19%	14%		13%	7%		5%		22%
Trucks and tramming	19%		14%	20%	13%	22%	14%	38%	33%
Slips and falling	5%	13%			13%				
Asphyciation		9%							
Rolling Rocks	5%			7%					
Tools and equipment		5%			7%		5%		
Winches		5%					5%		
Scrapers, rigs and ropes	5%		5%						
Falls from heights	5%								
Electrocution		5%							
Struck by Equipment		5%							
Inundation	4%				27%		9%		
Falling down an excavation				7%		11%			
Heat			10%		13%		5%		
Conveyance					7%				
Gasses						11%	41%	13%	11%
Falling structure						11%			
Conveyor belt			5%						
Headgear sheve wheel								13%	
Vehicle									11%

Table 1 Causes of fatalities between 2008 and 2016 (HAR 2008-2016).

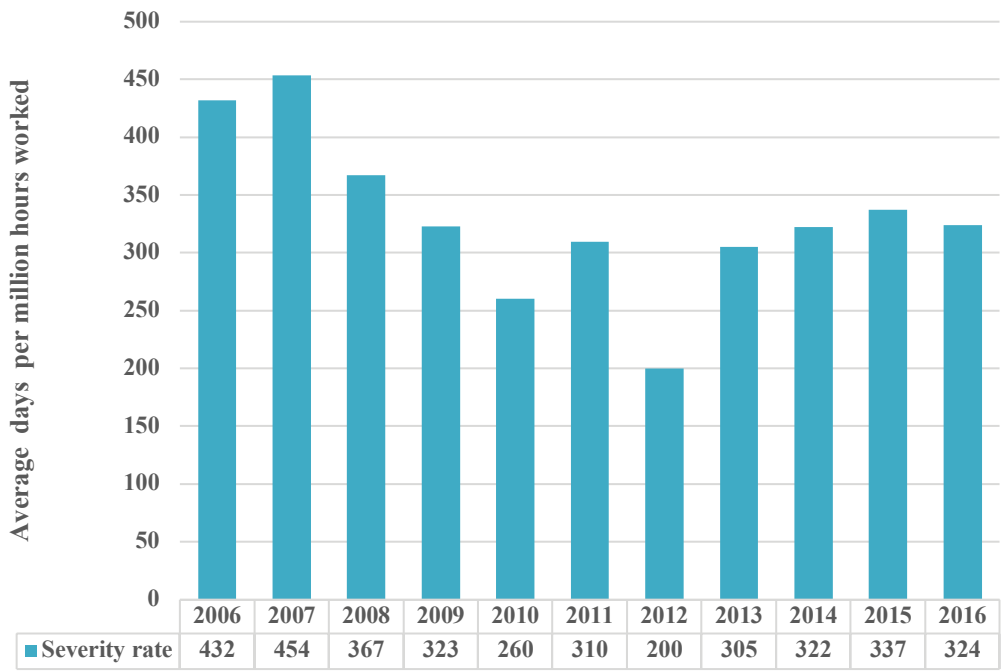
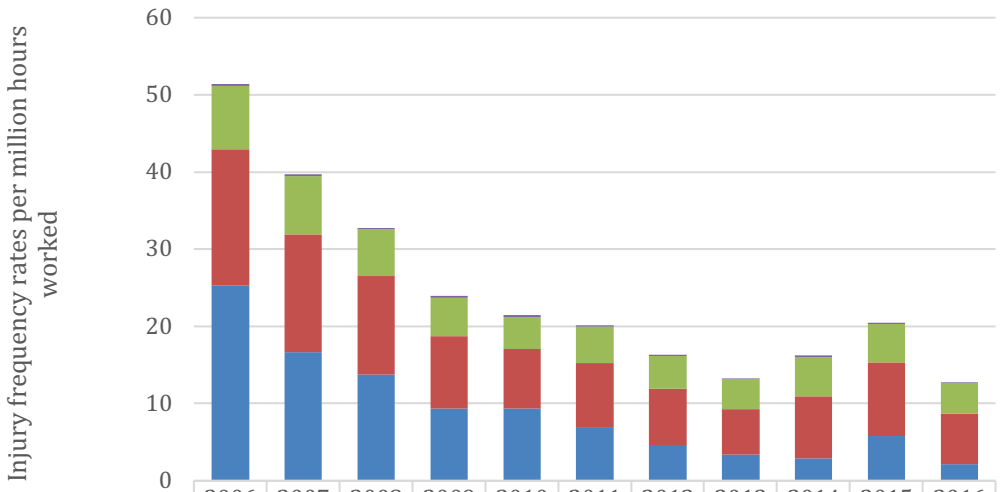


Figure 6 Injury severity rate, 2006-2016 (HAR 2006-2016).

Appendix C: Harmony

The correlation coefficient between number of employees and the number of shifts lost is 0,75. It could mean that there is a strong relationship between the downsizing of the organisation and the reduction in shifts lost. This in turns suggests that the injury severity rate decreased from 454 in 2007 to 323 per million hours worked in 2009. Thereafter it has been in the order of 324 per million hours worked. The severity rate of occupational injuries is still significant as shown in Figure 6.

The injury frequency rates reduced significantly between 2006 and 2012 but it has reached a plateau between 2012 to 2016 as shown in Figure 7.



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fatality injury	0,29	0,22	0,18	0,21	0,21	0,17	0,16	0,11	0,28	0,11	0,13
Serious injury	8,20	7,56	6,03	4,97	4,19	4,73	4,24	3,88	5,04	5,02	3,98
Lost Time	17,64	15,27	12,83	9,35	7,73	8,32	7,29	5,87	8,09	9,57	6,50
Dressing Case	25,28	16,65	13,72	9,39	9,33	6,95	4,63	3,41	2,87	5,76	2,18

Figure 7 Injury frequency rates, 2006-2016 (HAR 2006-2016)

7.1. PUBLIC SAFETY

In 2015 a methane explosion occurred at the Brand 1A ventilation shaft in Welkom, which was being rehabilitated as part of Harmony's extensive rehabilitation programme underway in the Free State (HAR 2015).

The accident occurred as a result of the ignition of methane within the explosive range in the shaft barrel when reinforced concrete material was thrown down.

Given the presence of flammable gas and methane in particular, Harmony re-drafted its rehabilitation procedure regarding the filling up of redundant shafts with inert material. Extensive testing for the presence of flammable gas prior to backfilling would be undertaken at all shafts scheduled for rehabilitation.

A special operations centre was set up for the reporting of any damage sustained as a result of this incident. 1,122 Reports of damage to properties were received and was repaired at an estimated cost of R25 million.

A permanent plug was subsequently designed for the Brand 1A shaft to prevent any such explosions in future.

In 2016 three community members lost their lives as a result of trespassing on hazardous mine sites. Various interventions to prevent any recurrence were added to the existing public safety awareness programmes (HAR 2016).

7.2. EMBRACE CONTINUAL IMPROVEMENT.

In 2007 substantial progress was made with the process of formalising the concept of continuous improvement in the company. Improvement leaders were appointed at an operational level to encourage ideas from employees at the rock face and to make continuous improvement a part of day-to-day operations. It included production, cost containment, human resources and health and safety. The elimination of bottlenecks in logistics resulted in an increase in throughput, which contributed directly to the bottom line (HAR 2007-1).

In 2008 a technical programme was put in place to prevent the recurrence of the Elandsrand shaft incident. A great deal of emphasis was placed on planning and re-planning, and on training (HAR 2008).

In 2014 the safety department verified and evaluated every injury on an ongoing basis (HAR 2014).

In 2015 an incident report detailing “lessons learnt” following each incident in which an injury occurred, was circulated to all operations to enable them to scrutinise their own systems and procedures. This enabled the pro-active

identification of potential shortcomings and to take remedial action where necessary to prevent a recurrence of any such incident (HAR 2015).

In 2016 the causes of all accidents were investigated and analysed thoroughly by Harmony safety personnel in conjunction with the authorities and employee representatives, and lessons learned were rigorously applied (HAR 2016).

8. SUMMARY

In 2006 no accident was acceptable, and Harmony would continue to aim to improve safety.

In 2007 the provision of safe and healthy workplaces was one of Harmony's key priorities, and the elimination of all workplace injuries was a strategic focus area. Harmony was accepted as a signatory to the International Council on Mining and Metals. The company embarked upon a three-phase, three-component strategy to 2012 and beyond.

In 2008 the company was committed to ensuring a safe working environment for all employees and placed the utmost importance on the monitoring and pro-active management of seismicity in an effort to reduce seismic activity, injury and damaged caused by seismic events.

The group experienced significant change with the focus on going 'Back to Basics' and in 2009 Harmony started to reap the rewards. However, the number of fatalities was of great concern and the company continued focus to improve safety.

The New Harmony

In 2010 Harmony remained determined in their efforts to continuously improve safety standards and records, and the target of zero fatalities remained steadfast.

In 2011 Harmony was highly influenced by public policy both locally and internationally Harmony continuously provided input on public policy development, especially legislative issues that affected or governed the mining industry through the Chamber of Mines (COM) (HAR 2011-1).

In 2012 Harmony's safety initiatives were aligned with the culture transformation framework agreed between industry stakeholders, DMR, COM and organised labour (HAR 2012-1).

In 2013 sustainable development practices were embedded in the business strategy, reflecting the belief that corporate citizenship was both a moral responsibility and a condition of the mining licenses.

In 2014 many mining industry occupational safety and health initiatives were put in place at the operations.

In 2015 each operation was monitored monthly through a formal review system in order to drive the continual improve of the safety performance (HAR 2015).

In 2016 Harmony intensified the focus on safety through the appointment of a Chief Operations Officer with specific responsibility for safety. The General Managers reviewed the top five safety risks weekly. The causes of fatal accidents were investigated, and lessons learnt resulted in revised procedures and the introduction of a central safety assurance team (HAR 2016).

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Appendix D

The Gold Fields safety journey between 2007 and 2016 case study.

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1 Gold Fields company background

In 2006 Gold Fields was the world's fourth largest gold producer. It was a major international employer with a total global workforce of 54,758 including full-time contractors. It provided direct permanent employment to 48467 permanent employees including 5 698 contractors in South Africa (GF 2006).

During the period 2006 to 2016 the company undergone major changes as it changed focus from a volume to a value driven organisation. In 2007 Gold Fields acquired control of South Deep Gold Mine. Due to its proximity to Kloof Mine, South Deep constituted a logical addition to the Gold Fields franchise of high-quality long-life mines in South Africa (GF 2007).

In 2008 three senior executives left the company, which resulted in management restructuring. The position of chief operating officer was done away with and the respective heads of the South African and international operations reported directly to the Chief Executive Officer (GF 2008).

On 7 May 2008 the Chief Executive Officer of Gold Fields, made the statement "If we cannot mine safely, we will not mine." This translated into a vast improvement in safety performance. It signalled a watershed in the Gold Fields approach to safety and was the foundation to a far-reaching suite of interventions, which, collectively, resulted in a very significant improvement in the safety performance during 2009 (GF 2009).

In 2011 Gold Fields merged Kloof and Driefontein through the clustering of shafts into five operating units and the combination of all reef and waste plants under one structure was done (GF 2011).

During 2012 a new Gold Fields Chairperson was appointed, and the company undertook a major strategy review, which was marked by the replacement of the previous goal of having 5 million ounces in production to one focused on cash generation. The reorganisation formally separated Gold Fields mines into two distinct portfolios:

- The open pit and shallow underground mines in Australia, Ghana, Peru as well as the deep underground mechanised South Deep mine.
- Sibanye Gold consisted of the mature, deep underground, narrow-vein Beatrix and KDC mines (GF 2012).

The previously 100%-owned subsidiary Sibanye Gold was launched as an independently managed entity. The New Gold Fields was still a large producer of gold with annual production of approximately 2 million gold ounces from six operating mines in Australia, Ghana, Peru and South Africa (GF 2012).

During 2013 Gold Fields had undergone a number of fundamental changes, which included the continued unbundling of Sibanye Gold Limited. Gold Fields shifted from being a 'Top 4' gold producer to be a more focused, mid-tier mining company (GF 2013).

The vision and values of the company remained constant while the strategic objective, commitments to stakeholders, operating model and structure, and the strategy evolved. The essence of Gold Fields remained intact, became better integrated, coherent and reflective of the stakeholder interests. The Group and regional-level management structures were decentralised.

In 2014/15 Gold Fields' value creation cycle started with ensuring it had the right assets, the right skills and that good governance was firmly entrenched throughout the organisation. The South Deep mine posed some significant challenges in that the implementation of a safety-critical, ground support remediation programme underground halted the bulk of the mine's production for four months (GF 2014-2105).

The Gold Fields employees in their South African operations reduced from a high of 54 758 in 2006 to 6 277 in 2016 which amounted to an 88% reduction (GF 2016).

1.1 Scope of the case study

Only issues affecting the Gold Fields South African operations, within the context of the global Gold Fields were addressed in the case study. Significant interventions on occupational health, HIV Aids and other medical conditions affecting the wellness of the workforce were not addressed in this case study. All the information contained in this case study was obtained from Gold Fields annual reports between 2006 and 2016.

2 External safety advocacy

2.1 International Council on Mining and Metals

Safety was always an important aspect of Gold Fields values and production approach. The company was an early adopter of broader global influences in order to pursue enduring value. This approach augmented the Gold Fields approach to Sustainable Development (SD), which included safety and health.

Gold Fields became a member of the International Council on Mining and Metals (ICMM) and a signatory to the Global Compact in 2007. The ICMM and Global Compact principles presented a well-tested and proven framework for Sustainable Development. Both the Global Compact and the ICMM required members and signatories to endorse and implement the principles within the organisation in a structured manner and to audit and report performance against the principles (GF 2007).

The ICMM Sustainable Development and the Global Compact Principles were used as it most appropriately reflected the relevant thought process throughout the Group. The SD process was to translate the principles into key performance indicators within a formal management system. In order to support this, a system of issue-specific internal peer groups, consisting of specialists and practitioners were created who would drive the process of developing policy practice guides, overseeing the implementation worldwide and acting as thought-leaders in each specific field.

Gold Fields chose to focus on improving internal data capture and monitoring systems, including the role of internal audit, to identify potential gaps in the eventual assurance process. The company maintained an active role and provided representation on numerous work programmes of the ICMM which included:

- Environmental Stewardship;
- Health and Safety;
- Materials Stewardship;
- Socio-economic Development, and

- Resource Endowment.

The involvement in these work groups served to actively assist the ICMM in developing responsible approaches to the mining and use of metals in keeping with the ICMM's overall objective and to provide insight towards Gold Fields' practices and experiences regarding the above.

2.2 Global Reporting Initiative

In 2003 Gold Fields adopted the Global Reporting Initiative (GRI) 2002 guidelines (GF 2006).

2.3 Department of Mineral Resources

2.3.1 Presidential Audit initiative

In 2007 the South African Government announced an industry wide mine safety audit that commenced in late 2007 as a result of peer national safety performance. The Gold Fields operations audits were completed by the end of 2008 and the lessons learnt and opportunities presented to improve was considered and implemented (GF 2007).

2.3.2 Section 54 Stoppages

In 2008/9 Gold Fields received and complied with various instructions to stop operations from the Department of Mineral Resources (DMR) (GF 2008-2009).

Gold Fields did not have extended Sect 54 safety closures of its mines during the second half 2010. The company intended to continue with this trend as the safety performance improved as well as closer co-operation with the DMR (GF 2010).

In 2011 Gold Fields ability to promote safe production was supported by the active involvement of employee representative organisations and unions, host governments and the DMR which continued to provide valuable guidance on how to improve the safety performance (GF 2011).

In 2012 Gold Fields placed increased emphasis on engagement with employees' unions as essential interlocutors and stakeholders in the safety management process, as well as the DMR as the key regulator and source of guidance (GF 2012).

In 2013 Gold Fields was issued with two Section 54 safety notices by the DMR. The findings were addressed and the notice lifted promptly (GF 2013).

In 2014 Gold Fields was issued with two Section 54 safety notices by the DMR (GF 2014).

In 2015 Gold Fields was issued with 16 Section 54 notices. A change of minister and director general in the DMR and differing policy priorities by various government departments, created significant uncertainty (GF 2014).

In 2016 Gold Fields was issued with 15 Section 54 notices. The company continued to work with the DMR in addressing safety and wellness related issues at South Deep (GF 2016).

2.4 Chamber of Mines of South Africa

In 2007 Gold Fields committed its South African operations to a number of health and safety targets and milestones, agreed to by the Mine Health and Safety Council (MHSC) as shown in Table 1 (GF 2007).

Mine Health and Safety Council milestones (South Africa)

Objective	December 2008	Target 2013
Zero harm	Achieve, as a minimum, safety performance levels equivalent to current international benchmarks for underground metalliferous mines.	
Noise	The hearing conservation programmes implemented by industry must ensure that there is no deterioration in hearing greater than 10 per cent amongst occupationally exposed individuals.	The total noise emitted individually and collectively by equipment installed in any workplace must not exceed a sound pressure level of 110dB at any location. (The exposure limit stated in the MHSA is no more than 85dB over an eight-hour period.)
Dust	Ninety-five per cent of all exposure measurement results must be below the occupational exposure limit of 0.1 mg/m^3 for respirable crystalline silica (individual readings).	Using present diagnostic techniques, no new cases of silicosis will be tolerated among previously unexposed individuals (i.e. individuals unexposed to silica dust prior to 2008).

Table 1 Mine Health and Safety Council 2013 milestones (GF 2007).

2.4.1 Mine Occupational Health and Safety

In 2008 Gold Fields supported the establishment of the Mine Occupational Health and Safety (MOSH) Task Teams to assist in the interventions for the MHSC milestones to reduce injuries, eliminate silicosis and noise induced hearing loss based on set targets (GF 2008).

In 2009 each operation implemented a comprehensive strategy to ensure compliance to the 2013 milestones as shown in Table 1 for health and safety (GF 2009).

In 2010 the company ensured the sustainability of the safety interventions and the achievement of the 2013 MHSC health and safety milestones (GF 2010).

In 2012 Gold Fields management was regular participants in the South African Chamber of Mines' newly formed Chief Executive Officer's Elimination of Fatalities Team. The team was a cross-sector initiative to share experiences and to help one another address key safety challenges. It included a specific focus on cultural transformation, which was re-introduced into the South Africa Region's safety strategy. It was Gold Fields belief that it was unlikely that the mining sector could completely eliminate all risks (GF 2012).

3 Internal safety advocacy

3.1 Gold Fields Vision

The Gold Fields Vision of global leadership in sustainable gold mining requirements included:

- Creating the greatest enduring value from gold, by delivering optimal financial returns to investors;
- Consistently deliver what was promised across all operations, by achieving and maintaining stability, predictability and consistency at the operations and only providing guidance for what was known that could be delivered;
- Adhere to the commitment that "if we cannot mine safely, we will not mine", which meant demonstrating real prioritisation of the safety and wellbeing of those at the operations above all other considerations, and
- Striving to protect and enhance the environments in which the company operated, by achieving the kind of environmental and socio-economic performance that would enhance stakeholder relationships and contribute to an enduring and positive legacy in the areas in which the company operated.

The Gold Fields leadership articulated their belief that 'Zero Harm' was possible and reflected the approach to safety. This strategic intent was incorporated in the policies and principles within which all aspects of mining were conducted at Gold Fields.

In 2009 Gold Fields embraced a new vision, which was for the company to be the global leader in sustainable gold mining. The company adopted six values to guide the company towards achieving this vision (GF 2009). It included:

- Safety: 'If we cannot mine safely, we will not mine.';
- Responsibility: We act responsibly and care for the environment, each other, and all of our stakeholders, our employees, our communities, and our shareholders;
- Honesty: We act with fairness, integrity, honesty and transparency;

- Respect: We treat each other with trust, respect and dignity;
- Innovation: We encourage innovation and entrepreneurship, and
- Delivery: We do what we say we will do.

In 2012 the Gold Fields Vision was to be the global leader in sustainable gold mining, which was included the pursuit of 'Zero Harm' in order to eliminate all harm to the people and contractors. The shift in focus had a major operational and strategic impact as the marginal production at the mines was phased out and the unbundling of the mature underground mines in South Africa, which would be managed by the newly independent Sibanye Gold. The focused long-term sustainability of the business entailed:

- The health and safety of the people;
- Respectful environmental stewardship, and
- The creation and equitable sharing of value for all stakeholders (GF 2012).

3.2 Leadership

In 2006 the Board and management were aware of the need to improve safety performance to eliminate fatal accidents and substantially reduce lost time accident rates. The safety target remained a zero rate for fatalities and injuries. Gold Fields continued efforts to improve systems and identify the underlying causes to implement remedial actions. It was the company's vision that no employee would leave the company having acquired an occupational injury or disease without follow-up treatment (GF 2006).

In 2007 Gold Fields remained committed to the objective that no employee should suffer an injury or acquire a disease while in the employ of the Group, and that fatalities and injuries sustained at its operations should be reduced to zero. Any safety incident was unacceptable, and the company continued to work towards achieving the goal of zero fatalities. The company undertook to accelerate the encouraging downward trend of fatal and other injuries. The company intensified efforts towards the goal of eliminating mine fatalities and committed to continue best efforts to combat the cause of fatal events until they were eliminated. The

focus on mine safety became a permanent feature of the mining ethic, and an industry task force was addressing aspects such as technology and best practice transfer to reduce mining risks. Further safety interventions were implemented at each operation based on behavioural safety and team-building research (GF 2007).

In 2008 Gold Fields reached a watershed in that a fundamental step change was required in the approach to safety. On his first day of the appointment as the new Chief Executive Officer, nine employees died at the South Deep gold mine when the vent hole raise conveyance in which they were travelling became dislodged and fell more than 60 metres. The incident contributed to what was already an unacceptable rise in fatal mine accidents across the Group. This incident occurred within the context of heightened South African and international concern over mine safety (GF 2008).

The Gold Fields Board announced on 7 May 2008 that no mining would be done if it cannot be done safely. While the short-term impact of this policy was at a high cost, there was confidence that the long-term gains would substantially benefit the employees and shareholders alike. The Gold Fields Board committed to making mining safe and safe production was the only way forward. “We will not mine if we cannot mine safely”, signified the unwavering commitment to the safety of the people.

The operations were confronted by several interruptions in production resulting from safety stoppages at all of the mines throughout the year. The overall trends in safety performance for both Gold Fields and the South African mining industry was encouraging as the total number of mine related fatalities steadily reduced to a third of the level two decades ago (GF 2008).

In 2009 good safety management remained essential to Gold Fields’ business. It was the cornerstone of everything that was done and the people of Gold Fields. There was no price to be placed on human health and safety, and by the economic reality that a stable, predictable and consistent operational performance was not

possible in an environment constantly plagued by accident induced interruptions to operations (GF 2009).

Various safety initiatives were successfully introduced, while others were in the process of being implemented. The Board was satisfied that these interventions had the desired effect and that there was a step change in the approach to safety and was now an integral part of the way Gold Fields conducted its business.

In 2010 Gold Fields reiterated the commitment to eliminate all serious and fatal injuries on the mines. The magnitude of this extraordinarily challenging commitment and the moral and commercial implications for the company of a failure to do so was understood. It was a priority for the company to ensure that the new approach to safety launched in 2009 was sustained and to ensure that it was firmly embedded and entrenched as the single most important value. It was the most important driver of sustainable, profitable production and a prerequisite foundation for consistent and predictable production (GF 2010).

There was no price to be placed on human health and safety and was a principle that informed the safety and health philosophy. The Board was committed to working with management to ensure that all serious and fatal accidents were eliminated. Safe production remained the single most important value and the Board continued to actively engage with management to ensure that every possible step was taken to improve the safety performance. It was believed that this was possible and the company would not rest until ‘Zero Harm’ was a reality at the operations. The mines managed to operate for extended periods without any fatal accidents were proof of this. Each fatality was viewed as a fundamental failure of the safety efforts, which was to be corrected. The leadership and management remained committed to its quest for ‘Zero Harm’ and maintaining a safe and healthy working environment for all employees. The goal was the total elimination of all serious and fatal accidents on the mines.

Gold Fields continued to further entrench and improve the efforts across the full spectrum of safety interventions to achieve a further 25 per cent average improvement in all safety indicators. The main priority was to strengthen the

values of personal and collective safety amongst the employees, which was a fundamental prerequisite for the behavioural change required to eliminate preventable accidents. The company was committed to the number one value of '*if we cannot mine safely, we will not mine'* (GF 2008, Page 10). Significant progress was made to entrench this as the defining value of the production culture (GF 2010).

In 2011 Gold Fields' objective was to achieve 'Zero Harm' and mitigate the risks associated with deep underground mining at the operations. The pursuit of 'Zero Harm' at the operations was the right thing to do to minimise the loss of production caused by safety related stoppages and impacted on profitability. The approach was driven by the determination to prove that deep underground gold mining could, when properly managed, be carried out safely. It was believed that with the right leadership, safety culture, procedures and engineering controls, deep underground mining could be carried out in a way that did not put employees at risk.

The Gold Fields promise that "if we cannot mine safely, we will not mine", was reflected in the prioritisation of employee safety and wellbeing. This was primarily driven by the moral imperative to protect employees as well as the need to protect the Gold Fields reputation and avoid operational disruption. It was challenging to achieve the objective of 'Zero Harm', which required constant diligence with no room for complacency. Gold Fields made significant progress in terms of engineering-out risks, entrenching rigid health and safety standards, and nurturing a safe mining culture.

Gold Fields established a sound relationship with both the government and the trade unions who were the key stakeholders in the safety efforts. The company was determined to move beyond the stigma of underground gold mining as an inherently dangerous activity by improving safety performance and consistently reducing the risk of fatalities. The company was complementing existing safety measures with programmes that enhanced workforce competence through capacity building, as well as proactive health, housing and welfare initiatives that focused on employee wellbeing 24 hours a day (GF 2011).

In 2012 the Board guided the company through wide-ranging restructuring brought about by the disenchantment of investors in the gold sector, which had been rising for a number of years. Gold Fields experienced its most far-reaching transformations in its 127-year history as it launched a new clear set of commitments to employees, investors, communities and society. The focus on safety, health, environmental stewardship, sound stakeholder relationships, in particular with government and communities, as well as a commitment to the highest corporate governance standards remained unwavering. It was about aligning the interests of the workforce with those of the shareholders and actions were taken to create the kind of corporate structure that would help to achieve this outcome. At the heart of this was the transfer of full operational accountability for sustainable cash generation to regions, supported by the appropriate resourcing of the regional management teams.

All employees were encouraged to act as entrepreneurs, which included identifying opportunities for innovation to continually improve the ability to generate positive cash flows and to create value for all key stakeholders (GF 2012).

In 2013 the safety and wellbeing of employees remained a priority and the promise that "if we cannot mine safely, we will not mine" remained in pursuing 'Zero Harm'. Gold Fields remained determined to demonstrate that gold mining could be carried out at less risk to employees, bearing in mind that mining has inherent risks to health and safety. It was required to minimise risks to levels that were more acceptable to all stakeholders (GF 2013).

In 2014 the Board continued to drive the achievement of 'Zero Harm' as a reality at the operations. Safety would always be management's first priority in running the operations and it was critical that it continuously be emphasised that the first value was "if we cannot mine safely, we will not mine". This reflected the need to minimise any potential negative impact on people, maintain operational continuity and protect the company's reputation. It was important to maintain the social licence to operate (GF 2014).

In 2015 the Board continued with the vision of the achievement of ‘Zero Harm’ at all the operations. Safety was management’s first priority in running the operations, and it was critical to continuously emphasise the first value ‘if we cannot mine safely, we will not mine’. This reflected the need to minimise any potential negative impact on people, maintain operational continuity and protect the company’s reputation (GF 2015).

In 2016 Gold Fields was encouraged by the progress made in terms of the overall safety performance during year. The safety, health and wellbeing of employees and contractors was a priority of the Board and management. Safety was management’s first priority in managing the operations, and it was critical to continuously emphasise that it was the first value that “if we cannot mine safely, we will not mine”. The work on safety was integral to the operational discipline and was accepted as the foundation for improved performance. There was no conflict between pursuing safety and productivity at the same time.

The Gold Fields Values underpinned how business was conducted in order to retain the regulatory and social licence to operate. The fundamental components included to have the right assets in the right locations; the right people to deliver, and a culture of good governance, which includes strict regulatory compliance and sound management of the company’s impacts (GF 2016).

3.3 Company strategy

In 2002 Gold Fields developed a strategy, which was premised on the three basic pillars including: Operational excellence, growing Gold Fields and securing the future. The company was committed to the concept of a simple head office structure where decentralisation to regional executive committees and mine management teams took local accountability and appropriately skilled teams closer to each job. The corporate functions remained focused on delivering expertise and thought leadership that built a common culture for the globalising workforce. It also provided the expertise to ensure well-communicated policies, effective internal processes and controls, and the maintenance of standards through a supporting rather than management role (GF 2006).

In 2007 operational excellence was the Gold Fields' strategy for optimising performance from existing operations. Its objective was to enhance shareholders' return on their current investment by sustaining healthy margins through improving revenue and effective cost control. This was accomplished by enhancing the quality of mining, productivity and sound cost control.

Securing the Group's social and legal licence to operate in a rapidly changing international environment depended on ongoing transparent engagement with all stakeholders, including regulators (GF 2007).

In 2008 the Board reviewed the Gold Fields strategy for its appropriateness after the South Deep shaft incident where nine employees died when the vent hole raise conveyance in which they were travelling became dislodged and fell more than 60 metres. It was concluded that the broad strategy remained robust and appropriate, but a number of strategic adjustments had to be made.

The most fundamental of these adjustments was the step change in the approach to safety. The Gold Fields Board committed to making mining safe and as a consequence a number of projects were launched that would set Gold Fields on a new 'high road to safety'. Safe production was the only way forward.

The Gold Fields Occupational Health and Safety Policy provided strategic guidance as to the intent and actions that were required throughout the organisation to support this commitment. "We will not mine if we cannot mine safely", signified the unwavering commitment to the safety of the people. It was a critical requirement for the company to achieve rapid and sustained improvements in health and safety (GF 2008).

The company intensified the focus on accelerating the pace of safety improvements with a consolidated approach deployed to pursue rapid and sustainable results through a holistic programme of interventions as shown in Figure 1.

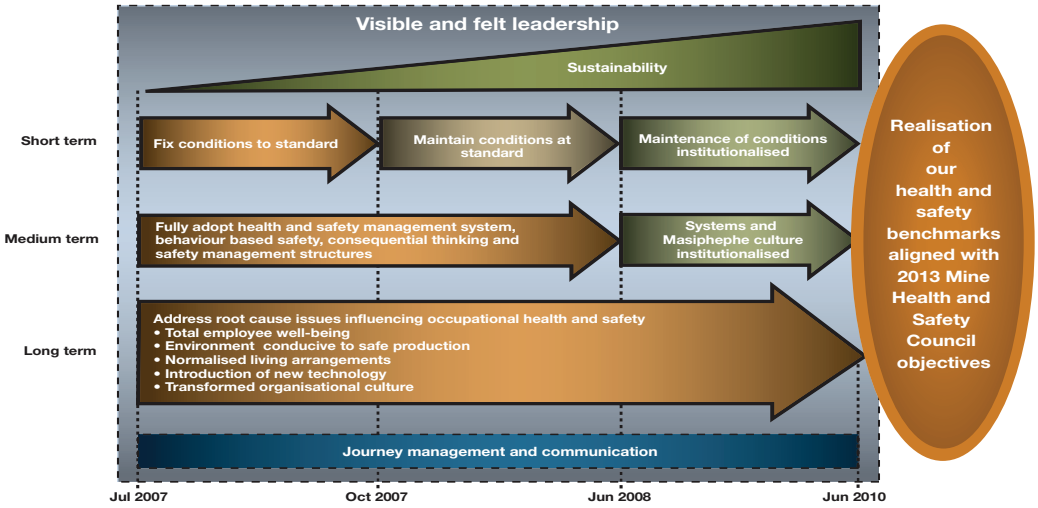


Figure 1 Health and Safety strategy (GF 2008).

It was Gold Fields' belief that this strategy of parallel interventions in the short, medium and long term would deliver the expected and desirable outcome as shown in Figure 2. The process was viewed as being dynamic and subject to continual review, thereby affecting a process of continual improvement at all levels of the organisation.

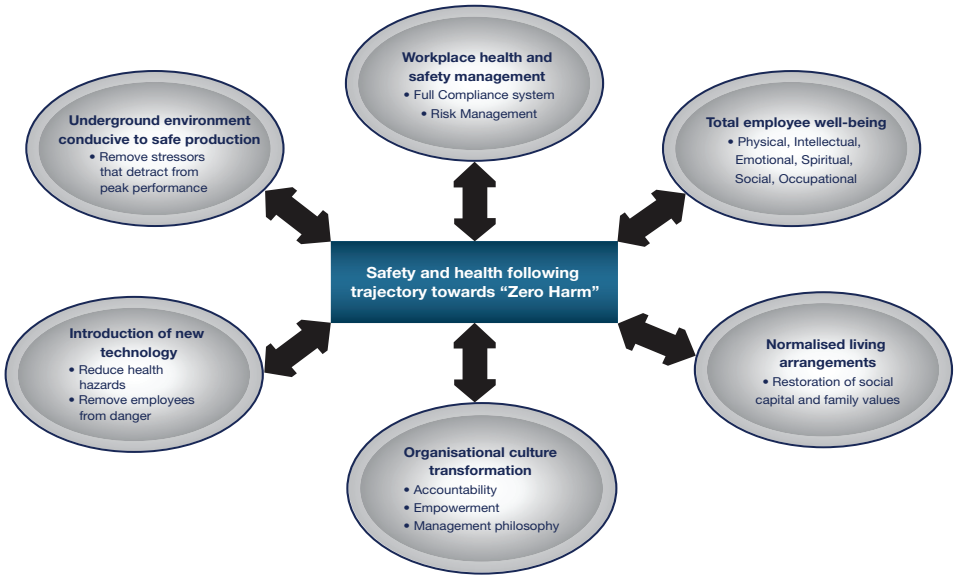


Figure 2 Trajectory to 'Zero Harm' (GF 2008).

In the short-term, there was an intensive focus on remediating physical conditions and undertaking refresher and new training. This approach included the stopping of work and re-training mining and support crews regarding safety and expectations around conditions in the underground environment. Once the re-training was completed, the crews, supervisors and safety staff audited workplaces. Other short-term risk control interventions included the assessments of physical conditions, as well as:

- Plans to address any potential or real deviations from planned arrangements including any refresher training that may be required;
- Monitoring and measurement processes to allow for assessment of performance against said arrangements;
- Processes to institutionalise the sustainability of conformance.

In the medium term, the safety management systems were designed around five key elements, which included the identification of hazards, assessment of risks and to institute remedial action. The establishment of procedures and standards that reduced risk to tolerable levels followed it. Other initiatives included:

- Training employees in the correct use of the procedures and standards;
- Supplying resources required for employees to implement procedures and standards;
- Monitoring compliance to procedures and standards;
- Institutionalising the safety management systems with full ownership from all employees, and
- Targets of conformance were set to provide a benchmark against which the performance could be monitored.

The long-term initiatives included a proactive response to significant root causes that might give rise to poor health and safety performance. This focus represented unique challenges that needed to be addressed to ensure success in the vision of long-term sustainability of performance.

Empowering people was the key element with regard to producing an incident free work place, managing the working environment and utilising effective systems and processes complements this.

The DuPont review informed the Group of the changes necessary to further improve the health and safety systems. The process of continual review was integrated into all levels of the structure and afforded the appropriate level of governance, which included a corporate review every two week, chaired by the Chief Executive Officer.

During 2010 Gold Fields achieved a second record safety year in succession with appreciable improvements on all important safety indicators. Gold Fields reached a turning point after several years of declining production and despite a number of unplanned safety-related production stoppages during the first half of the year. The operations achieved a new level of stability, predictability and consistency, which established a platform for an improved performance going forward and was a solid base from which it was expected to see further production improvement in future. The consistency in safe production was underpinned by the following strategic interventions:

- A further 25 per cent improvement in key health and safety statistics and a reduction in the number of unplanned safety-related mine stoppages or closures;
- An improvement in engineering efficiency, equipment utilisation and planned maintenance across all mines in the region;
- A comprehensive business process re-engineering programme aimed at realising maximum operational potential in conjunction with optimising both direct shaft costs and off-site overheads to deliver planned gold output at an overall notional cash expenditure margin of 20 per cent on a sustainable basis;
- Maintaining the momentum in production build-up, capital development and infrastructure installation at the South Deep project;

- A strong focus on performance management, skills development and competency training, and
- Continued focus on productivity improvements, technology and mechanisation implementation and the effective management of energy and utilities consumption into the future (GF 2009).

In 2012 the unbundling of Gold Fields delivered benefits in terms of management focus, agility and risk exposure. Despite the lower company risk profile, Gold Fields still reported a fatality at South Deep. The operations had long fatality-free track record before the incident. The Board asked management to refocus its efforts despite what appears to be a 'safer' operating environment.

The safety strategy was revamped due to the realisation that the working culture within the operations was starting to hamper efforts to improve the health and safety performance. It was based on:

- Engineering-out risks;
- Compliance with standards and procedures;
- Embedding the health and wellness programme;
- Cultural transformation, and
- Alignment with stakeholders, particularly government and trade unions.

Self-discipline, responsibility and a sense of mutual respect were essential components of any safety management programme (GF 2012).

In 2014 Gold Fields restructured the corporate, regional and operational management to be fit-for-purpose. It was a key compliance issue for the company to maintain safe and healthy working conditions. The Group intensified the operation-specific health and wellness programmes, focusing on improving the physical and mental health of the employees (GF 2014).

The regional operations were required to implement health, safety and wellness strategies, together with associated action plans, which in turn defined relevant management structures, resource allocations and reporting requirements. The

strategies addressed at least the following aspects: Occupational safety; Occupational health; Employee wellness; Community health, and Wellbeing.

3.4 The transformation of Gold Fields

In 2009 the regionalisation of the mines, which aimed at transforming Gold Fields from its centralised structure to a more dynamic, networked structure, was implemented. The South African operations were building-up to greater accountability and responsibility for their operations and growth ambitions (GF 2009).

The separation of the corporate and the South African regional offices was completed. The South African regional team was housed together in its own separate regional office, closer to the South African mines on the West Wits Line. This separation resulted in a greater focus by the South African team on the main strategic initiatives that were being put in place at the various South African operations, while the more streamlined corporate office was better positioned to execute its mandate of Group related functions. The corporate office was by then half the size that it was in the past (GF 2009).

In 2012/13 the transformation of Gold Fields aimed to turn the company into a focused, lean and globally diversified gold mining company that generated significant free cash flow and provided investors with superior leverage to the price of gold. It involved a strategic trade-off between production volume and production quality. The rationale behind the ambitious efforts was to move away from the pursuit of ounces of production and refocusing on driving margins and cash flow (GF 2012-2013).

One of the consequences was that Gold Fields moved from being one of the world's longest-established gold-mining 'majors' to what was a mid-tier operator. It was better focused, more coherent and a modern production portfolio. Gold Fields enjoyed a cost-effective, focused, flexible and fit-for-purpose management structure that was appropriate to both the size and strategic priorities as a result of

the corporate re-organisation. Managers and employees were encouraged to act like dynamic, engaged owners, and were rewarded for doing so.

The removal of the mature, deep and labour-intensive mines from the production portfolio and the conversion to a medium-sized, fully mechanised mining company materially reduced the overall safety risks faced by the workforce. The proportion of employees working underground and being exposed to the significantly higher safety risk reduced substantially.

Employees who continued to work underground now did so in modern, mechanised conditions that minimised their exposure to safety risks. This included:

- Up-to-date, modern mine infrastructure;
- The immediate physical protection offered by mobile mining machinery;
- The application of remote mining techniques, and
- The use of an innovative de-stress mining methodology to reduce fall-of-ground risks.

The new safety profile was not a cause for complacency, and it presented an opportunity to build on this lower-risk profile and further enhance the efforts to eradicate the residual safety risks associated with the activities. The transformation of Gold Fields focused on five key strategies.

- A new corporate structure;
- Focus on cash not ounces;
- Pursue opportunistic growth;
- Ramp up at South Deep, and
- De-risk the portfolio.

The operational accountability for sustainable cash generation was transferred to regions, supported by the appropriate resourcing of the regional management teams. There was a corresponding rationalisation of the corporate office, which was focused on a relatively narrow set of strategic Group policies and functions. It

scaled down the involvement in activities that was the typical domain of larger, industry-leading companies. The scaling down reduced activities that were the typical domain of larger, industry-leading companies.

As a result of the corporate re-organisation, Gold Fields enjoyed a cost-effective, focused, flexible and fit-for-purpose management structure that was appropriate to both the size and strategic priorities.

The focus on safety, health, environmental stewardship, sound stakeholder relationships, in particular with government and communities, as well as a commitment to the highest corporate governance standards remained unwavering. Gold Fields embraced the Shared Value approach as the key pillar in the efforts to promote sustainable development in the host communities and was rolling out a number of pilot projects at the mines (GF 2013).

In 2014 the transformation of Gold Fields into a mid-tier producer had a profound impact on the profile of the workforce. In order to ensure that integrated thinking was further entrenched in the business, the company introduced four key performance areas, which were: Business optimization; People; Finance, and Social licence to operate (GF 2014).

3.4.1 New model for industry

In 2015 Gold Fields perceived that the South African Mining industry needed a new mining model for the long-term sustainability of the industry. One of the emerging trends was that mining companies were increasingly co-operating in developing and managing gold mines to achieve economies of scale and address (GF 2015).

It would be essential to forge partnerships, with an emphasis on joint ownership, risk management and shared benefits for the mine of the future. It was envisaged that the future leaders would be strategists, focusing on coaching and mentoring, integrated stakeholder management, collaborative decision-making and managing a portfolio of mines. Operating decision-making would be devolved down to mine site level.

A number of technology companies were working on software advances in mining, which could be grouped under the 'Big Data' heading, where data captured by various sources, digitised, analysed and finally leveraged for better decision-making. This had multiple applications for mines, such as geological mapping, geotechnical design, fleet tracking and operator safety. Such technologies would provide the edge to fundamentally change the cost structure and improve safety. However, the mining workforce of the future needed to be highly skilled, specialised and trained in order to meet these technical challenges (GF 2015).

3.5 Governance

3.5.1 Safety, Health and Sustainable Development Committee

The company was committed to the achievement and maintenance of world-class standards in the management of the health and safety of its employees and the environment. The Health, Safety and Environment Committee, which was established as part of the corporate governance process, was reconstituted in May 2007 to become the Safety, Health, Environment and Community Committee. It was renamed as the SHEC Committee in 2008 (GF 2008-1).

The SHEC committee members were selected on the basis of their considerable experience in the field of sustainable development with the majority of independent, non-executive directors. All sustainable development matters, other than ethics and corporate governance issues, were reported to the SHEC Committee who played a pivotal role in assisting the board and their responsibilities. The Committee had formal terms of reference and assurance checklists were developed to provide operations with a yardstick for conformance. Other responsibilities included:

- The oversight of the effectiveness of the company's environmental, health and safety programmes;
- To keep the board informed in regard to the company's objectives, compliance with and maintenance of standards in these areas;

- Seeked to minimise health, safety and mining-related accidents within the Group;
- To ensure that the Group's operations complied with all environmental regulations, and
- Established a company policy in respect of HIV/Aids and health matters.

The Safety, Health, Environment and Community sub-committee was subsequently renamed to the Safety, Health and Sustainable Development Committee (GF 2008).

3.5.2 Risk Management Policy

The Gold Fields approach to risk management was guided by its Group Risk Policy. The policy required consistent and systematic risk assessment and reporting procedures across the Group.

The Board, via the Audit Committee, was ultimately responsible for the overall system of risk management. The committee strengthened the corporate risk management function and continued to monitor measures to mitigate existing risks and identified new risks on an ongoing basis (GF 2008).

4 Systemise activities required to achieve ‘Zero Harm’

4.1 Sustainable Development Framework

In 2006 the Gold Fields’ strategy was to ensure the sustainable growth of its business by focusing on operational excellence and securing its long-term future, by maintaining both the social and legal licences to operate. The primary objective was to secure the best possible returns for its shareholders. However, the long-term expectations of the performance depended on performance in the four cardinal areas of including economic, corporate governance, environmental and social issues (GF 2006).

Previously Gold Fields aspired to entrench the application of the core principles of sustainable development through direct and indirect projects and processes. It was achieved mostly without reference to an integrated framework. It was believed that sustainable development should at all time be a co-operative effort if it was to succeed. The company therefore developed and invested in partnerships and engagement processes because stakeholder relationships was about fostering a sense of mutual respect built on a real understanding of all circumstances affecting all parties.

During 2007 the board adopted the Gold Fields Sustainable Development (SD) Framework within which Group management and employees would operate as shown in Figure 3. Sustainable Development was achieved through peer groups with members who were acknowledged experts in the respective subjects and to ensure that intellectual capital was retained. The peer groups revised policies and developed strategic objectives and associated practical guidance. The objective of the approach was to ensure that the principles and practical guidance contained therein were cascaded back into the operational entities (GF 2007).

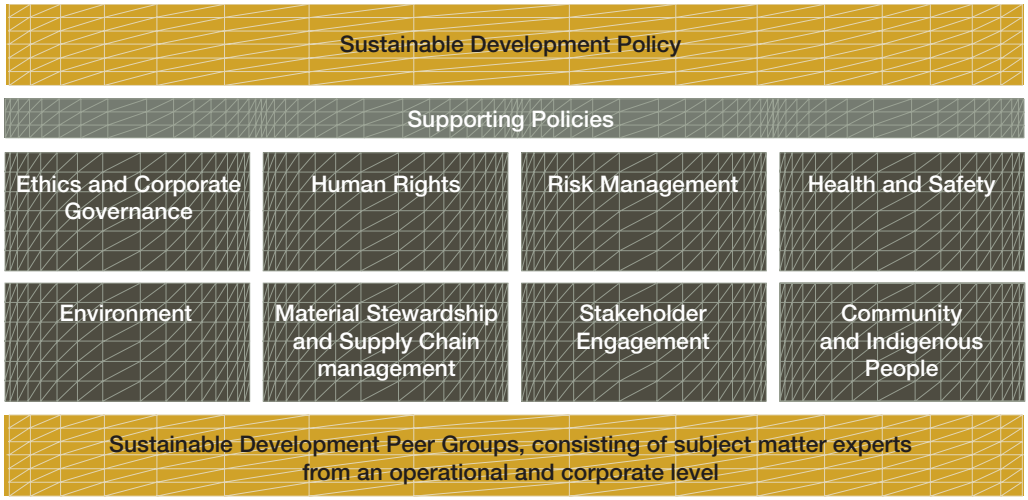


Figure 3 Sustainable Development Framework (GF 2008).

Gold Fields integrated sustainable development considerations into the corporate and operational decision-making processes of the organisation in order to achieve the objective of operating in a manner that represented a platform for responsible investment. The company strived towards achieving an appropriate balance between the Group's requirements to perform financially, achieve world-class standards in environmental management, and the desire and need to ensure broad social benefit.

Sustainable Development was managed by a Steering Committee, which was responsible to report progress to the Sustainable Development Executive Committee. The Safety, Health, Environment and Community (SHEC) Committee was responsible for guiding the implementation of strategy, management and reporting systems across the Group.

In 2008 the SD Framework was implemented within the organisation through the integration of the sustainable development requirements into the performance management system of the organisation. This performance management system effectively consisted of targets, which employees aimed to achieve and served to measure employee performance and provided guidance for incentive and reward. These contractual arrangements were secured through a Balanced Score Card, which was designed around the overall Gold Fields company strategy.

The SD Framework became a series of values that were entrenched throughout the strategy. This was done in order to ensure that the growth component of the strategy was undertaken with due regard to sound principles of sustainable development. The ultimate objective was the securing of the future by embracing the holistic concept of sustainable development within all activities. The framework was incorporated into the induction processes whereby all new employees, employees returning from leave, and contractors, were exposed to the Framework and were made aware of their responsibilities. The final component of the strategy was to implement scenario planning for sustainable development, which would inform any changes that might need to be made to the baseline in order to position the company appropriately. This triggered a requirement to further refine the culture within the organisation. It was believed that sustainable development was largely an evolutionary process within the organisation.

Sustainability was also introduced as a specific element in the new company vision statement, which was to be the global leader in sustainable gold mining. Sustainable development was viewed as:

- A balance between the optimal financial and operational performance of the Group;
- Maintaining of world-class environmental management standards, and
- Contributing meaningfully to socio-economic benefits for the communities in which the Group operated.

The SD Framework was improved, and a wide range of projects was undertaken at the mines to further enhance their sustainability. The mines that Gold Fields developed at the time typically had a ten to 50-year horizon and their success could only be ensured through investment in their long-term sustainability. A mine's successful operation was inextricably linked to:

- The skills and expertise of the people employed;
- The companies with which business was done with;
- The safety of the operations, and

- The nature of the relationships that was built with neighbouring communities and governments.

A careful consideration of sustainable development was critical for the global mining sector as historically the mining industry's social and environmental legacy was not always a positive one. Gold Fields needed to ensure that its impact was beneficial, economically, socially and environmentally. This remained a key responsibility for the managers and executives of the company and informed the business decisions made regarding safety, people, communities, the environment and the evaluation of new investments (GF 2008).

During 2010 the sustainable development framework incorporated best practice policies that were consolidated into eight pillars of sustainable development and refined to meet the operational needs. These included:

- Occupational health and safety;
- Human rights;
- Ethics and corporate governance;
- Risk management;
- Environment;
- Material stewardship and supply chain management;
- Community and indigenous people, and
- Stakeholder engagement.

While the operational roll-out of these policies and principles was the responsibility of management within each project or operation, the Safety, Health and Sustainable Development Subcommittee of the Board, supported by Sustainable Development managers in each region, monitored the Group's overall sustainable development performance and drove the ongoing sustainability strategy (GF 2010).

During 2011 a significant amount of work took place to improve the sustainability of Gold Fields. Leadership in sustainable gold mining was about effective risk management and 'business sustainability'. The company developed and

implemented fully integrated strategies at operational, regional and Group-level to ensure Gold Fields identified the risks and opportunities that faced the business. The risks were managed in a way that supported long-term profitability and ensured the long-term sustainability of the business. This included the commercial, technical, environmental, economic, social and political dynamics facing Gold Fields and the interrelationships between them (GF 2011).

Gold Fields operationalised Sustainable Development by integrating broad sustainability measures into the balanced score cards of key decision-makers within the organisation. Shorter-term goals around production and cost performance and decisions were made on the basis of the company's longer-term, 'holistic' performance.

4.2 Health and Safety Management System

The Gold Fields Full Compliance Health and Safety Management system, guided by the principles of OSHAS 18001, was designed to meet legislative requirements and was implemented at all the operations. Scheduled surveillance audits ensured that continual improvement measures were implemented and maintained. Regular internal audits were conducted at all operations to consider the day-to-day effectiveness of health and safety management systems.

Independent auditors were engaged to conduct OHSAS 198001 certification audits of Kloof, Beatrix and Driefontein. All three operations were recommended for certification. South Deep was to be audited in preparation for OHSAS 18001 certification by June 2008 (GF 2007).

During 2008 the OHSAS 18001 certification was maintained following two external surveillance audits. These audits included an assessment of conformance to the standard as well as measuring the process of continual improvement.

The Full Compliance Health and Safety Management System was revised and took into consideration the then recent multiple fatal accidents, lessons learnt from the investigations and the outcomes of the audits conducted. Each operation

submitted new health and safety plans to serve as the foundation for a more holistic approach to workplace safety. It included employee well-being and long-term improvements in the conformance levels to the Full Compliance Programme as well as the review of the risk rating of each work area. The frequency of Full Compliance Audits on all mines was increased to at least one full audit per year. It was planned to do these audits quarterly or half-yearly until the required level of compliance was achieved (GF 2008).

During 2009 a review of the Gold Fields Full Compliance audit system was carried out which resulted in the modification of the audit protocol and full implementation of a self-audit system for each site (GF 2009).

By 2010 the OHSAS 18001 Safety Management System was a Group standard within Gold Fields as well as a certification requirement. External OHSAS 18001 compliance audits were conducted, and certification was maintained.

The executive team considered each fatality as a fundamental failure of the safety systems. The singular focus on injury prevention resulted in a record safety year with significant improvements in most safety indicators for the second year in a row. Employee behaviour and the adherence to safety standards and norms still needed a quantum shift (GF 2010).

In 2012 all the operations were certified to the OHSAS 18001 International Safety Management Standard. In 2013 Gold Fields continued to seek continual improvement by building on the existing OHSAS 18001 compliant safety management systems (GF 2012).

In 2014 Gold Fields remained committed to eradicating residual safety risks by instituting further safety management initiatives. It included the integration of a Health and Safety Management System into the new induction processes introduced at South Deep, following the major review process as well as the standard induction process (GF 2014).

In 2016 all of the Group’s operations were re-certified to the OHSAS 18001 health and safety management system standard. The work on safety and wellness

was integral to the operational discipline and was accepted as the foundation for improved operational performance. There was no conflict between pursuing safety and productivity simultaneously. Gold Fields remained vigilant and continued to introduce and monitor proactive measures to build on progress made in the safety performance (GF 2016).

4.3 Enterprise Risk Management

Gold Fields had an Enterprise Risk Management (ERM) process which enabled the company to become more resilient in the global business environment and achieve the highest levels of corporate governance. The company believed that effective and integrated risk management, aligned with ISO 31000 as well as compliance with the risk management requirements of South Africa's King III Code, was essential to achieve business sustainability. The ERM covered operational, business, environmental, social, health and safety risks and comprised of operational risk management and strategic risk management.

The Mining Industry Underwriters that surveyed the operations confirmed continued improvement in risk management at Gold Fields as all of the mines were placed in the top quartile of the approximate 400 mines assessed.



Figure 4 Risk management process (GF 2012).

The multi-stage strategic risk management process, as shown in Figure 4, included quarterly strategic risk management assessments at each mine. The resultant top 10 risks and mitigation actions were subsequently presented to members of the Executive Committee (ExCo).

Regular operational risk assessments were conducted to ensure compliance with standards set by the Safety in Mines Research Advisory Committee (SIMRAC). The Group Risk Manager extracted all of the top risks from the regional and operational registers in line with the tolerance levels and compiled the Group risk register as shown in Figure 5. The risks were then assessed and moderated in a Group context by the relevant risk owners and ExCo members. A top risk register review was conducted, and Group-wide mitigating strategies were set and monitored during the ExCo Risk Meeting. The Audit Committee conducted a review of the top risks twice a year (GF 2012).

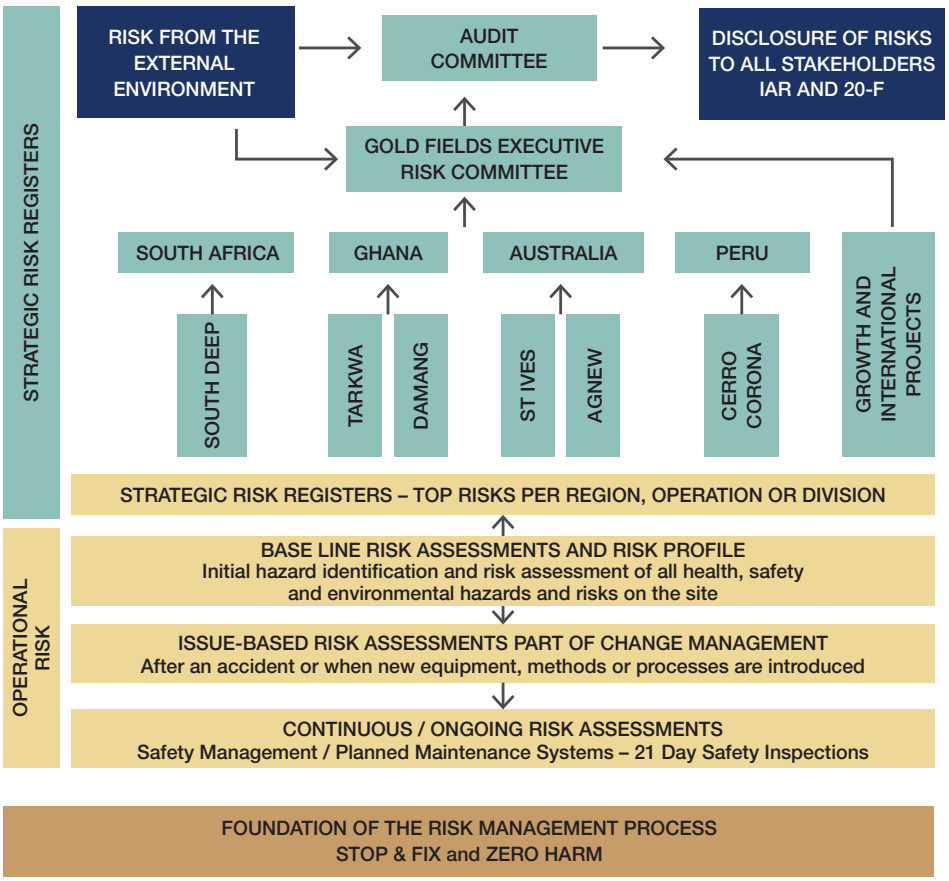


Figure 5 Risk management process (GF 2012).

Appendix D: Gold Fields

In 2006 Gold Fields utilised conventional risk assessment methodologies, which considered the severity of a risk, the probability of its occurrence and the effectiveness of control measures already in place. The risk management structures, system and capacity were expanded to reflect the increasingly globalised nature of the Group's operations. It was expected that it would result in a broader development of a risk management culture at all levels of the Group's operations (GF 2006).

The risk register compilation process was changed to focus more on the role of the individual operations in the identification of operational and strategic risks, which required management and mitigation strategies. Operations were required to review the risk register at least twice a year.

Operational management were required to integrate the identified risks into their strategic planning sessions and their control programmes and to report on the management and mitigation strategies of identified key risks to regional and corporate management. The updated site risk registers were collated at corporate level and the key risks prioritized for the company. The risk assessment process continued to highlight various key risks that could affect Gold Fields as it expanded globally.

In 2007 it was intended to broaden the development of a risk management culture. The risk management system was incorporated into the strategic planning process to avoid possible gaps between the two processes and to ensure integration. This consolidated risk management systems became a management decision making rather than an administrative tool (GF 2007).

An internal review was conducted of all risk mitigating strategies contained in the risk registers that were submitted in order to assess progress made in implementing risk mitigating strategies. The review took the form of a complementary gap analysis to avoid duplication of the work done by processes such as the Sarbanes-Oxley audits, internal audit and ISO 14001 and OHSAS 18001 certification audits. It indicated the increased complexity of the deep-level operations that required more effort in dealing with their risk profile.

Gold Fields commissioned an external benchmarking exercise to compare its risk management approach and management's attitude to risk with that of its global mining peers and global enterprises. The findings of the survey implied that risk management in Gold Fields was in line with global enterprises and the attitude to risk was less tolerant than that of the global mining average. The application of the risk management strategy contributed greatly to the successful risk management practice.

The survey also showed that there was greater accountability, involvement and focus on risk among the Gold Fields board, Chief Executive Officer, Chief Financial Officer and line management, than that perceived at the global mining and corporate companies. It was believed that Gold Fields had a risk awareness culture that was embedded throughout the organisation.

The risk identification process and the alignment to the corporate objectives and the lack of appetite for risk-taking were also some of the successes identified. Gold Fields was comfortable that the risk management remained a dynamic process and the approach to risk was appropriate to that of a growing global company (GF 2007).

In 2008 risk registers from all operations were produced by their respective management teams and reviewed by the Group Risk Management Division. The process of compiling the risk registers was used to strengthen the role of risk management within broader operational management. The intention was to achieve a more informed, pro-active way of risk management and mitigation (GF 2008).

In 2009 Gold Fields strived to manage risk effectively in order to protect the company's assets, stakeholders, environment and reputation and to ensure achievement of the business objectives. The aim was to achieve a fuller understanding of the reward/risk balance and pursued actions to reduce the likelihood and consequences of adverse effects to acceptable levels and to achieve continual improvement in the management of risk, thereby enhancing the degree of certainty. The Incident Causal Analysis method was a 'blame-free' system

which was used to assist in identifying the root causes of safety incidents to avoid repetition and promote accident prevention (GF 2009).

4.3.1 CURA risk management software

In 2008 CURA, an electronic risk management system, was implemented to assist in meeting the generic guidelines for the principles and adequate implementation of risk management set out in ISO 31000 (GF 2008).

In 2009 the CURA risk management software solution was used to analyse all the risk registers. An auditing function was added to the existing software in order to conduct ongoing internal assurances that mitigating strategies for risks were receiving the required attention. An internal controller on each operation conducted the audits. The Top 10 risks were extracted directly from CURA and presented for each operation and service division during the Executive Committee strategic management planning and review (GF 2009).

In 2011 CURA required the installation of a new database, the modification of the risk matrix, training for system users and the incorporation of risk management into individuals' balanced score cards, in addition to safety (GF 2011).

4.4 Standardised health and safety record database

During 2009 the Gold Fields international operations committed to use a single standardised health and safety record database. The Cintellate system, which was expanded to incorporate health, personal fitness and disease control data, was selected as the most appropriate platform (GF 2009).

In 2013 Gold Fields aligned its health and safety metrics with those of the ICMM. The total recordable injury frequency rate (TRIFR) was used as a key metric for the Gold Fields' peer companies to assist with benchmarking the Group performance against the wider sector (GF 2013).

5 Humanise the business systems

5.1 Engaging employees on issues of safety

Management, employees and contractors all played a crucial role in achieving health and safety goals. Employees were represented at various levels on health and safety committees and on a range of statutory and voluntary engagement forums between supervisors, line managers and organised labour. General health and safety topics were also covered in formal agreements with trade unions. Gold Fields initiated a tripartite forum between the company, government and labour.

In 2010 Gold Fields was aware that the realisation of the safety objectives would materialise only as a result of a sustained and ongoing effort. This objective, which was the number one priority in the company, could only be achieved if a tripartite approach to change involved every employee in the organisation. The tripartite arrangement included the leadership of the unions and employee representative bodies, and the government. The key stakeholder groupings realised that Gold Fields was serious about placing safety ahead of production and that the company was willing and able to make bold and courageous decisions when it came to ensure that no harm comes to any of the people (GF 2010).

In 2011 the company conducted operation-level Indabas for two-way safety discussions between overseers, supervisors and crews, as well as the development of defined action plans. Monthly ‘Shaft Communications’ for operations and underground managers were held to engage the entire workforce.

A total of 97% of employees in South Africa were represented through their unions at various levels on joint health and safety committees and on a range of statutory and voluntary engagement forums between supervisors, line managers and organised labour. The ability to promote safe production was supported by the active involvement of the employee representative organisations and unions, host governments and regulators. This included the DMR, which continued to provide valuable guidance on how to improve the safety performance and meet their Mine Health and Safety Council health and safety milestones (GF 2011).

In 2012 the company placed increased emphasis on engagement with employees' unions, the DMR as the key regulator and source of guidance, and other stakeholders in the safety management process. Gold Fields held a Health and Safety Summit involving representatives from the national, regional and branch levels of the Solidarity, UASA and NUM trade unions, as well as representatives from the DMR.

It was agreed that all parties would cooperate in the efforts to carry out social surveys across all of operations to help inform and improve the future safety and health management efforts. The summit established a strong and broad mandate for the safety management efforts to implement enhanced safety enforcement measures across the operations. This confirmed strong consensus around the updated safety strategy as well as collaborative work on key initiatives such as the management of fall of ground incidents, rail-related accidents, and dust and noise exposure (GF 2012).

In 2014 the company engaged with employees to reinforce a robust health and safety culture on-mine and the implementation of safety strategies including behaviour-based safety programmes. The management and the trade unions reached agreement on changes to the shift roster to facilitate the optimal re-deployment of employees to further improve productivity (GF 2014).

5.2 Safety culture

There was a significant strengthening of the safety culture in Gold Fields after the 2008 watershed in the approach to safety, with the commitment that *"if we cannot mine safely, we will not mine"*. This was bedded down as the single most important value, and the foundation of the Gold Fields culture (GF 2008).

The Chief Executive Officer went on a road show to all operations in South Africa to promote the new health and safety culture and encourage the buy-in from 55 000 employees at all levels in the organisation. A significant improvement was achieved in the pursuit to ensure a culture where the safety of everyone at Gold Fields was of the utmost importance. The operations embarked on a training

project around cultural safety change and the development of personal values for safe behaviour using qualified psychologists. Systems, rules and procedures, personal beliefs and values largely directed behaviours (GF 2008).

In 2009 the company understood that the safety culture and performance had to change radically. The commitment to eliminate all serious and fatal accidents on the mines and that *"if we cannot mine safely, we will not mine",* was reconfirmed by the board. The objective was to achieve a 'Zero Harm' working environment for all of the people. All the stakeholders including contractors, suppliers and unions embraced the new safety philosophy.

Gold Fields commissioned the services of DuPont to undertake a comprehensive review of the safety practices in the company, which included the assessment of management systems, culture and safety improvement objectives. The assessment included a safety perception survey, which covered a third of all employees and took the form of structured interviews, was utilised to uncover the internal beliefs and perceptions around safety (GF 2009).

In 2010 the follow-up health and safety audit by DuPont indicated a significant improvement in the overall safety culture, which implied that the efforts to boost safety on a sustainable basis were delivering results. It established that the various programmes resulted in a greater maturity in the approach to safety and served to entrench an improved safety mindset within the company.

The assessment showed that good progress was made towards establishing a culture where safe production and 'Zero Harm' were reflected as a standard way of working. The first value, 'if we cannot mine safely, we will not mine', was thoroughly entrenched throughout the company. The review also identified a number of areas for further improvement and appropriate interventions were implemented.

A fundamental requirement of a safe mining culture was full compliance with safety protocols, norms, standards and operating procedures. While significant progress was made in the overall safety performance since 2009 there remained a

number of areas in which a quantum shift was still required which included employee behaviour and adherence to full compliance. Sixteen of the eighteen fatalities that occurred during 2010 were preventable accidents, which resulted from:

- Risky behaviour;
- Non-adherence to established safety protocols and standards, and
- Inadequate supervision and leadership at different stages of the production process.

An enhanced behavioural-based safety programme was designed and commenced roll out for completion during 2011 in order to reduce accidents caused by negligence or non-adherence to standards. The objective was to strengthen the values of personal and collective safety amongst the employees and to ensure that all strictly adhered to the safe production rules (GF 2010).

By 2011 the company promise that "if we cannot mine safely, we will not mine" was integral to the safety culture and was acted upon on a daily basis. The ‘Stop, Think, Fix, Verify and Continue’ approach encouraged employees to stop work wherever there was a risk to health or safety and to examine if there were alternative, safer ways to continue mining. If there was no safe alternative, no mining would take place rather than put the teams at risk. Since 2008 Gold Fields wrote off about 2 million ounces of high-grade reserves, despite the economic cost and considerable expenditure incurred on engineering-out risks, as part of the risk management process.

Gold Fields actively countered perceptions around the ‘latent’ dangers of underground gold mining through the promotion of a ‘Safe Production Mentality’. It was based on instilling the belief amongst employees that mining could, if approached in the right way, be carried out without the need for exposure to risks. It was supported by the ongoing enforcement of the Safe Production Rules, as well as constant promotion of the ‘Stop, Think, Fix, Verify and Continue’ practice (GF 2011).

In 2012 Gold Fields implemented a cultural survey at the Beatrix and KDC mines, which was completed by 12 184 employees which was approximately 30% of the workforce. The survey was aimed at assisting safety cultural transformation and helped to understand the key determinants of workplace culture across all levels and functions. This included the examination of national and regional cultural dynamics, specific human dynamics and collective engagement relationships. The key findings from the survey indicated improvement opportunities including:

- The ability of supervisors to interact effectively and constructively with workers;
- Vertical and horizontal communication between employees, and
- Culturally sensitive performance management with respect to the treatment of under and over performers.

The results of the survey helped efforts to implement relevant interventions under South Africa's sector-wide Cultural Transformation Framework coordinated by the Chamber of Mines of South Africa. The framework, which was to be implemented over a two-year time frame, focused on:

- Enhanced collective leadership performance;
- Risk management;
- Incentivising;
- Implementation of best practice;
- Promotion of respect in the workplace, and
- Ensure that all relevant standards articulated by the Chamber of Mines and agreed to by stakeholders were met.

Gold Fields integrated the Chamber of Mines cultural transformation and internal safety engagement pillars into the Safe Production Management Strategy. Other initiatives included enhanced safety enforcement measures, including increased resourcing (GF 2012).

In 2013 Gold Fields continued to work with external experts to embed a safe mining mentality through on-the-job coaching. The programme was implemented by skilled employees who were trained in risk facilitation, risk assessment, identification of high-risk behaviour, coaching, and the analysis of critical behaviour.

These teams visit all de-stressed areas on an ongoing basis and focused on improving workplace competency, reducing high-risk behaviour, improving team work, and revising current working methods.

Safety audit teams visited each mine area every 21 days to ensure adherence to mine safety standards. The efforts to promote a safe mining mentality were further supported by the election of full-time health and safety representatives at South Deep.

Managers and employees were encouraged to act like dynamic, engaged owners, and were rewarded for doing so. It was about aligning the interests of the workforce with those of the shareholders. Steps were taken to create the kind of corporate structure that would help to achieve this outcome. All employees were encouraged to act as entrepreneurs, which included identifying opportunities for innovation to continually improve the ability to generate positive cash flows and to create value for all key stakeholders.

Gold Fields continued to implement a ‘cultural transformation’ programme in 2014 based on the COM approach, which included:

- Manager self-assessments on safety and health leadership;
- Employee engagement surveys;
- Safety focus groups, and
- A 360° safety leadership survey for all levels of leadership (GF 2013).

In 2015 the company continued to entrench a high-performance culture that encouraged people to meet and exceed their performance targets. A work environment was maintained to support optimal functioning and to ensure that employees were safe, healthy, balanced and productive (GF 2015).

5.3 Behavioural Safety

In 2006 Gold Fields realised that amid productivity drives and other workplace initiatives, it was often difficult for individuals to maintain a consistent state of safety vigilance. It was believed that human nature could be influenced to the stage where behavioural changes were achieved to a level where the likelihood of accidents and incidents could be reduced by constantly innovating, creating an enabling environment and management leadership by example. The company continued to explore ways in which this could be achieved, in conjunction with unions (GF 2006).

In 2007 several safety behaviour-based interventions and team-building initiatives were dedicated to coaching safety awareness and consequent behavioural change to limit injury by highlighting the need for pre-emptive safety action. It included:

- Laphuma-Ilanga at Driefontein;
- Eyethu at Kloof;
- Bompodi at Beatrix, and
- Fall of Ground campaign as well as the 'Courageous Leadership' at South Deep.

Specific high-risk hazards at Kloof and Beatrix were being addressed through the 'Snakes and Big Five'; 'Wars on Falls of Ground' and Khuseleka campaigns which were reinforced through the use of industrial theatre (GF 2007).

In 2008 DuPont was tasked to assess the existing health and safety management systems at Gold Fields and benchmark them against the international best practices. The audit covered all aspects of the health and safety management systems, strategies and plans, and also included a perception study with a sample size of 30 per cent of all employees across all levels of the organisation. It focused on the following: Leadership, organisation, operations and risk Assessment. Current behaviours, attitudes, practice and procedures were analysed, and a gap analysis conducted for each operation's attention (GF 2008).

In 2015 a number of new initiatives were launched to complement and support the behavioural-based incident-management system, which was the base for the mine's safety campaign. These included:

- Proper start-up procedures through workplace assessments and employees' medical screening;
- Increased visibility underground through multi-discipline audits and management presence;
- The launch of a number of safety enablers, such as competitions and recognition awards;
- A weekly safety meeting at which all incidents are discussed and analysed;
- A compliance system checklist that ensures work was stopped if a workplace was not fully compliant with safety standards, and
- Ongoing monitoring of the top five accident causes and ensuring appropriate measures were in place.

Behaviour-based safety programmes were in place across the company and the work at embedding these into the day-to-day performance, along with visible management leadership on the ground, continued (GF 2015).

In 2016 behaviour-based safety interventions were an ongoing priority at all the operations. Behaviour-based incident management and the strict enforcement of safety standards continued to be the pillars on which the mine relied to improve working place physical conditions and address at risky behaviour (GF 2016).

5.4 Safe Production Management

The outcomes of the DuPont assessments resulted in a Safe Production Management (SPM) project, which commenced with dedicated resources to ensure that the Gold Fields had the optimal health and safety culture and performance in future. It included:

- Leadership training programme for all managers and supervisors;
- Regular workplace inspections and general workplace visits;

- Incorporating well developed root cause analysis principles;
- Process prior to purchase and use;
- Accurate analysis of incidents and target areas, and
- Central risk assessment protocol.

The SPM Programme was principally focused on the prevention of serious and fatal accidents, which consisted of engineering out of safety risks, and to advance compliance by winning the hearts and minds of the people by reinforcing positive behaviour (GF 2009).

The Human Resources discipline played a critical role in bringing about the necessary conditions to progress from a culture of dependence to one of interdependence, engrained in beliefs and values that created the climate and context required for safe production behaviour by all employees. They became a strategic partner to the business in ensuring the successful implementation of the SPM as a pivotal driver for transformation and change in Gold Fields. The architecture of the SPM was founded on five pillars:

- Programme for Safe Production;
- Technical, Engineering and Mine Design;
- People driven outcomes: Cultures. Values and Beliefs;
- Organisational Structuring, and
- Performance Leadership.

5.4.1 Safe production rules

During 2009 the company developed Safe Production Rules (SPR) through a comprehensive analysis of historical serious incidences. The SPR aimed to reinforce the Gold Fields Health and Safety Policy and to pursue the objective of 'Zero Harm'. All Gold Fields employees, business partners and stakeholders had a duty to ensure that the SPR were constantly applied and remained an integral part of work practices and processes. The statement "If we cannot mine safely, we will not mine", translated into:

- Responsibility to understand the risks inherent in the task to be performed;
- Responsibility to withdraw from a dangerous situation;
- Required training, resources and personal protective equipment, and
- Required information to enable the employee to mine safely.

The SPR were integrated into a booklet format distributed to all employees in their preferred languages. The SPR were integrated into the induction processes whereby all employees returning from annual leave, new employees and contractors, were exposed to the SPR, operational safety standards, systems, rules and procedures.

The rules worked hand-in-hand with other initiatives like the 'Stop, Think, Fix, Verify and then Continue' campaign, which had a tremendous impact on employees' safety behaviour and awareness (GF 2009).

In 2010 the implementation of the *Safe Production Management Programme* was consolidated into risk reduction and compliance. This pro-active approach to safety was instrumental in achieving safety performance improvements. The SPR were successfully rolled out to all operations in the group in all relevant languages (GF 2010).

In 2011 Gold Fields continued to implement a range of activities aimed at cascading the Safe Production philosophy throughout the entire workforce. The SPM project assisted to transform the safety mentality of the employees through high quality, two-way engagement. It was vital that the company collectively achieved this transformation, as a significant proportion of serious safety incidents and fatalities continued to result from risky behaviour, non-compliance with standards or inadequate supervision/ leadership rather than factors such as fall of ground.

Safety remained a priority and due to the higher risks posed by the more labour intensive, deep underground operations meant that particular focus was placed on safety management in South Africa. The SPM project was one of the initiatives pursues in the quest for 'Zero Harm' which aimed to achieve a safe mining culture

that was in total compliance with the safety standards and procedures, including the Safe Production Rules.

A Safety and Health Production Management Task Team monitored safety management and performance. The committee included two members of the executive committee and was chaired by the Executive Vice President-South Africa region. The Chief Executive Officer also attended the quarterly SPM project meetings (GF 2011).

5.5 Compliance interventions

In 2011 Gold Fields instituted compliance interventions, which included:

- Implementation of a Priority Safety Disciplinary Case Procedure;
- Increased inspection and audit activity;
- Significant ramp-up in alcohol and drug testing;
- Enhanced Safety Alarm questionnaires to help crews analyse actual safety incidents;
- A Behavioural Safety Programme to encourage safety solidarity between supervisors and crews, and
- A consistent increase in 'Stop and Fix' stoppages by employees which averaged 1 000 per month. It demonstrated the success of the 'Stop, Think, Fix, Verify and Continue' campaign, which was the practical application of the most important value: 'If we cannot mine safely, we will not mine', (GF 2011).

In 2012 safety officers, who were independent and were not involved in day-to-day production and associated targets, planned visits were reduced from 45-day intervals to 21 days. An additional 65 safety of officers were employed at Beatrix and KDC to facilitate this change (GF 2012).

In 2014 Gold Fields remained committed to eradicating residual safety risks by instituting further safety management initiatives. A comprehensive mine-wide review of all safety protocols, procedures and standards was conducted at South

Deep in line with the mandate to improve the mechanised mining culture at the project (GF 2014).

5.6 24 Hours in the Life of a Gold Fields Employee

Gold Fields adopted an all-inclusive approach to the general wellbeing and productivity of the staff. In 2009 a broad range of interventions encapsulated in the '24 Hours in the Life of a Gold Fields Employee' programme was pursued. This programme was based on the Total Well-being Philosophy which was aimed at improving every facet of the life of each employee and included interventions in: Occupational health and safety; Healthcare; Living conditions; Nutrition; Sport and recreation and education (GF 2009).

This inclusive approach, including occupational safety, resulted in co-operation on all safety-related matters from the vast majority of the employees, contractors, leadership of the employee representative organisations and unions at the mines and the government.

In 2010 Gold Fields entrenched its efforts as part of its *24 Hours in the life of a Gold Fields employee* programme to combat the impact of diseases and encouraged a healthy lifestyle. Accidents were more likely to occur if the employees were unwell as a result of occupational and other diseases (GF 2010).

In 2012 Gold Fields implemented a comprehensive fatigue management programme focused on issues such as proper nutrition, prescribed rest periods and control of overtime (GF 2012).

During 2013 Gold Fields significantly increased testing for alcohol and drugs. It included 62 044 alcohol tests compared to 24 006 in 2012. Drugs testing were extended to employees involved in the conveyance of ordinary materials and goods as well as work involving heavy or potentially dangerous machinery. The testing programmes were supported by employee training on the effects and consequences of alcohol and drug abuse, as well as the available support on offer including through the Employee Assistance Programme (GF 2013).

5.7 Incentives

In 2008 the Group's operational bonus system was changed to provide for an equal weighting between production and safety performance. This principle was extended to all executive incentive remuneration, with approximately 30 per cent of executive bonus payments linked to health and safety performance, including that of the Chief Executive Officer (GF 2008).

In 2010 incentivising the employees was a critical component in the achievement of safety targets. It accounted for between a 33 percent and up to 50 percent of their bonuses and incentives (GF 2010).

In 2011 Gold Fields implemented a mine-wide safety recognition programme to actively reward safe behaviour. Relevant safety targets included in managers' Individual Balanced Scorecards determined approximately a third of their variable bonuses and incentives. This helped ensure that the safety policies and guidelines were 'mainstreamed' into everyday thinking and practice (GF 2011).

In 2012 the incentive scheme included a condition that teams would only receive full monthly bonuses in the absence of a single reportable safety incident. It was done to ensure that the scheme did not tempt unsafe behaviour (GF 2012).

In 2015 Gold Fields worked more efficiently to improve productivity due to the restructuring and the smaller more skilled workforce. The key to this was that employees were incentivised to deliver against clearly defined performance targets that directly supported the achievement of business objectives. The remuneration strategy was changed to attract and retain these skills. The people development approach was amended to ensure Gold Fields built a robust internal skills pipeline that could supply the skills that the business needs in the future (GF 2015).

Leading and lagging indicators were included in the analysis of the safety component of the bonus and the achievement of safety targets accounted for 30% of the total bonus paid to teams.

5.8 Training

In 2008 more than 28 000 staff received additional training in various safety programmes. All supervisors were exposed to a two-day intervention at Beatrix focusing on theory and practical exposure of technical skills required to improve their quality of work (GF 2008).

In 2009 a specialised, on-site training facility was established at South Deep, using advanced training packages and electronic simulators to produce world-class underground mechanised miners (GF 2009).

In 2010 general and job-specific health and safety training formed part of induction and was reinforced annually through refresher training. Risk-specific training was also provided where needed (GF 2010).

In 2011 the company rolled out the practice of removing crews, which were experiencing safety problems, from the workface for a day to deliver high quality safety training to all operations. All employees received both general and role-specific health and safety training during induction. This was supported through annual refresher training, risk specific training and regular safety awareness campaigns.

Gold Fields implemented a Supervisory Skills and Leadership Development programme to address a number of skills gaps identified through an internal audit including those relating to safe production performance (GF 2011).

In 2012 it was envisaged that training at South Deep would improve markedly with the completion of the world-class, on-site Trackless Engineering Skills Training Centre in 2013. The new Operator Training Centre was to be fitted with an advanced suite of operator, tele-remote load haul dump and drill rig mesh-handling simulators. Surface driving and mining mock-up areas were to deliver the highest standards of practical mechanised training (GF 2012).

In 2013 following a fatality that took place at South Deep, enhanced safety training for all of underground contractors at the mine was implemented (GF 2013). This included training on:

- Testing for flammable gases;
- Measuring environmental conditions;
- Identifying rock strata conditions that require support, and
- Installing temporary support for drilling and safely removing temporary support after installing permanent support.

In 2014 South Deep reverted to a 7-2/7-5-roster system in part, to address concerns about fatigue-related safety risks caused by the then recently introduced 24/7 12-hour shift system. A five-day training programme supported this transition for each new roster cycle to ensure employees and contractors were sufficiently trained to work safely within the new roster system.

Workers were provided with general refresher safety courses as they returned to work following the Section 54 safety shutdowns as well as role-specific modules. This also included training on the new roster system.

The lack of experienced mechanised mining skills was one of the largest contributors to the delay in the build-up of South Deep and this challenge was underestimated in the past. It was further complicated by the absence of a sufficiently deep pool of mechanised mining skills in South Africa (GF 2014).

In 2015 the skills of operating and optimising of equipment was challenging in a mining culture that was overwhelmingly conventional mining. It was perceived that mining companies and universities would need to work together to develop and train the personnel required in future. The mine of the future would have a high-level skill set that would lead to a smaller overall workforce. This created a dilemma for many gold miners as adjacent communities relied on them for jobs and procurement.

South Deep recruited an additional 164 skilled employees during 2015 mostly from the platinum sector, which had a similar mechanised mining skill set in order to augment the skills base. The recruitment of identified critical skills was 98% completed by the end of 2015 and most of the core mining and engineering positions were filled.

The mining approach towards mechanisation and automation required the recruitment of the appropriate skills at the mines augmented by Gold Fields' own people through focused internal training efforts. An intensified training programme for the existing staff supported this approach (GF 2015).

During 2016 South Deep rolled out four programmes to improve its safety performance, which included (GF 2016):

- Back-to-basics training;
- Hazard identification;
- Risk assessments, and
- Artisan upskilling.

5.8.1 Ensuring a safe return to work after the strike

During 2012 Gold Fields proactively managed the potential safety impacts of strikes at the operations, which resulted in a significant amount of disruption, temporarily impacted working relationships and interrupted routine maintenance work.

The supervisors played a strong role in maintaining constructive safety engagement between the management and crews, whilst roof-bolting at the stope faces minimised the potential deterioration of the workplaces during the strike. The company instituted special temporary procedures to ensure the safe resumption of work, including a slower rate of advance per blast and the installation of support structures right up to the work face. This approach was well adhered to and implemented by all parties and helped return to full production within two weeks of the strike, with no evidence of a 'spike' in safety incidents (GF 2012).

5.9 Innovation, upskilling and mechanization

During 2007 the global demand for technical and specialist mining-related skills persisted. It led to a high turnover of trackless mining skills at South Deep and contractor capacity constraints also impacted on the project. Gold Fields had a strong pool of professionals and the need for innovative approaches to attract and retain experienced staff was being addressed with a multi-tier strategy whose main focus area were:

- Exploring a wider range of mentoring support and development opportunities to support skilled employee career development;
- Re-investing in employee benefits infrastructure, such as housing and sports facilities, on mines to support the branding of Gold Fields as an employer of choice;
- Re-engineering of skilled employee work flow to refocus skills of individuals on primary functions as opposed to ancillary roles;
- The standardisation and alignment of production bonuses, retention bonuses and artisan market allowances across the South African operations, and
- Large-scale training partnership initiatives at Gold Fields Business and Leadership Academy (GFBLA) to reduce specific skills shortages at a national level in South Africa (GF 2007).

In 2013 the lack of experienced mechanised mining skills was one of the largest contributors to the delay in the build-up at South Deep. This challenge was under estimated in the past and was further complicated by the absence of a sufficiently deep pool of mechanised mining skills in South Africa. A team of mechanised mining specialists joined South Deep to embed a mechanised mining culture at the mine. Their key tasks were to improve fleet availability and utilisation, operator and technician skills, and the ore-handling infrastructure.

The company reduced the number of contractors (540) at the mine by replacing them where practical with own employees and implemented enhanced management of overtime. The management team was right sized, and the new operating model was entrenched (GF 2013).

Appendix D: Gold Fields

In 2014 the transformation of Gold Fields into a mid-tier producer had a profound impact on the profile of the workforce. It was believed that four key performance areas would be the focusing in future to ensure that integrated thinking was further entrenched in the business. These performance areas were: Business optimization; People; Finance, and the social licence to operate.

Gold Fields' transformation required different skills set in that it was pioneering mechanised gold mining on a scale and depth that was new in South Africa, and the success of the operation was largely dependent on its people. It was planned to develop the staff through focused internal training efforts and to recruit the best local mechanised mining skills to supplement the existing talent pool. The company collaborated with the South African platinum industry in setting training baselines for mechanised mining.

It was imperative for the company to introduce international best practice standards at South Deep. Mechanised mining at depth had limited industry precedent globally and by necessity the operating model continued to evolve as mining processes and practices were refined.

The shortage of mechanised mining skills in South Africa was in many instances responsible for some of the challenges at South Deep. The company placed a strong senior management team with underground-mechanised platinum mining experience in charge of the mine.

The management team of South Deep was mandated to set the mine up for long-term sustainable delivery though it would require more time than was originally anticipated. The original long-term targets were relinquished as a consequence (GF 2014).

6 Operationalise the safety management system

6.1 Group Technical Services

In 2012 the Gold Fields Group Technical Services function continued to play a leading role in improving the quality of the operational performance, innovation and technical management across the Group.

The initiation of a new, medium-term Heavy Mining Equipment (HME) Strategy to support Gold Fields shift towards owner mining was developed. The strategy was based on analysis and communication of sector best practice across the Group as well as through the development of Group-wide guidance and protocols including around fleet management systems, enhancement of tyre life, road maintenance, condition monitoring and planned maintenance. This was with the ultimate aim of optimising HME utilisation and availability and of establishing internal benchmarking of performance, as well as the transferability of skills and equipment across the Group.

A group-wide Planning Handbook was developed to ensure consistency of approach and to mitigate the potential impacts of personnel turnover (GF 2012).

6.2 Technology and Innovation division

In 2016 a new Technology and Innovation division was established to develop a Gold Fields Technology and Innovation strategy. The key features of this strategy included a five-year implementation plan commencing with a foundational phase over the first two years, optimising the operations by year three and implementing new technologies and innovation over the full five-year period.

Gold Fields tasked the regions to develop and implement three-year technology plans starting in 2017 with the corporate office consolidating and driving the process. A platform was developed to share lessons learned and roll out successful projects across the Group. The ultimate goal of the strategy was to work towards the “Gold Fields Mine of the Future”, which would be premised on automation,

an integrated digital data platform, remote machine operation, virtual reality and reduced mining waste.

During the foundational phase opportunities were identified to enhance efficiencies within the current regional portfolios. The South Deep mine would upgrade its underground wireless connectivity and radio communications systems to use technologies such as online maintenance and dispatch systems and remote operating equipment more effectively (GF 2016).

6.3 Engineering out safety risks

In 2007 an extensive review of ventilation and refrigeration requirements was done at the South African operations (GF 2007).

In 2009 the 'engineering out' of safety risks at the deep underground mines was a key management priority. Gold Fields focused on improving the production environment and had a number of planned, safety related production interruptions at the mines for the rehabilitation of critical infrastructure. The critical safety related rehabilitation of infrastructure at the operations, as well as the secondary support backlog was completed. These interventions came at a significant opportunity cost in lost production and revenue, but it was done in interest of the safety of the people and the long-term sustainability of the business. It resulted in a six per cent decline in the gold production.

A step change in the overall safety performance was achieved with all safety indicators showing a considerable improvement over the year. Commitment was made to eliminate all serious and fatal accidents on the mines. While this was a profound commitment to make in an industry that was characterised by high levels of risk, especially in the seismically active deep level mining environment in South Africa, it was a moral and commercial imperative for the future existence of the industry (GF 2009).

In 2010 the ultimate goal was the total elimination of all serious and fatal injuries and a further 25 per cent improvement was planned at the mines in all safety indicators. Gold Fields planned to enhance extensive safety interventions with a

new focus on “engineering out” safety risks and advancing compliance by winning the hearts and minds of the people through positive behaviour re-enforcement (GF 2010).

In 2011 the unacceptable safety performance prompted Gold Fields to accelerate the widespread programme to engineer out risks. This had a real effect, with a marked decline in fatalities in the second half of the year. The initiatives included safety compliance, leadership, behaviour-change, and installing in-stope bolting in stope panels.

The ‘engineering out’ of safety risks at the deep underground mines was a key senior management priority. It was reflected by the comprehensive system of reporting to the Safe Production Management Task Team, the Safety, Health and Sustainable Development Committee and the Board of Directors. Efforts to ‘engineer-out’ health and safety risks included:

- The implementation of fully mechanised production at South Deep to improve production performance and reduce employee exposure to the safety risks posed by this deep level mine;
- Mechanisation of all of the flat-end development tunnels to improve productivity and reduce employee risk exposure;
- Implementation of ‘Project 31’ to reduce workplace temperatures to 31.0°C or less (32.5°C in trackless operations);
- Implementation of ‘Project 10’ to reduce exhaust column leakage to below 10% for conventional development ends and below 20% for trackless operations;
- All project feasibility assessments included occupational health risk management. Relevant risks were addressed through targeted design interventions to ensure all infrastructure, equipment and processes were safe before they became operational (GF 2011).

In 2013 work continued at South Deep to engineer out safety risks as in the past much of the effort to ‘engineer-out’ safety risks were focused on the mature, deep

underground Beatrix and KDC mines which were unbundled from Gold Fields and owned by Sibanye Gold since 2012 (GF 2013).

6.4 Seismicity

In 2008 the pillar extraction risk assessment was established based on the set of parameters, including average pillar stress, energy release rate, width to height ratio, and geological features. The ongoing monitoring of risk parameters was conducted during the pillar extraction period in order to withdraw employees should the risk factor exceed the acceptable level.

A study was conducted to determine the ground conditions that led to injuries in the event of different peak particle velocities caused by a seismic event. The outcome of the study was used to optimise the design of different support configurations and to further reduce exposure to high risk geological features (GF 2013).

In 2009 Gold Fields introduced a Seismic Task Team, comprising of both internal and external experts to study and advise Gold Fields on six priority activities aimed at reducing the prevalence and impact of seismic-related incidents. The priority areas were:

- Operational control to standards;
- Mine layouts and support systems;
- Estimating and managing risk;
- Modelling rock responses to seismicity;
- Seismic data collection;
- Processing and analysis, and
- Support to rescue operations.

Driefontein and Kloof Mines had underground geophones equipped with three-way sensors detected seismic events that sent the data through to a centralised control room, alerting the Seismic Task Team whenever a potentially dangerous seismic event occurred. The Seismic Task Team made great strides in quantifying the risk associated with seismicity and put strategies in place to reduce the

exposure of Gold Fields' workers to seismic events. The team analysed the data to determine a more precise location within a 30-meter margin of error, before sending this information through to the shaft at the mine where the event took place. The entire process could take as little as three minutes and actively saved lives (GF 2009).

Gold Fields implemented centralised blasting, whereby all blasting took place during a specific time window when there were no workers underground. Research showed that seismic action was directly related to blasting activity and that 70 per cent of seismic events occur within two hours of blasting, so this strategy drastically reduced the exposure of the workforce. This was instrumental in reducing the operations' fall-of-ground (FOG) injuries by 38 per cent and a reduction of 82 per cent in the number of seismic related fatalities, from 11 in 2009 to two in 2010. Additionally, the recommendations resulted in a 65 per cent reduction in all seismic-related injuries and an improvement of 82 per cent in the number of seismic-related fatal injuries, from 11 in 2009 to two in 2010.

These major advancements were the result of the combined efforts of a team of highly qualified and experienced mining seismologists, and some of the best seismic systems in the country, all stationed at Gold Fields' Seismicity Laboratory at Driefontein (GF 2010).

In 2011 the Seismic Task Team continued to play a leading role in minimising underground risks within the existing operations, by pre-warning mining teams of potential seismic-related fall of ground and enhancing the blasting scheduling and techniques to minimise safety risks. The positive impact of the Seismic Task Team remained evident. Some of the initiatives pursued included the elimination of night shifts, where the mining layout and configuration could result in elevated risk.

Although there was a short-term increase in fatal seismic fall of ground incidents from 0 in 2010 to 5 in 2011 the overall trend showed significant improvement, falling by 16% since the Seismic Task Team was formed in 2008. This was

reflected in the long-term fatality trends and was making an important contribution to the journey towards ‘Zero Harm’.

A particular focus of the efforts was the mitigation of fall-of-ground and seismic-related incidents through initiatives such as centralised blasting, pre-conditioning, selective cessation of night-shifts, and continuous improvement and innovation in seismic monitoring (GF 2011).

In 2016 the number of seismic events at South Deep registering above one on the Richter scale increased from 73 in 2015 to 101 in 2016 (of which six were over two on the scale) as the mine accelerated its ramp-up.

Despite the fact that the average energy released per seismic event dropped, the mine intensified its efforts at improving its forecasting abilities. The company was working with 12 consultancies and institutions, including the Institute of Mine Seismology and the Council for Geoscience, to monitor, understand and mitigate against seismic underground events (GF 2016).

6.5 Fall of ground prevention initiatives

In 2011 South Deep built safety measures in from the start in particular to the technically sophisticated de-stress cut methodology. Gold Fields commenced with the installation of yielding bolts in the de-stress excavations, preconditioning of the de-stress faces and introduced the use of semi-automated drilling machines for the installation of support in the de-stress panels.

The MOSH leading practice for entry examination was implemented. Safety nets were installed to be used during the drilling shift to protect stope face employees from fall of ground hazards. Roof bolting were introduced in all stope panels, to supplement the pre-existing safety netting. Bolting was completed at all up-dip panels and wide raises, whilst bolting of all breast panels was due for completion in early 2012. This was specifically aimed at trying to prevent a resurgence in fall of ground fatalities (GF 2011).

In 2012 Gold Fields completed the fitting of removable safety nets during drilling shifts and the installation of roof bolting on all stope panels except where hanging wall rock conditions did not allow this, in which case alternative solutions were devised. This marked a major step forward in the delivery of a safe working environment and in terms of addressing what had traditionally been one of the most problematic areas.

The completion of this initiative appeared to have made a real contribution to a sharp fall in Fall-of-Ground (FOG) accidents during 2012. This included a fall in FOG-related fatalities from 12 in 2011 to 2 in 2012 of which one was gravity and the other seismic-related. It also suggested the 'feed-through' of benefits from ongoing and extensive seismic risk management initiatives, including:

- Enhanced pre-conditioning of rock before it is worked on at all three mines;
- Ongoing mine planning reviews to ensure the minimisation of a high-risk concentration of mining;
- Centralised blasting during a narrow time window to minimise the exposure of crews to seismicity during shift times at Beatrix and KDC;
- The cessation of night-shift working in isolated areas that have a high night-time seismic risk profile;
- Delivery of regular seismic hazard assessments by the Seismic Task Team, allowing for the temporary withdrawal of crews as necessary;
- Mechanised in development ends at KDC and Beatrix;
- The use of galvanised mesh and bolts at South Deep;
- Implementing additional measures to enhance the performance with respect to FOG accidents included the testing of a new generation of 'yielding' rock bolts at South Deep, which were better able to withstand seismic energy, and
- A trial study at KDC to investigate the use of steel mesh to provide enhanced aerial support between support units (GF 2012).

In 2013 the company introduced tensioners for tightening flexi bolts to reduce fall-of-ground risks by strengthening the rock mass and reducing deterioration over time (GF 2013).

In 2016 South Deep intensified its effort to engineer-out safety risks, through pre-conditioning of working areas, as well as a focus on consumable material and equipment (GF 2016).

Secondary support

In 2009 improved secondary support initiatives to secure the integrity of the deep level haulages were done and the rapidly deteriorating backlog in secondary support and infrastructure rehabilitation across all operations was largely completed (GF 2009).

In 2016 Gold Fields continued the efforts to move mineworkers away from potentially dangerous areas and installed extensive secondary support throughout the mine to limit the impact of rock bursts (GF 2016).

Pillar and remnant mining

In 2008 a comprehensive review of all pillar and remnant mining across all operations was undertaken. Extensive work was done to reassess design criteria used to assess pillars and remnant areas before a decision was made to mine these areas. The pillar mining at Driefontein and Kloof was reduced by 25 and 50 per cent (GF 2008).

In 2009 Kloof adopted a more prudent approach to pillar mining. Identified remnant pillars were comprehensively analysed and approved by the Rock Engineering Department before any mining took place (GF 2009).

6.6 Rail bound tramming initiatives

In 2011 the MOSH leading practice of auto-coupling and guard communication systems to reduce tramming-related risks was evaluated by Gold Fields. The company prepared for the evaluation of proximity-warning systems (GF 2011).

In 2012 tramming incidents were responsible for five of the 16 fatalities. Gold Fields continued to initiate a new Guard Communications System programme and commenced a major overhaul of the 1 200 underground locomotives, which

included improved cab designs, enhanced braking systems, and electronic data recording.

Hand-held controls with ‘pivot-based’ safety systems and enhanced communications were introduced. This included a ‘fail-safe’ command system that required both the driver at one end of the locomotive and the guard at the other end to issue the same instructions to the locomotive before it would function. It also included an emergency stop function that could be instigated by either individual. It would be supported by additional, related measures such as training for locomotive operators and the implementation of safer alternatives to the manual coupling of rolling stock (GF 2012).

In 2013 the trial of auto-couplers and installation of proximity detections systems (PDS) to the rail-bound equipment was ongoing. This was with the aim of reducing employee exposure to the risks associated with manual coupling and collisions as well as damage to equipment. The company continued with the installation of PDS’s to the trackless mobile machines for both vehicle-to-vehicle detection and vehicle-to-person detection. Automation of tip ramps was done, which were previously operated manually by the locomotive drivers (GF 2013).

In 2014 the company installed proximity detection systems, which help personnel avoid danger zones when working near heavy mining equipment. New rail-bound equipment, including an auto-coupler, which eliminates the need for personnel to manually couple and uncouple rolling stock, was also installed (GF 2014).

In 2015 South Deep intensified its effort to engineer-out safety risks. Some initiatives included the commencement of fitting 56 locomotives with rail-bound proximity detection system and relevant operators and artisans trained in its usage. The second phase of the project would comprise the installation of fixed beacons at the mine in 2016 to facilitate communication between the locomotives (GF 2015).

In 2016 the installation of a rail-bound proximity detection system was completed with which all 56 locomotives at the mine were fitted and relevant operators and

artisans trained in its use were completed. The installation of fixed beacons at the mine during the latter part of 2016 helped to facilitate direct communication between the locomotives (GF 2016).

6.7 Mechanisation

In 2008 Gold Fields entered technology Joint Ventures with suppliers to ensure that the transition to mechanisation was effective. The establishment of training facilities for mechanised mining was advanced.

All operations were implementing elements of mechanisation to improve productivity and reduce health and safety risks. This initiative, dubbed 'Jurassic to Joystick' involved detailed workflow studies for all primary productive roles aimed at optimising all workflow processes as well as a variety of logistics initiatives (GF 2008).

It was a major priority for Gold Fields in 2009 to grow the production through a safe and responsible approach. Structured project initiatives were in place to ensure optimised energy and utilities consumption. The company targeted a mechanised rate of 100 per cent by the end of 2010 with some 46 per cent of development having been mechanised to date, with unit cost, equipment efficiency and labour productivity improving on a daily basis. Mechanised equipment was used in all flat-end development areas at the long-life shafts of Driefontein, Kloof and Beatrix (GF 2009).

In 2010 Gold Fields continued with the application of fully mechanised, deep underground mining, which significantly improved productivity and reduced employee exposure to fall-of-ground and heat (GF 2010).

In 2011 mechanised underground mining was already well established in the Australian operations and was moving towards mine automation. Gold Fields piloted the use of a loader controlled by a surface operator, as well as an automated drill-rig. The company was laying the ground for the implementation of this technology, including examination of the potential for remote cleaning,

which would allow for the quick clearance of post-blasting areas and make productive use of shift handovers.

Automation technology had the potential to allow employees to carry out their work in remote locations and would mark a major step-change that was likely to require significant time and investment. The technology had the potential to significantly reduce the safety hazard exposure of the employees, minimise handover times and enhance productivity (GF 2011).

The Non-Entry Mining Project initiated in 2012 was a collaborative, open-innovation research programme involving the original equipment manufacturers. The project was examining how existing equipment platforms could be adapted with advanced technology and tools to allow for their application in remote mining.

Sibanye Gold piloted three remote control demolition units to clear long-abandoned underground access tunnels at KDC East that were too unsafe to clear using conventional methods. This was with the ultimate aim of extending advanced mining technology to the safe extraction of 28 high-grade pillars at the mine (GF 2012).

In 2013 Gold Fields no longer aspired to being pioneers of research and development in areas such as technology but to be fast adopters of best practice. This would help reduce the costs of developing and applying cutting edge practices, while still ensuring the leverage of their benefits (GF 2013).

In 2014 Gold Fields was pioneering mechanised gold mining on a scale and depth not previously seen in South Africa, and the success of the operation was largely dependent on its people. The transformation required a different skill set, which was envisaged to be achieved through focused internal training efforts and the recruitment of the best local mechanised mining skills to supplement the existing talent pool.

A significant effort was made to introduce international best practice standards at South Deep. Mechanised mining at depth had limited industry precedent globally

and by necessity the operating model continued to evolve as mining processes and practices were refined (GF 2014).

6.8 Infrastructure upgrade

In 2008 a comprehensive review of the status of all infrastructure across all operations in the Group was initiated. An external consultant was appointed to audit the Infrastructure Review.

The review identified a number of infrastructure installations at the operations that required remediation to improve safety. While most of these repairs were of such a nature that it could be completed in the normal schedule of planned maintenance, three instances required a suspension or curtailment of normal production while repairs and remediation were carried out.

- At South Deep, 3 access ramps were in urgent need of additional support;
- At Driefontein, the chronic backlog in secondary support at the high grade one tertiary, four and five shafts, which plagued this mine for several years, represented an unacceptable risk;
- The backlog at four and five shafts was made up without an interruption in production, but the one tertiary shaft backlog could not be eliminated in the normal course of business and as a consequence all production was stopped in this area while the remediation work was undertaken, and
- The Main shaft at Kloof Mine was in urgent need of rehabilitation due to extensive corrosion. As a consequence, it was decided to limit hoisting from the shaft to one day per week for the remainder of the year so that the shaft could be repaired.

These interventions resulted in short-term production sacrifices, however, the long-term benefits to employees and shareholders alike would significantly offset the short-term losses (GF 2008).

On 2009 an enhanced planned maintenance programme was introduced, and condition assessments were being conducted on all vertical mine shafts and plant

infrastructure. Audits were done to identify all repairs required. The Main shaft steel work rehabilitation at Kloof was completed (GF 2009).

In 2010 engineering integrity was a fundamental requirement for safe production in deep-level mines. The programme of infrastructure rehabilitation across all mines in the region continued. It included:

- The replacement of the water pump column in the Kloof main shaft;
- The elimination of the secondary support backlog at the Kloof and Driefontein Gold Mines;
- After the implementation of updated ground support protocols in all mines, dedicated support crews consistently maintained secondary support within 120 meters of current development faces, and
- The introduction of a new enhanced maintenance system introduced during 2009 was a prime focus during the year and revised protocols were in place to facilitate rapid management of all planned maintenance issues (GF 2010).

6.9 Underground Fires

Underground fire protection continued to be of vital importance in the South African mines. In 2000, the operations embarked on a campaign to inertise all hazards in the intake airways. Timber going underground was flame retardant and other materials such as conveyor belts, electrical cables and plastic pipes were carefully selected for safety criteria.

In 2012 following the major fire at the KDC Ya Rona Shaft, Gold Fields reviewed safety measures to minimise the risk of such an event re-occurring. These included:

- Revision of the fire and explosion guidelines and enhanced training for operators;
- Implementation of dedicated, dual-oversight of the Fire Detection Systems, and
- Additional oversight of the electronic Fire Detection System by the shaft-based control rooms (GF 2012).

Emergency evacuation plans

Gold Fields had comprehensive emergency evacuation plans for fires, gas and major falls of ground. All underground workers were equipped with self-contained self-rescuers and key personnel carried portable gas monitors.

In 2007 there were 861 equipped underground refuge chambers in the Group. Regular escape drills were conducted, and 18 employees successfully escaped to refuge chambers during actual fire emergencies without any casualties or serious injury. Eight self-contained self-rescuers were successfully used during these incidents (GF 2007).

6.10 South Deep

In 2009 South Deep was 100 per cent on trackless mechanised mining methods, which significantly contributed to improved safety performance. The mine adopted a ‘one pass system’ for support, which covered all development headings across the mine.

A comprehensive, external review was done of South Deep Gold Mine resulting in Gold Fields having greater confidence in the overall integrity of the project, and its ability to deliver exceptional value to the shareholders for approximately the next fifty years. The re-commissioning of part of the South shaft was completed, with single shift hoisting planned for the next year to support the reef and waste tonnage build-up. The development rates were progressed to enable the mine to build to full production.

The additional mining fleet required for the short-term build-up was acquired and the first thirty years of the mining plan was fully re-modelled and scheduled. Work was on schedule to complete the ventilation shaft of the Twin Shaft Complex by early 2012 which was a very important milestone to achieve full production (GF 2009).

In 2011 the South Deep ore body raised a number of unique technological challenges due to the scale, depth and positioning. Gold Fields accelerated the

implementation of the horizontal de-stress cut methodology increased the rate at which the ore body could be opened up to mitigate risks associated with the geotechnical stress regime (GF 2011).

In 2012 the focus at South Deep was on de-stressing and developing the ore body and ramping up production. It was a good example of how, with the right mining methodologies, technology and labour models, deep underground gold mining could thrive and prosper. The potential application of two mining methodologies that could further support future build-up at the mine was explored. It included a new ‘vertical slot’ de-stress cut methodology, which was aimed at reducing horizontal stress and with it the need for additional horizontal de-stress cuts. It was estimated this would reduce the amount of de-stress cutting at South Deep by around 15%, accelerating the opening up of the ore body. Alternatively, the use of ‘crush pillars’, which were themselves safely mined out once the rest of the area they support was fully exploited, reduced back-fill requirements.

Despite an encouraging year at South Deep, in which improvement was achieved in most major metrics, the rate of de-stress to open up the ore body further was not at a level to underpin the company’s planned ramp-up targets.

Gold Fields concluded an agreement for the introduction of a new 24/7/365 operational schedule, which was in line with best practice, mechanised underground operations worldwide.

The major infrastructure installations at South Deep required to full production target by 2016 was completed. The operations continued to de-stress and develop the underground workings. South Deep had everything in place to ensure that it fulfilled its potential. It was a model for the industry in terms of production, technology, safety and transformation.

South Deep was of key strategic importance to Gold Fields as its application of deep-underground mechanised mining and advance de-stress methodologies allowed for safe, relatively low-cost and cash-generating production.

Collectively, the efforts would make a significant contribution to getting production momentum back on track. Other initiatives included:

- Engineering-out of safety risks, including fall of ground hazards;
- Establishment of a seismic task team and upgrading of secondary support standards;
- Engineering-out of health risks, and
- Enhancement of personal protective equipment performance (GF 2012).

In 2013 South Deep remained a strategic asset for Gold Fields and was projected to deliver long-term, cash-generative production to the Group once it achieved full production. The mine achieved further positive progress in terms of safety, de-stress mining and reef tonnes mined, taking the mine closer to full production.

The production remained behind plan and required a restatement of the mine's production targets. Gold Fields was confident that the remaining underground bottlenecks would be addressed and that the mine would live up to its true potential. Gold Fields carried out a number of immediate actions to address the production and costs at the mine. It included a major operational review to ensure the full grade gets to the mill and the application of enhanced vehicle maintenance practices. The de-stress development at South Deep was behind plan, due to underground ore-handling constraint, sub-optimal fleet availability and insufficient mechanised mining skills.

South Deep introduced a Safety, Health and Environment Committee chaired by the Chief Executive Officer. A new 24/7 operating model was introduced which achieved further positive progress in terms of safety, de-stress mining and reef tonnes mined, taking the mine closer to full production. The de-stress development at South Deep was behind plan, due to underground ore-handling constraints, sub-optimal fleet availability, and insufficient mechanised mining skills (GF 2013).

In 2014 South Deep reverted to a 7-2/7-5 roster system in part, to address concerns about fatigue-related safety risks caused by the recently introduced 24/7 12-hour shift system.

The underground mechanised mining equipment was rationalized by the removal of surplus and redundant equipment as well as the limited introduction of more appropriate specialised new equipment in certain areas. This resulted in lower maintenance costs, consumables and contractor costs. The South Deep machinery and vehicle fleet were optimised and a total of 24 Category 1 machines were delivered and commissioned during the year. An additional 24 machines were to be acquired during 2016. These fleet acquisitions would mean that South Deep would have replaced more than half of its fleet by the end of 2016 which should have a positive impact on availability and utilisation.

The maintenance capacity at South Deep improved during the year through the implementation of supplier maintenance contracts (approximately 35% of total mining), as well as the commissioning of an underground workshop. A team of mechanised mining specialists joined South Deep to embed a mechanised mining culture at the mine. Their key tasks were to improve fleet availability and utilisation, operator and technician skills, and the ore-handling infrastructure.

2014 was a challenging year for South Deep with the project's build-up interrupted by an unplanned four-month long ground support remediation intervention, necessitated by safety considerations, as well as three fatal accidents. It was determined that legacy ground support in some of the ramps in the older part of the mine was below the international best practice standards.

Despite the fact that 70% of South Deep's output was sourced from these areas all production and de-stress activities in the affected areas were stopped for about four months so that a ground support remediation programme could be implemented. The programme contributed significantly to de-risking South Deep's build-up and made the mine safer.

The management team at South Deep conducted a comprehensive mine-wide review of all safety protocols, procedures and standards in line with its mandate to improve the mechanised mining culture. A programme was implemented to address issues deemed critical to de-risk the mine's build-up to full production and working practices to ensure that fatalities were avoided in future.

The company continued to focus on fixing the base at South Deep resulting in some early signs of improvement at South Deep during the second half of the year. Management utilised an unplanned four-month production stoppage at South Deep to fast-track a number of critical interventions aimed at setting the mine up for long-term success (GF 2014).

The alignment of South Deep to the Gold Fields engagement structures and policies Implementation of Group-wide engagement structures and policies, included the establishments of:

- Health and Safety Committee;
- Shaft Leadership Forum;
- Operational Leadership Forum;
- Skills Development Forum, and
- Employee Equity Forum.

During 2014 and 2015 South Deep management, in collaboration with a team of leading international and local geotechnical experts, reviewed the de-stress mining method. A strategic mine design change in the de-stress methodology and a conversion from low profile (2.5 metres vertical height) to high profile (5.0 metres vertical height) de-stress mining commenced in the September quarter.

By year-end 2014 about 70% of the mine was employing this approach already contributed to simplifying and de-risking the mining process. The transition to high profile de-stress was expected to continue until the early part of 2018 (GF 2014).

In 2015 after a difficult 2014 at South Deep and the introduction of a new management team, it was decided to take a step back and 'get the basics right' to

ensure a stronger foundation for sustainable growth in the future. The first six months of the year came with its own challenges as the new management team adopted a strategy of embedding an improved safety and productivity culture as it set the mine up for the long-term.

The Gold Fields South Africa Regional Office was closed, and regional management was embedded at South Deep and the company recruited a number of experienced mechanised mining executives from the platinum sector to strengthen the South Deep management team.

The Board continued to engage with management in their quest to achieve ‘Zero Harm’ at all the operations. At South Deep, the Chief Executive Officer’s ‘Zero Harm’‘ task team was strengthened with the addition of a Board director to the team. The Group also intensified operation-specific health and wellness programmes, focusing on improving the physical and mental health of the employees.

The recommendations stemming from the review were implemented and had a visible impact on the safety performance. It included the integration of a Health and Safety Management System into the new induction processes introduced at South Deep following the major review process as well as the standard induction process.

South Deep, as the mine of the future focused on four key areas which included operating practices and technology, talent and leadership, partnerships with key stakeholders and industry, and governance and transparency. The key operational challenges were:

- Embracing digital mining, advanced analytics and new software technologies;
- Mining on demand, being the ability to run agile production schedules;
- Converting conventional mining practices to mechanisation and automation;
- Improving the economics of low grade and residual ore bodies, and
- Embracing energy and water efficiencies.

Optimising existing technologies and new technologies would provide the solutions to these challenges, but adoption by the industry was slow. Several mines rolled out the new technologies with a significant impact on costs, productivities and safety. It was the Gold Fields view that if other mines wanted to be sustainable, they would have to follow this course. Gold Fields pursued closer co-operation with Original Equipment Manufacturers who developed and operated best-of-class technologies and equipment at various levels of automation (GF 2015).

During 2016 full implementation of the high-profile de-stress mining method proved to be successful. The recruitment of identified critical skills and most of the core mining and engineering positions were filled and intensified training programmes were launched.

The renewed underground mining fleet had a positive impact on availability and utilisation. The maintenance capacity at South Deep improved during the year through the implementation of supplier maintenance contracts in corridor 2 (approximately 35% of total mining), as well as the commissioning of the underground workshop (GF 2016).

7 Safety performance

7.1 Fatalities between 2006 and 2016

Gold Fields had 122 fatalities in South Africa during the period 2007 to 2016 as shown in Figure 6.

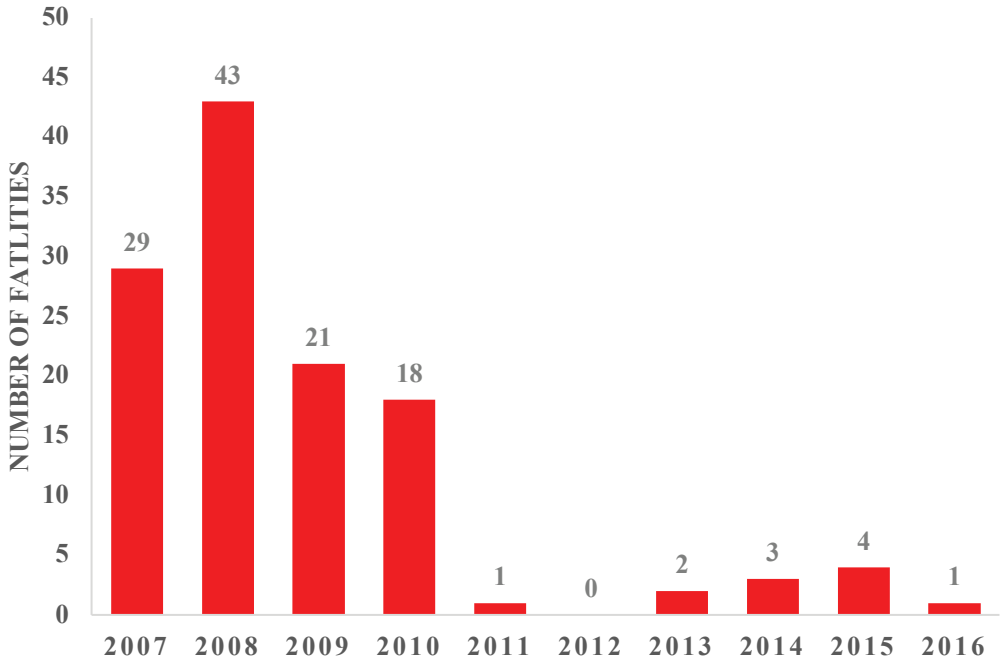


Figure 6 122 Fatalities at Gold Fields, 2007-2016 (GF 2007-2016).

The number of fatalities reduced significantly after the split off of the mature mining assets to Sibanye in 2012 as shown in Figure 7. It must be noted that the transition period for the formation of Sibanye and the ultimate spinoff, resulted in the employee statistics for the period 2011/12 to be inconclusive. However, it can be seen that the Gold Fields employee numbers are orders of magnitude different post the formation of Sibanye.

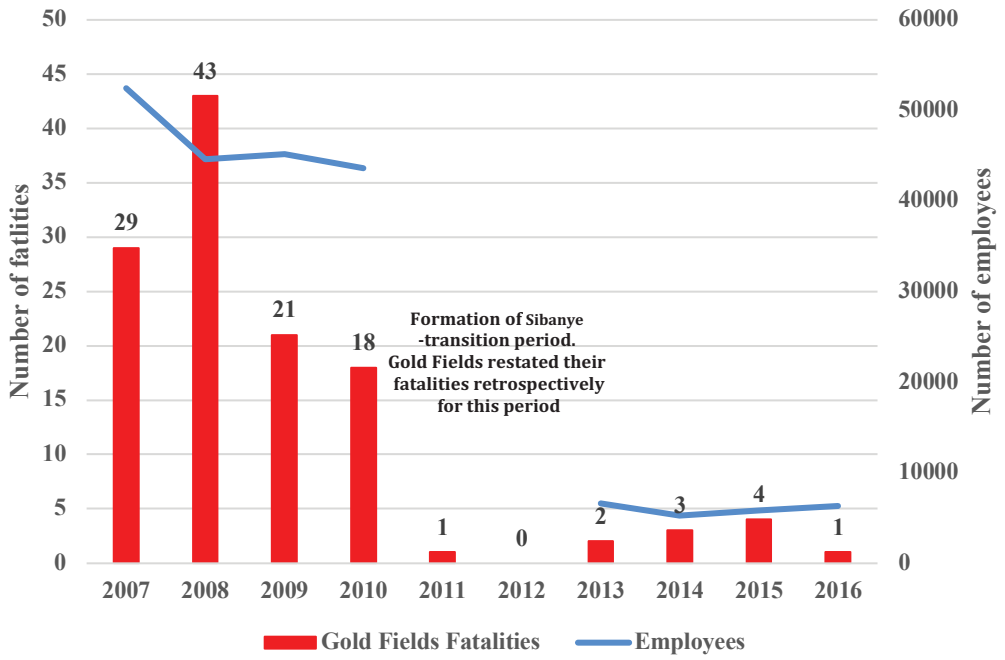


Figure 7 Number of fatalities vs employees, 2007-2016 (GF 2007- 2016).

7.2 Major safety incidents

Prior to acquisition of South Deep, the mine suffered a shaft accident in May 2006 in which the Twin shaft complex was damaged. The recommissioning of the Twin shaft complex was completed, ahead of schedule and without a lost time injury.

A fire broke out at South Deep in August 2006 which took until late December to bring under control. Subsequent flooding occurred due to the mud press ore pass hanging up. A total of 18 fire incidents occurred at the South African operations. Six of the incidents were classified as major incidents, but no fatalities were recorded as a result of fires (GF 2006).

On his first day as the Chief Executive Officer on 7 May 2008 nine employees died at the South Deep gold mine when the vent hole raise conveyance in which they were travelling became dislodged and fell more than 60 metres (GF 2008).

8 Summary

Gold Fields became a member of the International Council on Mining and Metals (ICMM) and a signatory to the Global Compact in 2007. The ICMM Sustainable

Development and the Global Compact Principles were used as it most appropriately reflected the relevant thought process throughout the Group.

Gold Fields committed its South African operations in 2007 to a number of health and safety targets and milestones, agreed to by the Mine Health and Safety Council.

On 7 May 2008 the Chief Executive Officer of Gold Fields, made the statement "If we cannot mine safely, we will not mine." Gold Fields supported the establishment of the Mine Occupational Health and Safety (MOSH) Task Teams in 2008 to assist in the interventions for the MHSC milestones to reduce injuries, eliminate silicosis and noise induced hearing loss based on set targets.

In 2009 Gold Fields embraced a new vision, which was for the company to be the global leader in sustainable gold mining.

In 2011 Gold Fields merged Kloof and Driefontein through the clustering of shafts into five operating units and the combination of all reef and waste plants under one structure was done.

In 2012 the Gold Fields Vision was to be the global leader in sustainable gold mining, which was included the pursuit of 'Zero Harm' in order to eliminate all harm to the people and contractors. The company undertook a major strategy review, which was marked by the replacement of the previous goal of having 5 million ounces in production to one focused on cash generation. The reorganisation formally separated Gold Fields mines into two distinct portfolios:

- The open pit and shallow underground mines in Australia, Ghana, Peru as well as the deep underground mechanised South Deep mine.
- Sibanye Gold consisted of the mature, deep underground, narrow-vein Beatrix and KDC mines (GF 2012).

The previously 100%-owned subsidiary Sibanye Gold was launched as an independently managed entity.

During 2013 Gold Fields had undergone a number of fundamental changes, which included the continued unbundling of Sibanye Gold Limited. Gold Fields shifted from being a 'Top 4' gold producer to be a more focused, mid-tier mining company (GF 2013). The net result was that Gold Fields got out of the business of deep level mature mining in South Africa.

In 2014/15 Gold Fields' value creation cycle started with ensuring it had the right assets, the right skills and that good governance was firmly entrenched throughout the organisation. The South Deep mine posed some significant challenges in that the implementation of a safety-critical, ground support remediation programme underground halted the bulk of the mine's production for four months. (GF 2014-2105).

The Gold Fields employees reduced from a high of 54,758 in 2006 to 6 277 in 2016 in their South African operations, which amounted to an 88% reduction (GF 2016).

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Appendix E

The Sibanye Stillwater safety journey between 2012 and 2016 case study.

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1 SIBANYE COMPANY BACKGROUND

In 2012 Sibanye Gold, previously a wholly owned subsidiary of Gold Fields (GFI Mining South Africa Proprietary Limited ('GFIMSA')) and owning its more mature South African assets, Kloof, Driefontein and Beatrix was spun out of Gold Fields and listed as a fully independent company on 11 February 2013 (GF 2012).

In 2013 Sibanye was the largest individual producer of gold from South Africa and one of the world's 10 largest gold producers which owned and operated three underground and surface gold operations with 33 773 employees and 2 501 contractors as shown in Figure 1 (SIB 2013).

In 2014 Sibanye acquired Wits Gold, Cooke and Burnstone.

In 2015 Sibanye owned and operated four underground and surface gold operations in South Africa, Kloof, Driefontein, Cooke (KDC) and Beatrix (SIB 2013).

In 2016 the mining at Cooke 4 ceased following unsuccessful engagement with key stakeholders in an attempt to restore the mine to profitability. Sibanye revised its organisational structure and the management of its business in order to ensure continued delivery on its strategic objectives. The company then comprised of the Gold Division and Platinum Division after significant acquisitions including:

- Aquarius Platinum Limited which included a 50% stake in each of the Kroondal and Mimosa mines, and associated infrastructure and concentrating facilities, as well as Platinum Mile (91.7%).
- Anglo American Platinum Limited assets which included the Bathopele, Siphumelele, and Thembelani (including Khuseleka) shafts, two concentrating plants, an on-site chrome recovery plant, the western limb tailings retreatment plant and all associated surface infrastructure, referred to as the Rustenburg Operations.
- Sibanye announced the proposed acquisition of Stillwater Mining Company (Stillwater), which had palladium and platinum producing operations in Montana in the United States (SIB 2016).

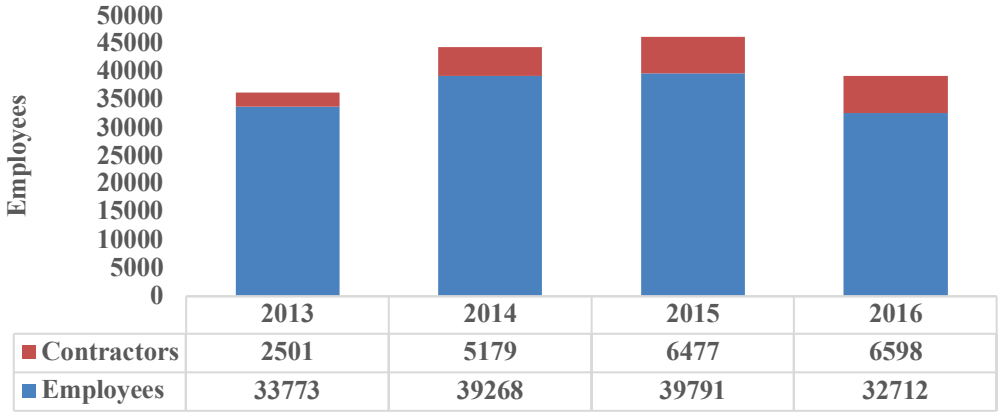


Figure 1 Number of employees (SIB 2013-2016).

1.1 SCOPE OF THE CASE STUDY

Only issues affecting the SibanyeStillwater South African operations were addressed in the case study. Significant interventions on occupational health, HIV Aids and other medical conditions affecting the wellness of the workforce was not addressed in this case study. All the information contained in this case study was obtained from the Gold Fields annual reports 2010-2013 and the Sibanye Stillwater annual reports between 2012 to 2016.

2 External Safety advocacy

2.1 Department of Mineral Resources

Sibanye engaged with all levels of government and various government departments and regional offices of the Department of Mineral Resources regarding safety. Engagement with the national offices was on an as-and-when-needed basis. Inconsistencies in the application of regulatory requirements and individuals' preferences was problematic (SIB 2012).

2.1.1 Section 54 work stoppages

Sibanye had 466 Section 54 work stoppages that were imposed by the Department of Mineral Resources (DMR) during 2012-2016 as shown in Figure 2. The Platinum Division had 55 Section 54 work stoppages in 2016 (SIB 2012-2016).

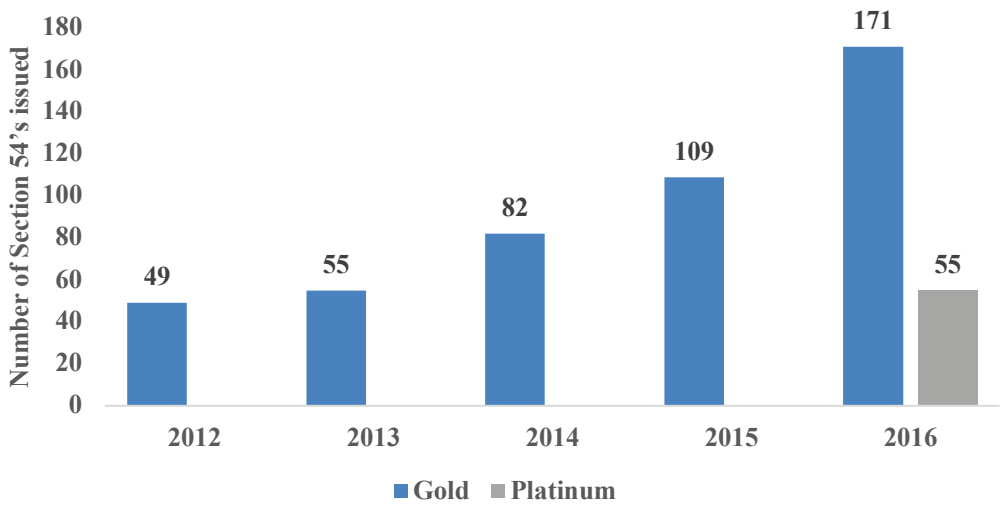


Figure 2 Section 54 work stoppages (SIB 2012-2016).

In 2013 Sibanye participated in quarterly Regional tripartite meetings with the DMR and with various discipline specialists from within the Group who participated in the Chamber of Mines forums that deal with, among other issues, the overall improvement of health and safety in the industry (SIB 2013).

In 2014 it was Sibanye's view that the mining industry needed to engage with the DMR as it was believed that the Section 54 stoppages should be restricted to the

immediate area of an accident's occurrence and not involve the complete closure of a shaft, which can have a detrimental impact on the viability of an entire mine (SIB 2014).

In 2015 the extent to which the DMR imposed Section 54 closures in the event of accidents was an industry concern. Sibanye agreed with the need for operational closures when the causes of accidents need to be investigated, and when it was necessary to ensure that safety conditions and procedures were rigorous. However, it was believed that the Section 54 stoppages should be restricted to the immediate area of an accident's occurrence and not involve the complete closure of a shaft, which could have a detrimental impact on the viability of an entire mine (SIB 2015).

In 2016 Sibanye seeked tripartite commitment from the Mine Health and Safety Council and the DMR in support of a more effective safety management process at all operations. The company's commitment to safety remained firm and significant resources were applied to improving safety. The Section 54 stoppages had a significant impact on the economic viability of operations and future employment.

Having noted the high number of Section 54 notices issued to the Platinum Division's Kroondal mine by the Mines Health and Safety Inspectorate in 2016 the Board approved the issuing of a legal claim against the DMR, the Minister of Mineral Resources and officials in the MHSI for financial losses incurred as a result of what were unjustified S54 stoppages (SIB 2016).

2.2 Chamber of Mines of South Africa

In 2013 regional tripartite meetings were held on a quarterly basis with the DMR and with various discipline specialists from within the Group who participated in the Chamber of Mines forums that deal with, among other issues, the overall improvement of health and safety in the industry (SIB 2013).

Sibanye participated in the Chamber of Mines (COM) Chief Executive Officers Elimination of Fatalities Team which was a cross-sector initiative established to

facilitate the sharing of experiences and initiatives to address safety challenges among mining companies in South Africa.

In 2015 Sibanye believed that the Chamber of Mines played an important role in expediting peer engagement and in lobbying national government on behalf of the industry, protects the collective interests of mining companies and promotes a positive image of the mining sector as being progressive, transformed and effective, in consultation with other national stakeholders.

The Chamber provided a platform, through company representation on collective committee structures, to discuss matters of strategic importance to the mining industry and to provide a mandate to the Chamber. Experts within the Chamber provided leadership in strategic thinking on a broad range of policy domains. It established communication channels are in place to secure strong alignment between the Chamber and its members (SIB 2015).

2.2.1 Industry peer engagement

Sibanye engaged regularly with its peers in the gold, platinum, coal and bulk minerals segments. Collaborative engagement, involving non-competitive issues of common interest, was more prevalent in the gold sector with information and other lessons, particularly sharing health and safety management and community engagement, and collaboration was actively pursued where it could be more effective. The Group also co-operated in strategic industry interventions with potential for synergies which was based on agreed mechanisms for and mature rules of engagement.

2.2.2 Mining Phakisa

In 2016 Sibanye actively participated and assisted with the innovation aspect of government's Mining Phakisa, in addition to the work done internally. The Mining Phakisa encompassed several exciting developments, including the establishment of an innovation hub, which was a collaborative initiative involving the Chamber of Mines, government and counterparts in the mining industry. The hub, supported by an initial R17 million grant from government, was based at the

former Chamber of Mines Research Organisation (COMRO) facility. The South African government committed additional funding of R150 million, over three years, in support of this collaborative approach to innovation in mining.

The innovation hub registered a number of quick win projects, facilitated by participating mining companies and illustrating the mining industry's commitment to technological development. Resources from the overarching mining hub supported these projects with information shared among participating companies. The aim was to maximise the value of the research and development funding committed (SIB 2016).

2.3 International Council on Mining and Metals

In 2013 the Social and Ethics Committee discussed the 10 principles of the International Council on Mining and Metals (ICMM). In 2014 Sibanye subscribed to the 10 Principles of the ICMM (SIB 2013-2014).

2.4 Global reporting initiative

In 2013 Sibanye adopted the Global Reporting Initiative's guidelines (SIB 2013).

3 INSTITUTIONALISE 'ZERO HARM' AS A BUSINESS IMPERATIVE

3.1 LEADERSHIP

In 2013 the company had undergone radical change and the Sibanye workforce embraced the new operating model and organisational structures that were implemented since the formation of the company. The operating results were not achieved at the expense of safety, which was a key priority for the company. The safety indicators continued to improve in 2013 and Sibanye would continue to strive towards its goal of 'Zero Harm'.

Sibanye defined and adopted as its core values: commitment, accountability, respect and enabling (CARE) culture. The company commenced the rolling out of the CARE model and would embed these values as part of a new, more holistic safety health and wellness strategy in 2014. It was expected that this strategy would deliver further safety improvements in future as the Group works towards its goal of 'Zero Harm' in the workplace.

The focus on improving productivity and reducing costs was coupled with a dedicated health, safety and wellbeing strategy. The company continued with initiatives to engineer out risk in its quest to 'Zero Harm'. The company achieved a 41% improvement in the fatality injury frequency rate per million hours worked, which was the lowest ever rate achieved over a year at these deep level gold mines. The lost time injury frequency rate improved by 11% year-on-year.

Sibanye believed that deep-level mining could be riskier than many other mining or industrial enterprises. However, the safety of the employees was the most important aspect of the approach to sustainability and the company embraced the target of 'Zero Harm'. The company would never allow production to take precedence over safety. Employees had the right to return home safely and unharmed at the ends of their working shifts (SIB 2013).

In 2014 management was conscious about the use of technology to improve working conditions and provide a safer working environment. It was about

responsibly maximising production while promoting a safe and healthy operating environment and culture as well as upskilling employees.

The company focus was on establishing a safe, production friendly operating environment, through the ongoing implementation of the health and safety strategy and initiatives to reduce risk in order to achieve ‘Zero Harm’. The majority of the fatal incidents that occurred during the year were a result of avoidable human error. The safety performance was being addressed through ongoing implementation of Sibanye’s safety management systems and practices (SIB 2014).

In 2015 a primary concern for Sibanye was the health and safety of employees and members of the communities with the aim of zero mining related fatalities and diminishing accident rates.

Sibanye believed healthy employees were more aware of safety and were more productive than would otherwise be the case. The safety of employees was paramount, and the company continually strived to improve health and safety standards in order to achieve the goal of ‘Zero Harm’.

Sibanye achieved a 50% reduction in the FIFR despite the incidence of events such as underground fires and seismicity. The FIFR was comparable with the US mining-industry averages despite their mines generally being shallower, and less hazardous and labour-intensive.

The number of disabling injuries increased during the year. Every accident was one accident too many, and Sibanye would continue to determine the underlying causes that lead to each accident as well as to near-accidents in order to devise ways to prevent recurrences. Management acknowledged that the deterioration in other safety trends was a cause for concern, but action plans were in place to address these issues.

All accidents were investigated, and the main causes were found to be incorrect identification of risks, not timeously and effectively correcting identified risks and

not complying with mine standards. Greater attention was paid to the impact supervisors had on the work environment.

The industry was experiencing the negative effects of pandemics, such as HIV/Aids, along with accidents, accident investigations and stoppages, which adversely affected productivity and costs. It was recognised that investors do not want to invest in companies that do not manage their safety and health matters effectively (SIB 2015).

In 2016 employee safety was of critical importance to Sibanye and the regression in safety performance in the first half of 2016 after several years of consistent improvement caused grave concern to the Board. As a result, a full review of Sibanye's safety strategy and procedures was undertaken to improve safety performance and prevent accidents. More assertive safety leadership structures were put in place and 'safety' was launched as a separate and distinct value. In so doing, Sibanye reaffirmed its commitment to the health and safety of employees.

Safety was included in the values underpinning Sibanye's business. Line management accountability increased with renewed commitment to improve safety performance and to ensure rigorous compliance with laws, regulations, standards and procedures. The company was aware that poor company health and safety performance could affect employee morale and productivity. The loss of confidence in management and investor confidence could be unintended consequences. Employees were key stakeholders, and the health, wellbeing and safety of Sibanye's employees was of primary importance.

Workplace accidents were not an inescapable factor of mining. Accidents were preventable and could even be eliminated through coordinated action by everyone involved within Sibanye, across all occupations. Sibanye would continue to strive to achieve the goal of 'Zero Harm' in the workplace and had a structured, workable plan to achieve it (SIB 2016).

Sibanye recognised that a step change in safety performance requires innovative technologies to engineer out risk. The company therefor will continue to work

towards eliminating inherent safety risks by developing and implementing systems, such as mechanised equipment, that reduce employees' exposure to risk. Technology projects were pursued that would greatly reduce the risk profile and therefore improve the safety performance with related cost and productivity gains.

The roll out of the 'Sharp! Sharp!' campaign across the Group continued to be led by the Vice Presidents and the Executive Safety Subcommittee under the guidance of the CEO.

The 'Zero Harm' task teams were responsible for investigating high-potential accident risks. Sibanye continued to play a leading role in supporting the development of technology and new generation mining through the Chamber of Mines (SIB 2016).

3.2 POLICIES

3.2.1 SAFETY POLICY

Sibanye Gold Limited strived for 'Zero Harm' at its operations. The company aimed to eliminate the potential for accidents and injury at the workplace and strived to minimise hazards inherent in the working environment in a reasonably practicable manner. Sibanye Gold Limited was committed to:

- Continually improving occupational health and safety performance through the setting and assessment of goals and considering evolving stakeholder expectations, best practices, scientific knowledge and available new technology;
- Providing a workplace that is conducive to health and safety;
- Risk management in the workplace and surveillance of workplaces and employees;
- Complying with applicable legal requirements and with other requirements to which the organisation subscribe;
- Ensuring that appropriate resources, training and personal protective equipment are provided to improve occupational health and safety;

- Ensuring that employees and contractors have the relevant skills to perform work related tasks in a safe manner and that they are aware of their individual occupational health and safety obligations and rights;
- Applying a consultative and constructive approach in interactions with stakeholders, and
- Making this policy and its revisions, objectives and targets available to employees, contractors and other stakeholders.

Employees and contractors working on Sibanye Gold Limited operations play a fundamental role in achieving occupational health and safety objectives through:

- Their right to work in an environment where health risks are reduced and their duty to withdraw from and report an unreasonably unhealthy or dangerous situation, and
- Taking ownership of occupational health and safety management programmes and initiatives and complying with documented standards and procedures (SIB 2013).

3.2.2 RISK MANAGEMENT POLICY

Sibanye's Risk Management Policy strived to manage risk effectively to protect the Group's assets, stakeholders, environment and reputation to ensure that we achieve our business objectives. The aim of the risk management framework was to achieve:

- A fuller understanding of the reward/risk balance;
- Seeked to reduce the likelihood and consequences of adverse effects to levels that were within the risk appetite/tolerance, and
- Achieve continuous improvement in the management of the risks, thereby enhancing the degree of certainty of achieving the objectives.

The Board believed that Sibanye's risk-management policies, practices and management systems were sound, well-established and entrenched at the operations (SIB 2012).

3.3 ENTERPRISE RISK MANAGEMENT GUIDELINE

The Group implemented an Enterprise Risk Management guideline, which was aligned with the ISO 31000 international risk-management standard and the governance principles enshrined in King III. The objectives were:

- To identify, assess and manage risks in an effective and efficient manner;
- To make decisions based on a comprehensive review of the reward-to-risk balance;
- To provide greater certainty on the delivery of objectives, and
- To fulfil corporate governance requirements (SIB 2012).

3.4 SUSTAINABILITY FRAMEWORK

Sibanye developed specific policies and procedures relating to its sustainability practices and underpinned the Sibanye's strategy. These policies and practices formed an integral part of the management of the Group and employed a holistic approach to sustainability with the support and collaboration of all the stakeholders.

Sibanye embraced the concept of 'Strong Sustainability', as defined by the Brundtland Commission, 'development that meets the needs of the present without compromising the ability of future generations to meet their own'.

The corporate-level Sustainable Development team and other critical departments entered into service level agreements with the operations to deliver coherent strategies and approaches. The Five Capitals Model was used as a framework for sustainability and provided a basis for understanding sustainability in terms of the economic concept of wealth creation or 'capital'. It provided a broader understanding of financial sustainability by enabling business to consider the effect of wider environmental and social issues on long-term profitability (SIB 2013-1).

3.5 GOVERNANCE

The Board was responsible for sustainability and delegated specific responsibility for oversight of various sustainability issues to:

- The Audit Committee;
- The Safety, Health and Sustainable Development Committee, and
- The Social and Ethics Committee.

All the Board committees were composed exclusively of independent non-executive directors (SIB 2012).

3.5.1 THE SAFETY, HEALTH AND SUSTAINABLE DEVELOPMENT COMMITTEE

In 2013 the Safety, Health and Sustainable Development Committee reviewed Sibanye's adherence to occupational health, safety and environmental standards. The committee had oversight of efforts to minimise mining related accidents, to ensure that Sibanye operations complied with all environmental regulations, to establish policy in respect of HIV/AIDS, and other health matters. Its primary activities included:

- Assisting the Board in its oversight of the effectiveness of the Group's sustainable development programmes;
- To keep the Board informed about the Group's objectives, and
- Compliance with and maintenance of standards in Sustainability.

The committee comprised of non-executive directors and the Chief Executive Officer attended the meeting (SIB 2013).

3.5.2 AUDIT AND RISK COMMITTEE

In 2013 the management of risk formed an integral part of Sibanye's approach to sustainability. Risk management, included the related systems of internal control, was the responsibility of the Board, although management was accountable to the Board for designing, implementing and monitoring an integrated process of risk

management into the Group's daily activities. The Board, through the Audit and Risk Committee, ensured that management implemented appropriate risk-management processes and controls (SIB 2013).

In 2015 the risk management process was a systematic application of management policies, procedures and practices in communicating, consulting and establishing the context, and identifying, analysing, evaluating, treating, monitoring and reviewing risk. Risk management documents included the Risk Policy, Plan and Charter, which set out the requirements for effective oversight of risks, including the identification, assessment, evaluation, treatment and reporting of risks. The risk-management process was embodied in Sibanye's Risk Management Framework, which was used for implementation.

The strategic risk register maintained at corporate level was reviewed twice a year by the Risk Committee. The operations had a formal quarterly risk review process, which followed a formalised responsibility structure where the risk registers were discussed and updated. It included support services, engineering, health and safety and environmental staff. Should any additional risks be identified, plans to address it were implemented.

At corporate level, the risk owner was represented on the Executive Committee. Responsibility for mitigating risks was given to representatives of relevant departments as emphasis was placed on the business taking ownership of risk. At the operations, risk assessment was a daily activity and work areas were assessed daily in terms of their compliance with the requirements. The Internal Audit Department was responsible for conducting annual audits on mitigation actions and reported four times annually to the Audit Committee (SIB 2015).

3.5.3 Social and ethics committee

The Social and Ethics Committee was responsible for discharging its statutorily imposed as contemplated in the applicable regulations. It included monitoring Sibanye Gold's activities in relation to relevant legislation, other legal requirements and prevailing codes of best practice regarding, amongst others, the

environment, health and public safety and their impact on Sibanye Gold's activities (SIB 2012).

3.6 COMPANY STRATEGY

It was concluded in 2012 that the strategic implications of the separation of New Gold Fields and Sibanye Gold enabled the two independently governed and managed companies to focus on their respective strategic goals and to operate more effectively as separate entities, to the benefit of shareholders, employees and communities.

The unbundling enabled an initial focus on achieving stable and safe production at Beatrix and KDC. Sibanye would be in a position to use the significant cash flow generated by these mines to extend their operational lives and increase the dividends paid to shareholders. When these assets formed part of the Gold Fields portfolio, they faced a declining production profile and a life-of-mine production plan, which assumed extraction of the existing reserve only without factoring in any investment to convert the substantial resources to reserves.

The focus was to reverse declining production trends and the optimisation of the extraction of its substantial Mineral Resources and Mineral Reserves and so as to extend the life of both mines. It would pursue technological solutions to help meet the challenges posed by deep underground, narrow reef mining. In addition, Sibanye Gold seeked to add profitable, stable and low-cost operations that provide a high degree of leverage to the gold price through the selective pursuit of synergistic opportunities for consolidation within the broader South African gold mining sector (SIB 2012).

2014 was a year of operational and financial consolidation for Sibanye, after significant restructuring in 2013. The primary objective was to entrench the new operating model and operational structures, which was successfully implemented at the Beatrix, Driefontein and Kloof operations in 2013, whilst integrating the newly acquired Cooke Operation into the Group. It was important to ensure the consistency and sustainability of the performance. The company established

dedicated internal capacity focused on securing the long-term future of the company (SIB 2014).

In 2016 Sibanye's strategy needed to be sound and consistent in order to deliver in the long term, yet flexible enough to respond to sudden changes in the operating environment. This required optimising the operations and ensuring that it continued to deliver on the operational deliverables of safety, volume, cost and grade and by extending, as far as is profitably possible, the lives of the operations. Sibanye's commitment to its vision of 'creating superior value for all stakeholders' defined and guided all aspects of the business.

There was still substantial value to be unlocked through the development and adoption of new technologies in the West Wits gold mines. Sibanye committed to further advance various developments and projects. The overall strategy based was on three pillars comprising of capitalising on legacy mining; optimising current mining horizons and developing the future state mining method (SIB 2016).

3.7 MANAGEMENT STRUCTURE

In 2012 the strategic intent for Sibanye included the establishment of a fit-for-purpose and dedicated management team to focus on Beatrix and KDC. The company would ring-fence cash flows from its mature, deep underground mines in order to invest in related development projects or pay out in dividends (SIB 2012).

In 2014 'Safe technology' was identified as a strategic imperative. The company established a new operating structure in 2014 headed by Senior Vice President: Safe Technology, assisted by two project engineers. A dedicated projects team assessed all organic opportunities within the Group while a new business development function was established to consider external, value-accretive opportunities, ensuring that the operations focus on delivery (SIB 2014).

In 2016 a Senior Vice President: Safety, Health and Environment was appointed in the office of the CEO to spearhead the health and safety strategy. The safety department was restructured to ensure appropriate allocation of skills (SIB 2016).

3.8 SAFETY AND HEALTH STRATEGY

In 2012 Sibanye inherited a strong safety culture with good and improving safety performance trends, large high-grade resources, and well-maintained assets from Gold Fields. In combination, these attributes set the scene for a significant turnaround by the focused management team (SIB 2012).

In 2013 engineering out safety risks at Sibanye's operations was a key priority and a number of ongoing and extensive safety risk-management initiatives contributed significantly towards a reduction in the severity of safety incidents. These initiatives related to reducing falls of ground, seismic and tramming incidents, which accounted for approximately 37% of injuries during the year. The company had measures in place to manage seismic risk.

Tramming entails moving people, material and ore using railbound equipment, including locomotives, hoppers and other rail cars. The rolling out of a fail-safe command system continued and was expected to be completed by mid-2014.

The rollout of an auditing team resulted in a significant improvement in the physical condition of the underground workings, which contributed toward the achievement of the safety objectives. Safety remained an imperative and Sibanye Gold continued with practices initiated by Gold Fields which included:

- Behaviour based safety initiatives;
- Health and safety agreements with labour;
- Integrated Visible Felt Leadership;
- Mandatory Codes of Practice issued by DMR;
- Mine Codes of Practice for rock fall and rock bursts;
- Mine Codes of Practice and standard operating procedures, and
- Safe production rules.

Sibanye's vision was that every employee had the right to a healthy and safe working environment. Its Health and Safety Policy committed Sibanye to conduct activities in a manner that ensured employee health and safety as a priority. The Group's safety strategy required compliance as a minimum, while engineering out safety risks and collaborating with stakeholders, including employee representatives and the DMR, to improve performance. The implementation of the overall safety strategy remained a key focus in order to realise continuous improvements (SIB 2013).

In 2014 Sibanye's safety, health and well-being strategy was reviewed and rolled-out across the Group. The company focus was on establishing a safe, production friendly operating environment, through the ongoing implementation of the health and safety strategy and initiatives to reduce risk continues, in the pursuit of 'Zero Harm'. The company aimed to achieve continuous safety improvement by aligning beliefs and behaviours with the CARE values, including the goal of 'Zero Harm'. Sibanye pursued maximising production responsibly while promoting a safe and healthy operating environment, culture, and upskilling employees at the same time.

The focus was on compliance and engineering out risk. This systematic reduction was achieved by identifying and ranking risks; identify technical and procedural engineering solutions in terms of a risk mitigation hierarchy to eliminate the risk completely; control the risk at source; minimise the risk; provide personal protective equipment and monitor risk exposure.

The safety, health and well-being strategy included compliance to rules that were in place; risks to be identified and engineered out; employee well-being was critical; staying fit and healthy was a joint responsibility, and that relationships should be based on mutual respect.

Managers and employees needed to share goals and engage with teamwork underpinned by motivated and competent teams. It was Sibanye's objective to have motivated and competent employees so that it could achieve the Group's

business and operational goals and make a positive contribution to the quality of life of the employees (SIB 2014). The focus was on:

- Safe, consistent production;
- Eliminating injury;
- Constructive labour relations;
- Attracting, developing and retaining employees;
- Legislative and regulatory compliance, and
- Managing power / electricity.

In 2015 Sibanye believed that the safety and health of employees were essential for an engaged, productive workforce and that healthy employees work safely. The company aimed to eliminate the potential for accidents and injury, and to minimise hazards inherent in the working environment in a practical manner in order to achieve 'Zero Harm'.

Sibanye had extensive systems of control in place to minimise health and safety risks. About 80% relied on employees taking ownership, from the CEO to line management, supervisors and mineworkers. The company aimed to eliminate the potential for accidents and injury, and to minimise hazards inherent in the working environment in a practical manner in their quest for 'Zero Harm'. The integrated safety and health strategy included:

- Adherence to operational standards and responsibility;
- Engineering-out risk initiatives;
- Fall-of-ground initiatives and action plans;
- Improvement of employee wellbeing;
- Application of appropriate technologies, and
- Effective education and training.

Modernisation of mining processes was a means to improve productivity and the safety of employees in the workplace. The development of new technology or innovation would have a substantial impact on Sibanye's ability to create value over time. The company developed partnerships with developers and suppliers as

well as memorandums of understanding governing information sharing with counterparts in the mining industry in order to develop fit-for-purpose technology.

Improved mining methods and cycles would allow for the extraction of maximum value from assets and resources by lowering cut-off grades, decreasing dilution and increasing production rate. The net result would be higher volumes of better quality product with substantial reductions in injury-frequency rates, facilitated by reduced employee exposure to dangerous areas (SIB 2015).

In 2016 the health and safety focus were re-energised as the Sibanye management implemented urgent action to address the regression in safety. The executive management, together with senior safety specialists, completely reviewed the Group's safety principles and, following the review, rolled out an extensive safety awareness campaign, elevating safety as a core value in the Group ‘CARES’ values. An Executive Safety sub-committee was established to ensure that the safety strategy was implemented accordingly and that operations were accountable. The commitment to safety remained firm and the company applied significant resources to improving safety at the operations.

A 12-point safety plan was formulated through a series of high-level safety workshops as shown in Figure 3. The focus from a leadership perspective included improved executive safety leadership, reviewing the safety leadership structure, and operationalise the divisional safety structures. In the case of humanising the strategic intent there was additional focus safety systems compliance; safety awareness campaigns; training to enhance management capability; focus on safety mind-set and behaviour, and the alignment of the stakeholder approach to enhance safety management.

The safety systems were consolidate into a combined Sibanye-Stillwater safety strategy and safety risk management was improved regarding ‘A’ hazards. The CEO reviewed all fatal accidents, and serious incidents were reviewed through a ‘Zero Harm’ task team.

Sibanye continued to strive to achieve the goal of Zero Harm in the workplace. The company had a structured, workable plan to achieve this, however, it was essential to create alignment with relevant stakeholders. The Safety, Health and Wellbeing strategy was supported by the CARES values, which included commitment, accountability, respect, enabling and safety.

The Short-term plans included:

- Restructuring the safety department by appointing a senior executive in the office of the CEO to spearhead the health and safety strategy;
- Launching the new safety value now included in our CARES value system and the roll out of the 'Sharp! Sharp!' campaign across the Group to reaffirm the commitment to safety;
- Entrenching visible-felt leadership by executive and senior management at the operations to ensure close out of action plans and high potential hazards that warrant an immediate stop and fix;
- Establishing an Executive Safety Subcommittee to ensure that the safety strategy is implemented accordingly and that operations are accountable;
- Setting up a 'Zero Harm' task team to investigate serious incidents and ensure that recommendations are implemented to prevent recurrence, and
- Reviews of all fatalities by the Office of CEO to ensure close outs are made to prevent recurrence.

The Medium-term plans intended to ensure that safety is constantly top of mind include:

- Changing the hearts and minds of the employees to be more safety conscious in the workplace and adopt a safety-first attitude as a way of life. Training is provided to encourage accountability for safety incidents or substandard conditions including a new slogan: 'I am safe! We are safe! Phepha mina! Phepha zonke!'
- Restructuring the entire safety department to ensure appropriate allocation of skills, and

- Implementing measures that ensure employees comply with the safety system to reduce non-compliances, substandard conditions and accidents.

The Long-term safety plans include:

- Aligning systems in the safety department across both the gold and platinum divisions to ensure common understanding and a single reporting system that enables the sharing of experiences and knowledge of best practice;
- Documenting the new safety management system to guide management of safety, and
- Securing tripartite commitment from Sibanye, the Mine Health and Safety Council and the DMR in support of a more effective safety management process at all operations (SIB 2016).

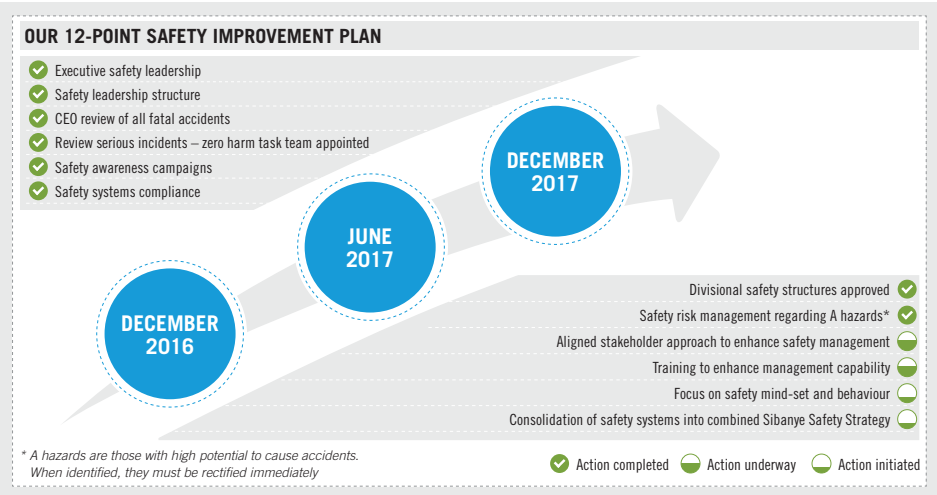


Figure 3 2016 Safety improvement plan (SIB 2016).

3.9 HEALTHCARE STRATEGY

In 2015 while the company continued to attempt to reduce accidents in the workplace, the approach to healthcare was also revised. It aimed to provide employees who were injured or fall ill with treatment or medication as quickly

and conveniently as possible. Sibanye moved away from the conventional industry approach of running centralised mine hospitals, which was not core business or expertise. The company established primary health and safety clinical facilities, which were located at each shaft. In this way, minor injuries and other less serious illnesses could be treated promptly and efficiently.

Employees with more serious traumas or illnesses were transferred to regional hospitals where they were assured of first-rate treatment at facilities run by dedicated healthcare experts. Employees knew that, when in need, they could count on receiving the best possible medical care (SIB 2015).

3.10 Modernised industry vision

In 2016 Sibanye created a vision for a future 'modernised' industry run in a sustainable manner for the benefit of all stakeholders as shown in Figure 4. A modern mining industry would:

- Optimally extract and beneficiate the country's natural resources;
- Cause no harm to people or the planet;
- Benefit both the local community as well as the national economy;
- Procure locally;
- To be a preferred employer of well skilled people;
- Creates appropriate risk adjusted returns for investors, and
- Regulations, taxation and incentives are consistent, transparent and recognise mining as a long-term driver of economic growth.

Sibanye believed that they already embraced the requirements for the mine of the future through the corporate vision of creating superior value for all stakeholders. Sibanye pursued this vision with passion, knowing that it was an imperative for the sustainability of the business (SIB 2016).

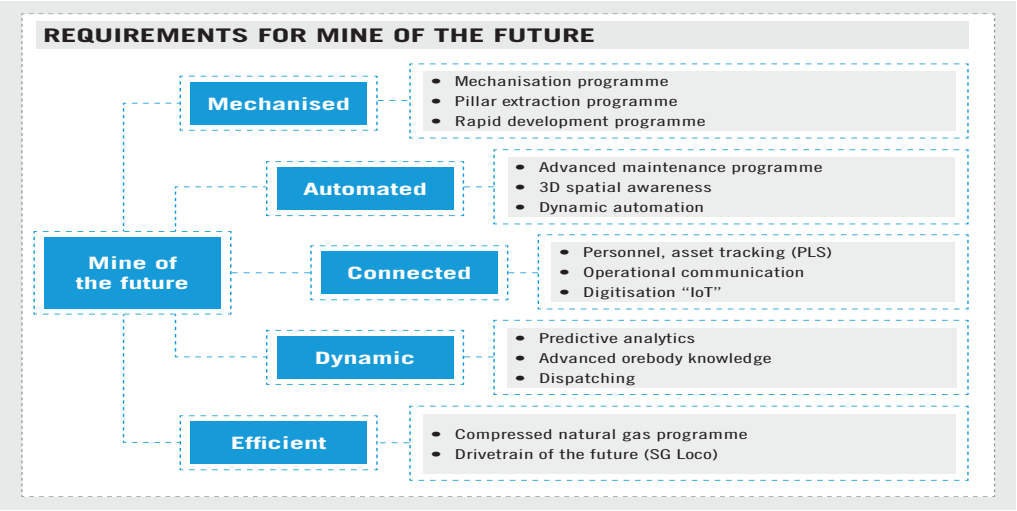


Figure 4 Mine of the future (SIB 2016).

4 SYSTEMISE ACTIVITIES

4.1 HEALTH AND SAFETY MANAGEMENT SYSTEM

The Sibanye Health and Safety Management System was developed in line with internationally accepted standards. The system was reviewed on an ongoing basis to ensure that a continuous improvement process was realised as the system evolved. In 2016 it was planned to aligning systems in the safety department across the gold as well as the platinum divisions to ensure common understanding and a single reporting system that enabled the sharing of experiences and knowledge of best practice. The new safety management system would be documented to guide the management of safety (SIB 2016).

4.2 RISK MANAGEMENT

In 2013 the company introduced a comprehensive and systematic risk-assessment and reporting process across the organisation. The outputs of specialist risk functions provided an integrated view of the risks associated with the business activities. Risk management awareness in business processes was instilled in all associated stakeholders. Risks were controlled and mitigated within the accepted and approved risk-tolerance levels and appropriate risk financing programmes, based on the risk profiles, were created. The company fostered a culture of continuous improvement in risk management by aiming to achieve best practice standards, supported by audit and review processes.

Sibanye believed that mining and the processing of ore involved inherent hazards, which must be understood and effectively managed to eliminate or minimise risk of injury or harm to employees. This was particularly pertinent when it came to ultra-deep underground conventional mining (SIB 2013).

In 2014 Sibanye aimed for ‘Zero Harm’, prevent all accidents and to have a healthy and productive workforce through continuous improvements. The company focused on compliance and the systematic reduction of employees’ exposure to risk in the work environment and engineering out risk. The risk management hierarchy included:

- Identifying and ranking risks;
- Identifying technical and procedural engineering solutions in terms of a risk mitigation hierarchy to eliminate the risk completely;
- Controlling the risk at source;
- Minimising the risk;
- Providing personal protective equipment, and
- Monitoring risk exposure.

Operational risk assessment was a daily activity. The operations had a formal quarterly risk review process, which followed a formalised responsibility structure and includes support services, engineering, health and safety and environmental staff where the risk registers were discussed and updated.

The corporate level strategic risk register was reviewed twice a year by the Risk Committee. Risk owners was represented on Exco and the responsibility for mitigating risks was given to representatives of relevant departments as emphasis was placed on the business taking ownership of risk. Annual audits on mitigation actions were conducted and reported quarterly to the Audit Committee (SIB 2014).

In 2015 Sibanye had extensive systems of control in place to minimise health and safety risks. About 80% of the implementation of the controls relied on employees taking ownership, from the CEO to line management, supervisors and mineworkers (SIB 2015).

In 2016 the employees were the company's most important asset and in order to keep the workforce safe and healthy, the company focused on compliance and systematically reducing employees' exposure to risk. Sibanye identified material issues for the business through a process of internal and external environmental scanning, information from the risk register, feedback from stakeholders and assessment of management. It included:

- Employee safety, health and wellbeing;
- Eliminating injury;

- Addressing occupational hygiene;
- Employee wellbeing, and
- Stakeholder engagement and employee relations.

The high-level safety risk management controls included:

- Ensuring that integrated safety and health plans and systems were in place;
- Continue with the monitoring and root cause analysis of safety incidents conducted to ensure that root causes were addressed, and
- The application of engineering and technology to make the workplace safer (SIB 2016).

4.3 INCIDENT REPORTING

Incident reporting was promoted as part of the Group's safety risk management strategy. Attention was given to near-miss incidents in order to reduce the likelihood of the occurrence of more serious incidents.

The group reported 10 383 internal incident reports in 2013 and 7 776 in 2014 which included safety stoppages. Attention was given to near-miss incidents in order to reduce the likelihood of the occurrence of more serious incidents. The Stop, Think, Fix, Verify and Continue process also formed part of the incident-reporting system (SIB 2013-2014).

4.4 STOP, THINK, FIX, VERIFY AND CONTINUE.

Sibanye aimed to create a working environment that was conducive to the long-term, holistic wellbeing of employees and contractors. Its approach was risk-based and focused on the prevention and treatment of occupational illnesses through effective occupational health management and on a reduction in exposure to occupational hazards by, as reasonably practicable, engineering out health risks. Sibanye had a risk management process in place that was referred to as Stop, Think, Fix, Verify and Continue and included:

- Individuals or teams to stop work;

- To withdraw to a place of safety;
- To assess the risk in collaboration with the appropriate supervisory level or discipline specialist;
- To rectify the situation in terms of mine requirements, and
- To continue activities only once the required remedial action has been verified should a risk be identified (SIB 2013-1).

4.5 AUDITS AND REVIEWS

Safety officers, who were independent of day-to-day production and associated targets, visited each workplace on a monthly basis, on a 21-day audit cycle, throughout the year which was in line with legal requirements.

In 2016 a 'Zero Harm' task team was set up to investigate serious incidents and ensure that recommendations were implemented to prevent recurrence. All fatalities were reviewed of by the Office of CEO to ensure closeouts were made to prevent recurrence (SIB 2016).

4.6 SAFETY STATISTICS CLASSIFICATION

Sibanye, made the distinction between three severity levels in terms of injuries, namely treat and return, lost day and serious injuries and including fatalities. All injuries less severe than a lost-day injury was classified as Medical Treatment Cases in accordance with internal reporting standards (SIB 2013-1).

5 HUMANISE THE BUSINESS SYSTEM

5.1 CORPORATE CULTURE

In 2015 the corporate culture was founded on the values of CARE, which underpinned the business strategy, and promoted competitiveness and success. These values were embedded through continuous communication, transformation, education and training.

The values were supported by the safety, health and wellbeing strategy, which had five key pillars: Compliance with safety rules was essential; workplace and process risks had to be identified and engineered out; employee wellbeing was fundamental to success; staying fit and healthy was a joint responsibility; relationships were important and should be based on mutual respect; managers and employees needed to share goals and engage with teamwork to underpin what was to be done through motivated and competent teams (SIB 2015).

5.2 HEALTH AND SAFETY COMMITTEES

All employees were represented in formal joint management-worker health and safety committees through their representatives to assist in monitoring and advising occupational health and safety programmes. Additionally, the health and safety committees had to ensure that the occupational health and safety programmes were agreed and was effective.

In 2013 Sibanye's approach to safety and health in the workplace was guided by extensive legislation and regulations, the most significant of which is the Mine Health and Safety Act. The appointment of workplace health and safety representatives as well as full-time health and safety representatives was done. The establishment of joint health and safety committees to deal with appropriate health and safety matters at the mine, among other issues. Driefontein and Kloof both concluded new agreements with newly appointed employee stakeholder representatives. These agreements remained in place at Beatrix (SIB 2013).

5.3 EMPLOYEE COMMUNICATION

In 2015 Sibanye re-established direct lines of communication with its employees. Given the close contact and consistent communication, there was a shift from an adversarial to a more collaborative approach. Sustainable employment, higher wages and benefits were the main tangible employee expectations. However, they also expected a relationship based on values. Union relationships tended to be more complex with a clear political influence affecting relations. The quality of the relationship with employees was evident in greater participation in Group programmes, feedback and the degree of workplace disruptions (SIB 2015).

5.4 WELLBEING OF EMPLOYEES

In 2013 the Group's health and wellbeing programme addressed general health management, individual safety behaviour, lifestyle management including influencers such as living conditions, nutrition, sport and recreation as well as education and development.

It was a strategic imperative to protect the safety, health and wellbeing of the employees and it took precedence over production in every instance. Sibanye was dependent on a healthy, skilled, trained and committed workforce, capable of completing tasks safely and productively depended on a healthy, motivated and skilled workforce to function. The health, knowledge, skills, intellectual outputs, motivation and capacity for relationships of the individual were important aspects.

The damage to human capital by abuse of human or labour rights, or compromising health and safety, had direct as well as reputational costs. Efforts to develop and empower employees were ongoing and formed part of a drive to continuously improve the quality of life of those who sustained the Group's business.

Employees were actively encouraged to exercise their right to refuse to work if they believed that conditions were not safe. The right to withdraw from an unsafe

situation or workplace was outlined in the Group's Health and Safety Policy and formed an integral part of induction training offered to all employees (SIB 2013).

5.5 'CARE' SAFETY CULTURE

Sibanye aimed to build a corporate culture by increasing awareness of the company's vision, mission, aims, objectives and values. Employees were aligned with the purpose, vision and values and understood what was needed of them to make a meaningful contribution. The employees, officers and directors alike were required to adhere to and be bound by a Code of Ethics.

At the end of 2013 Sibanye launched the CARE, which articulated the Sibanye's culture and mirrored its values (SIB 2015). CARE was part of everything that was done at the company. It included:

- Commitment: Delivering on our promises to all our stakeholders;
- Accountability: Accepting responsibility for our actions and their consequences;
- Respect: Showing regard and consideration for others, and
- Enabling: Creating an environment where it is possible to work safely and productively.

Sibanye conducted its business in an ethical and fair manner, and promoted a non-sectarian, apolitical, socially and environmentally responsible corporate culture. The corporate culture was founded on the values of CARE, which underpinned the business strategy, and promoted competitiveness and success. These values were embedded through continuous communication, transformation, education and training. It was supported by the safety, health and wellbeing strategy, which had five key pillars:

- Compliance with safety rules was essential;
- Workplace and process risks must be identified and engineered out;
- Employee wellbeing was fundamental to success;
- Staying fit and healthy was a joint responsibility, and

- Relationships were important and should be based on mutual respect.

A commonly understood language, was used to convey the CARE values to all employees and the company was in the process of introducing the 'New Way of Communication'. The aim of this intervention was to eradicate the use of Fanagalo and replace it with the languages identified by Wits Language School. The New Way of Communication involved ongoing training as the language policy was rolled out across the Group.

At the end of 2014 e-learning resources were provided to support self-learning by middle management while recognition of prior learning in isiZulu and Sesotho were provided to supervisors and employees. It was believed that this would enable safer mining with a well-trained, motivated and stable workforce communicating effectively to further embed the CARE culture (SIB 2014).

In 2015 Sibanye's CARE values underpinned its strategy, how it conducted its business and interacted with stakeholders. In living these values, the company showed that it cared about safe production, stakeholders, the environment, the company and the future. The approach was holistic with clear focus on delivery of all strategic imperatives critical to Sibanye's long-term success. Sibanye recognised that:

- Safety, costs, volumes and grade were the primary operational deliverables that underpinned the business;
- Strong cash flow supported the dividend paid to shareholders and underpinned the growth, and
- Organic and acquisitive growth ensured the long-term delivery of sustainable value to all stakeholders (SIB 2015).

In 2016, visible-felt leadership was entrenched by executive and senior management at the operations to ensure close out of action plans and high potential hazards that warrant an immediate stop and fix.

Changing the hearts and minds of employees to be more safety conscious in the workplace and adopt a ‘safety first’ attitude as a way of life, was an initiative to be pursued. Training was provided to encourage accountability for safety incidents or substandard conditions including a new slogan: “I am safe! We are safe! Phepha mina! Phepha zonke!”

The company launched the new safety value ‘Safety’ which included in the previously ‘CARE’ and then the ‘CARES’ value system. The roll out of the ‘Sharp! Sharp!’ campaign across the Group reaffirmed the commitment to safety, to encourage safe behaviour, address the regression in the safety performance and to reintroduce a culture of continuous improvement (SIB 2016).

5.6 TRAINING

In 2013 all employees and contractors received safety induction training and were subject to the Group’s safety standards. Awareness and behaviour-based safety programmes were in place to reduce incidents that caused injuries. Programmes were in place to equip employees with the information they needed to reduce hazards and eliminate risks so that they may enjoy a safe and healthy workplace. All employees and contractors received safety induction training and were subject to the Group’s safety standards (SIB 2013).

In 2015 there was a renewed emphasis on supervisor safety-awareness training to positively influence employees’ behaviour so as to timeously and correctly identify and deal with risks as well as to ensure compliance with mine-safety standards (SIB 2015).

5.7 WOMEN IN MINING

In 2014 Sibanye established a task team to develop a strategy to increase numbers of women in mining and the issues they face, including successful integration of women underground as well as personal safety. These issues were monitored by women in mining forums made up of female employees at each operation.

In 2015/16 issues specific to women in mining was monitored by women in mining forums made up of female employees at each operation. These forums dealt specifically with gender-related challenges and their aim was to ensure that there was a complete integration of women in all working places and at management levels.

Key focus areas included gender-neutral policies and procedures, wellbeing of women including safety and security in the workplace, creating working environments conducive to the employment, placement and development of women. In order to increase the number of women employed in core and critical skills, changes were made to Sibanye's recruitment strategy (SIB 2015-2016).

6 OPERATIONALISE SAFETY

6.1 ENGINEERING OUT SAFETY RISKS

In 2013 the engineering out of safety risks at Sibanye's operations remained a key priority and a number of ongoing safety risk-management initiatives contributed significantly towards a reduction in the severity of safety incidents. These initiatives relate to reducing falls of ground, seismic and tramming incidents, which accounted for approximately 37% of injuries (SIB 2013).

6.2 SAFE TECHNOLOGY DEPARTMENT

In 2014 Sibanye focused on the use of technology to improve working conditions and to provide a safer working environment, as well as the potential productivity benefits that may arise as shown in Figure 5. The focus areas included improving the safety, efficiency and productivity of current mining processes; emphasis on reducing employee exposure to danger areas and increasing output and decreasing costs.

An interim Safe Technology strategy was developed subsequent to a 100-day process to identify the immediate operational needs of the business. The Safe Technology function guided interventions towards modernising the operations by using new technologies to improve working conditions. The Safe Technology team capitalised on Sibanye's internal wealth of knowledge and experience in investigating, developing and driving innovation. The team established symbiotic relationships with counterparts in the industry, innovative developers and original equipment manufacturers (OEMs) to ensure that safety technology added value.

The Safe Technology strategy considered ways in which new technology could impact on Life of Mine projections, orebody complexity, productivity profiles, cost pressures, as well as growing the portfolio of capital expansion projects in order to improve productivity (SIB 2014).

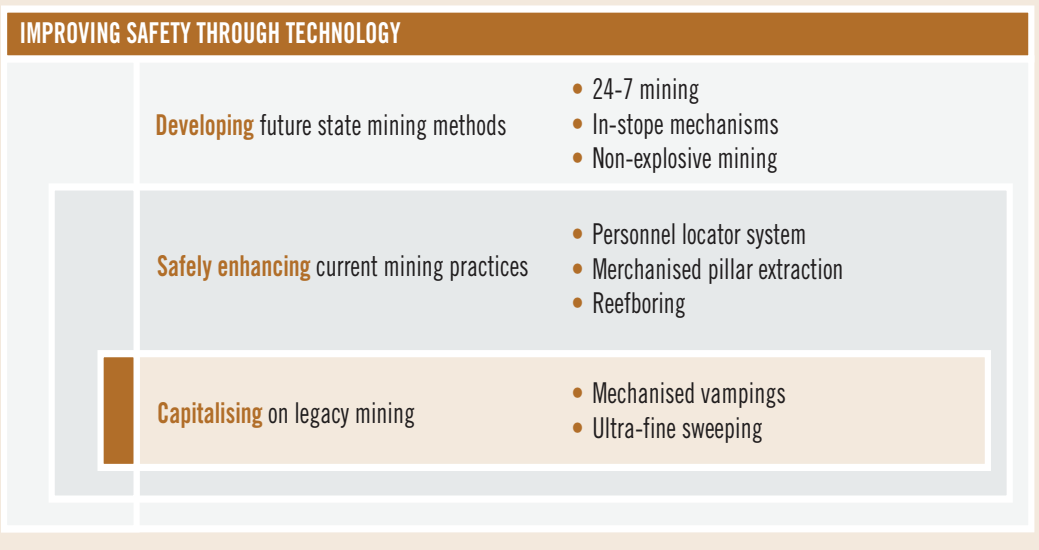


Figure 5 Improving safety through technology (SIB 2014).

Refinements of the Safe Technology strategy was completed in 2015. The initial functions required a comprehensive review of technologies used in the past, investigation into current industry-relevant technology development as well as establishing collaborative networks with OEMs, research institutions and other mining houses. The focus was on modernising narrow, tabular and steeply dipping ore-body extraction. A number of technologies were actively pursued, and were in various stages of investigation, development and implementation.

The development of appropriate new technology was a critical programme to ensure the safety of employees, particularly as the mines became ever deeper and more complex. The Safe Technology programme was advancing technical innovation by designing and developing machines to be deployed underground to make mining at depth safer. The machinery was to be operated remotely to enable mining safely at greater depths and in more onerous conditions than was previously possible. It would have longer-term benefits for the operations and for the country as a whole (SIB 2015).

In 2016 the Platinum and Gold divisions were integrated in order to derive maximum value from the resources committed, the combined organisational structure would form part of the resources function and facilitate cross-divisional

technology project management and information sharing. This would eliminate duplication of effort and propagating divisional successes throughout the Group (SIB 2016).

6.2.1 SAFETY RELATED PROJECTS

The Safe Technology department would assist with safety-related project and mining innovation projects. The mechanised pillar extraction aimed at enabling the extraction of increased resources that were contained within strike and stability pillars at the gold operations.

The advanced transport programme aimed to develop more cost-efficient, environmentally friendly means of transport of ore and material in particular (SIB 2014).

Smaller safety enhancing projects

In 2015 some of the smaller safety enhancing and production optimization projects included roof-bolting optimisation and standardisation; localised hydropower mining; winch signalling; automated cleaning methods; continuous dust monitoring and suppression; structural inspection and maintenance management system optimisation; diesel particulate matter reduction and control.

Macro safety enhancing projects

During 2015 Sibanye collaborated with its peers in the mining industry regarding technology development through inter-company, regulatory, administrative and institutional relationships as well as partnerships. Some of the macro projects include mechanised wide-raise development in production trials at Kloof's Ikamva Shaft; mechanised and rapid infrastructure development using tunnel boring machines and production trials of strike-and-dip pillar reef-boring with positive initial results (SIB 2015).

6.2.2 STOPE MECHANISATION PROJECT

A paradigm shift in hard-rock mining was required for the Group to remain competitive locally and globally. The Safe Technology department commenced a stope mechanisation programme aimed at enabling the removal of the operator from danger, reduce costs and paylimits, and enable non-explosive, continuous production (SIB 2014).

The stope mechanisation programme aimed to develop a suite of mechanised machinery, especially for the narrow tabular environments prevalent in both gold and conventional platinum mining that was also capable of performing drilling and cleaning operations. A significant advantage would be the removal of employees from dangerous work areas, thus contributing to greatly increased safety performance. The increased efficiency and accuracy of such units would improve the rate and quality of mining, reduce pay limits and allow for additional resource to reserve conversion (SIB 2014).

In 2015 in line with the future-state mining method, work included facilitating the conceptualisation and design of two primary mining platforms, and the commissioning of prototypes for delivery in the first quarter of 2016 (SIB 2015).

6.2.3 HYBRID LOCOMOTIVE

In 2015 it was envisaged that Sibanye's hybrid locomotive would use highly efficient asynchronous permanent magnet motors, with an increased voltage, enabling the use of smaller, less costly and more readily available motors that were capable of regenerating approximately 30% of the energy expended in a tramming cycle. Energy storage would be facilitated by lithium-ferrite phosphate batteries, which present reduced weight and substantially increased life when compared to the current lead-acid equivalent. A generator set would charge the batteries when required and thus alleviate the need for up to three lead-acid batteries per locomotive, presenting a substantial reduction in capital.

The locomotive was designed to be a direct replacement for conventional diesel locomotives without having to construct capital-intensive battery bays and associated infrastructure. The first hybrid locomotive was planned to be delivered in the first quarter of 2016 (SIB 2015).

6.2.4 MINE DIGITISATION PROJECT

In 2016 the mine digitisation project involved capitalising on the increased availability of data to enable development of comprehensive asset and behavioural management tools to enhance the efficiency and safety of mobile machinery. Operational transparency, greater insights, through digitisation, would enable informed, real-time decision making and dynamic responses to changing operating conditions. It was envisaged that it would drastically reduce the environmental impact through efficient and renewable energy consumption (SIB 2016).

6.2.5 MINING HORIZON IMPROVEMENT PROGRAMME

In 2016 the mining horizon improvement programme involved several short-term projects aimed at improving current mining methods. The safety performance would improve markedly as employees were removed from dangerous work areas. Advanced mining systems would enable a drastic increase in the convertibility and sustainability of Sibanye's resources. High-efficiency, remote and low-cost mining systems would allow access to previously inaccessible mining areas such as white areas, low-grade areas, those below-infrastructure, stability pillars and sections that are inaccessible owing to seismicity.

A potential consequence of the projects could result in upskilled job creation through the generation of secondary industries to manufacture and service the mechanised mining equipment. The associated need for highly skilled workers, would contribute to local community development and have an economic multiplier effect (SIB 2016).

6.2.6 Personnel locater system

In 2014 it was planned to design a personnel locator which was envisaged to be a small transmission and receiving device, which was included in the battery packs of employees and could be activated from surface. The radio waves were to be transmitted from one locator to the next, forming a transmission web underground and the information was relayed to surface, thereby allowing management to obtain information about where a missing person may be without the need for expensive infrastructure to be installed underground (SIB 2014).

6.2.7 Mechanised sweeping

A mechanised ultra-fine sweeping machine was designed to complement the Cooke Crush Pillar Extraction Project. It was based on an adaptable platform allowing the machine to be operated remotely, and extract ultra-fine material left in old workings, eliminating the need for employees in the danger zone.

It was envisioned that the adaptable platform would be coupled with an array of interchangeable attachments, performing multiple operations from surveying to reconnaissance (SIB 2014).

6.2.8 Project Goldfinger

In 2014 Project Goldfinger, pillar-and-stope mining, began at Driefontein 10 shaft testing the reef-boring and mechanisation equipment developed in 2014. Following a successful reef-boring development programme, potential was identified to unlock 2.4Moz in strike and dip pillars across the Kloof and Driefontein operations. This excluded strike and dip pillars in non-operational shafts. Both mining methods significantly reduced employee exposure to dangerous working areas (SIB 2014).

6.3 Reducing falls of ground and seismic risks

In 2013 Sibanye's initiatives relating to seismic risk management included the fitting removable safety nets during drilling shifts and the installation of roof

bolting on all stope panels at all operations. In the instance where hangingwall rock conditions did not allow this, alternative solutions were devised

The enhanced pre-conditioning of rock before stoping commenced which entailed drilling longer-than-normal holes and time-detonating explosives ahead of the scheduled blast to allow for fracturing of the rock at the face, consequently releasing energy within the rock mass. It reduced the likelihood and/or impact of strain bursting while employees were working on the panel.

Ongoing mine-planning reviews were conducted to ensure the minimisation of high-risk concentration of mining. Centralised blasting was conducted during a narrow time window to minimise the exposure of crews to seismicity during shift times. The cessation of night-shift working in isolated areas that had a high night-shift seismic-risk profile and the company undertook regular seismic hazard assessments, allowing for the temporary withdrawal of crews (SIB 2013).

6.4 Crush pillar extraction project

Significant progress was made at the Cooke 1 shaft, which employed conventional methods to mine high-grade crush pillars. These methods, although proven and successful, were time-consuming in terms of site establishment and offered limited potential to increase production rates due to single-shift time blasting and face availability.

Safe Technology developed a non-explosive, remotely operated mining technique with readily available equipment and suitable support design, which could present a quantum leap in production rates and safety improvements by facilitating continuous mining and removing the operator from the danger zone (SIB 2014).

6.5 Reducing tramming risks

Tunnels accessing the orebody were relatively restricted and needed to be laid out so as to prevent the risk of collisions. Underground tramming which entailed moving staff, material and ore by means of rail-bound equipment, which included locomotives, hoppers and other rail cars posed a significant risk.

In 2013 Sibanye continued with the Guard Communications System programme to reduce the risk of collisions and the potential injury of individuals in close proximity of the trains. Underground locomotives were overhauled including improved cab designs, enhanced braking systems, electronic data recording, hand-held controls with pivot-based safety cut-out systems and enhanced direct communication with drivers. This system required both the driver at one end of the locomotive and the guard at the other end to issue the same instructions to the locomotive before it would function. It included an emergency stop function that could be initiated by either individual (SIB 2013).

The rolling out of a fail-safe command system continued and was completed by mid-2014.

6.6 Drill Rigs

In 2013 conventional handheld rock drill machines in flat-end development were replaced by drill rigs, which allowed for remote operation of drilling machines. This minimised the extent to which employees were exposed to potential hazards in the development end (SIB 2013).

6.7 Infrastructure maintenance

In 2014 the company was aware that inadequately maintained infrastructure could result in unplanned breakdowns and stoppages with possible production delays, increased costs and industrial accidents. Maintaining infrastructure necessitated a planned programme of maintenance and upgrades, which had to be funded by capital expenditure which was linked to infrastructure risk assessment. Sibanye kept a maintenance risk register and conducts regular shaft-infrastructure maintenance management inspections (SIB 2014; 2016).

6.8 Public safety

Sibanye instituted preventative measures, such as fencing off specific areas, establishing only one access/egress point, activating facial biometric access control on various shafts and greater visibility with the deployment of additional

employees on shafts and in crush offices to prevent illicit mining activities (SIB 2016).

7 SAFETY PERFORMANCE

The Sibanye assets had 72 fatalities in the gold division between 2011 and 2016 as well as 2 in the platinum division in 2016 as shown in Figure 6 (GF 2011; SIB 2012-2106).

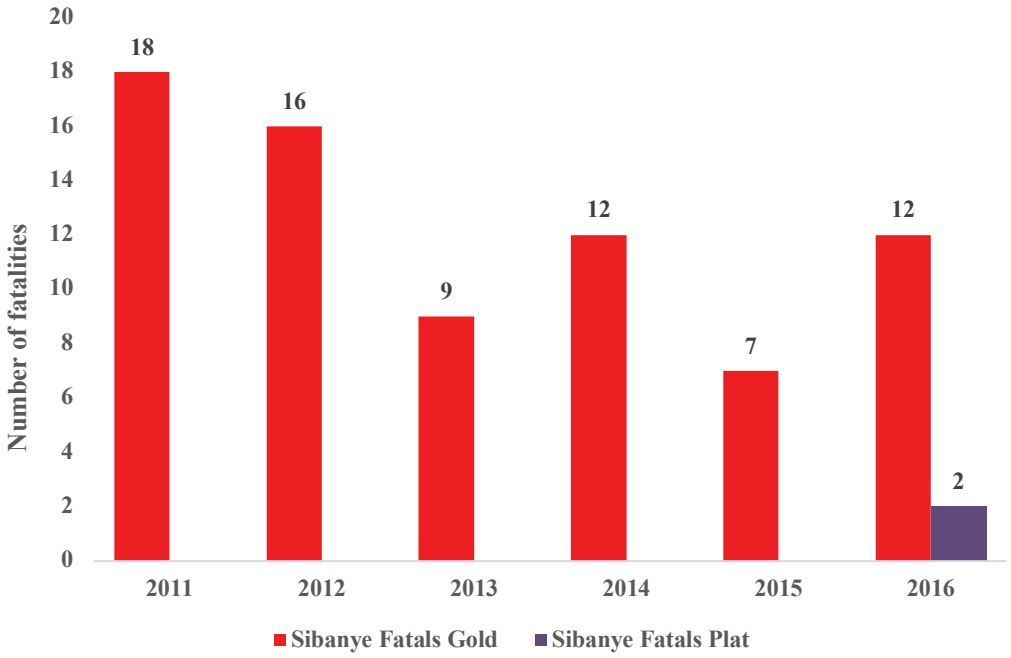
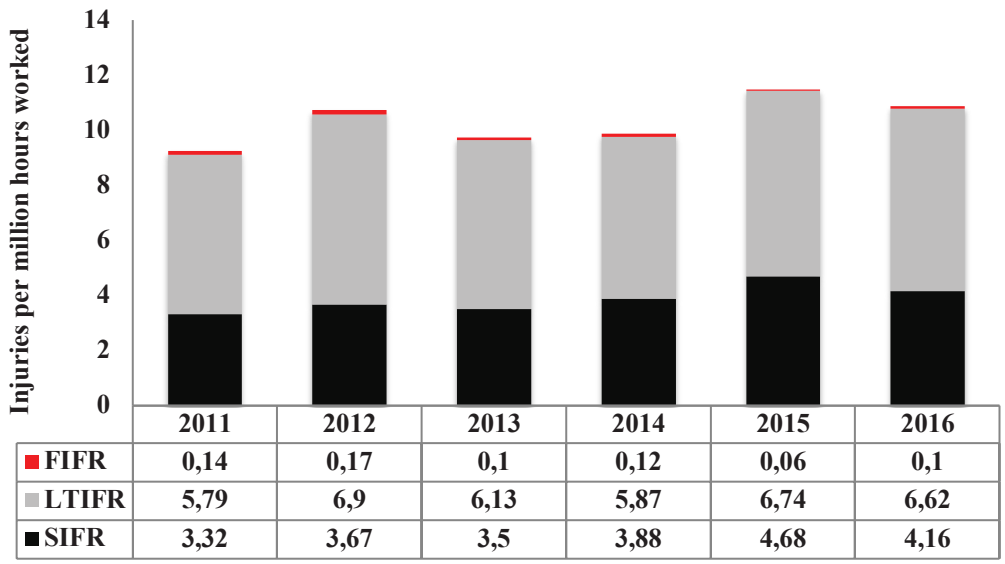


Figure 6 74 Fatalities at Sibanye, 2011-2016 (GF 2011; SIB 2012-2106).

The overall safety statistics did actually increase between 2011 and 2016 as is shown in Figure 7.



	2011	2012	2013	2014	2015	2016
FIFR	0,14	0,17	0,1	0,12	0,06	0,1
LTIFR	5,79	6,9	6,13	5,87	6,74	6,62
SIFR	3,32	3,67	3,5	3,88	4,68	4,16

Figure 7 Sibanye injury frequency rates, 2011-2016. (GF 2011; SIB 2012-2106).

8 SUMMARY

Sibanye Gold, previously a wholly owned subsidiary of Gold Fields and owning its more mature South African assets, Kloof, Driefontein and Beatrix was spun out of Gold Fields and listed as a fully independent company on 11 February 2013 (GF 2013).

Sibanye believed that deep-level mining could be riskier than many other mining or industrial enterprises. However, the safety of the employees was the most important aspect of the approach to sustainability and the company embraced the target of ‘Zero Harm’.

In 2014 the company was aware that inadequately maintained infrastructure could result in unplanned breakdowns and stoppages with possible production delays, increased costs and industrial accidents. Sibanye’s safety, health and well-being strategy was reviewed and rolled-out across the Group.

In 2015 Sibanye re-established direct lines of communication with its employees. The company believed that modernisation of mining processes was a means to improve productivity and the safety of employees in the workplace. The development of new technology or innovation would have a substantial impact on Sibanye’s ability to create value over time.

In 2016 Sibanye re-energised their safety focus by including safety as a value and rolling out a 12-point safety plan.

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Appendix F

The Lonmin safety journey between 2007 and 2016 case study.

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1 LONMIN COMPANY BACKGROUND

In 2006 Lonmin was the world's third largest producer of Platinum Group Metals. The South African operations comprised of mining complex in Limpopo located near Polokwane, the Smelter and Base Metal Refinery near Marikana and a Precious Metal Refinery located at Brakpan. The company had 23 804 employees and 6 932 contractors as is shown in Figure 1 (LON 2006).

In 2007 the mining operations in South Africa were highly unionised and at Lonmin a single union represented the vast majority of the Group's workers. There was a risk that strikes or other types of conflict with unions or employees may occur which could have an adverse effect on the Group's performance and its financial condition (LON 2007).

In 2008 South Africa experienced an outbreak of violent attacks on foreign nationals and Eskom declared *force majeure* on electricity supplies. South Africa unexpectedly experienced a drastic reduction in the availability of electricity supply due to capacity constraints faced by the national electricity utility. Electricity restrictions were implemented nationally, and mining industries were faced with an immediate 10% decrease in supply (LON 2008).

The operations were impacted by the electricity supply situation with an industry-wide shutdown in January as well as a rationing of the energy consumption to 95% of normal levels. The company successfully managed the business at this level of energy consumption for around five months.

The company struggled with a number of challenges and was performing below its potential. Short-term market conditions would lead to structural shifts within the Platinum industry and it could include shaft closures and mothballing. A review of the operations was conducted, primarily focusing on improving performance, reducing costs and maximising the value of the assets. The overall production and cost performance in 2008 were disappointing as productivity was below expectations, primarily at the mechanised shafts.

Lonmin restructured key parts of the business, with a view to aggressively cutting

and better managed costs, while at the same time increasing management's focus on delivery against plans. It included the eliminating non-value adding ounces and the suspended production from the opencast operations at Marikana. Other actions taken included the curtailment of all recruitment, halving the exploration expenditure and the capital expenditure programme primarily focused on mine development at Marikana and obligatory spend at the Process Division. The company placed all other growth projects on a care and maintenance basis.

There was a lack of mine ore reserve development that would impact the production during the year and would continue into 2009. The company continued to accelerate ore reserve development to address this issue (LON 2008).

In 2009 Lonmin operated in an extremely difficult pricing and currency environment with revenues declined dramatically by over 50%. Management took immediate decisive action through the closure of unprofitable operations, the reduction of costs and the restriction of capital expenditure.

The management team made good progress in the drive to restore the operational health of the business. There was much to be done before the operational health of Lonmin was fully restored. This was to be achieved in conjunction with an increase in safe production and an improvement in the position on the cost curve. All efforts were directed in order to position Lonmin to maximise benefit as the market recovered. The ability to operate effectively as an investor in South Africa was a function of the company's behaviour as a responsible corporate citizen (LON 2009).

In 2010 Lonmin's operations had been largely been restored and the company could look forward to improving on the work practices and disciplines that were introduced into the operations in order to drive efficiency and productivity (LON 2010).

In 2011 Lonmin delivered a solid operational and financial performance. The two major operating challenges were safety and labour relations. Lonmin and its management remained committed to ensuring the safety of the employees and

‘Zero Harm’ as a core value (LON 2011).

In 2012 the Marikana event, in which several people lost their lives, was a defining moment for South Africa’s labour relations. One of the consequences was the establishment of a platform for critical conversations needed about mining and society (LON 2012).

In 2013 the South African mining industry was at a crossroad for decision making to resolve issues and disagreements before they turned into tension and mistrust and required a new collaborative model to be developed. Lonmin was committed to a process of fundamental change to rebuild trust with all the stakeholders. Marikana had a six-week long strike, which was marred by violence. The Lonmin Renewal Plan included the safe start-up of the operations, securing corporate funding, and managing costs. There was a backdrop of the hostilities that existed between rival unions, the breakdown in the relationship with employees, and the difficult economic circumstances that continued to prevail (LON 2013).

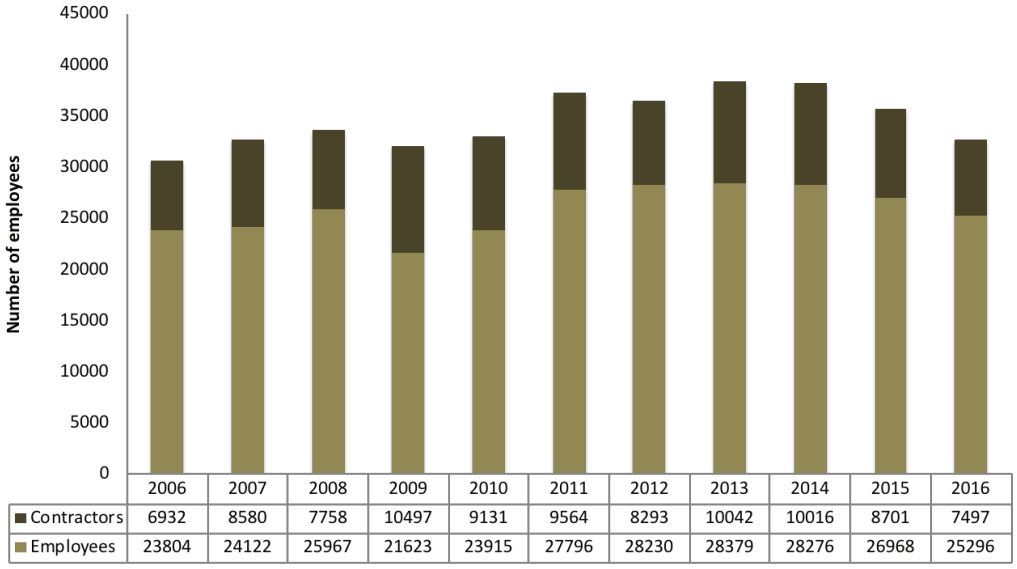
In 2014 the Lonmin brand was negatively impacted due to the Marikana incident, the protracted strike of 2014 and the media reporting about the Farlam Commission of Inquiry. The majority union downed tools on 23 January 2014 and only on 24 June 2014 an agreement was reached for the return to work (LON 2014).

In 2015 Lonmin in particular was dominated by unprecedentedly low metal prices and correspondingly low profitability. Decisive action was taken to protect the business in the low price environment to reshape and resize the company to withstand these pressures on profitability in the medium term, whilst ensuring that the value of the company was retained for when prices rose. Lonmin accelerated the reshaping and resizing the business for the low-price environment and the safe efficient running of the Group’s operations through reducing fixed-cost expenses, removing high-cost ounces and reducing headcount as shown in Figure 1, and capital expenditure to the minimum required (LON 2015).

In 2016 Lonmin acquired Anglo American Platinum’s (AAP) 42.5% stake in

Pandora, that brought the total ownership in the asset to 92.5%. The company experienced a combination of factors that increased the industry cost base and hindered efficient production for a number of years. These factors included rising wage demands, labour unrest, low labour productivity, above-inflation electricity and water price increases and electricity supply disruptions.

During last three quarters of the 2016 financial year, Lonmin managed to be cash flow positive after capital expenditure. Lonmin's objectives were to reduce fixed costs, keep capital expenditure to the minimum necessary, improve efficiencies, and preserve the company's long-term value. The reorganisation of the company had a disruptive impact on the mining production despite it being completed without business interruptions (LON 2016).



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Contractors	6932	8580	7758	10497	9131	9564	8293	10042	10016	8701	7497
Employees	23804	24122	25967	21623	23915	27796	28230	28379	28276	26968	25296

Figure 1 Number of employees (LON 2006-2016).

1.1 COMMUNITY ENGAGEMENT

Community perception surveys were conducted in 2004 and 2005, which resulted in the formation of the Greater Lonmin Community (GLC) Lentswe ('The Voice') Forum, which was formalised in March 2005. The Forum took place every second month at which the Chief Executive's Forum members and representatives from

the various communities around the Marikana and Limpopo operations were encouraged to share their experiences and concerns (LON 2006-1).

The GLC Lentswe Forum was the cornerstone of transformation process between the company and the Greater Lonmin Community. The findings for 2006 highlighted the need to focus on more effective two-way dialogue and there was an emerging gap between the experience and rating of participants and non-participants of the Lentswe process. This indicated that the process had a positive impact on those involved.

In 2008 Lentswe meetings were held with the communities as a platform to raise concerns and to discuss general matters pertaining to the community and the Company (LON 2008-1).

1.2 SCOPE OF THE CASE STUDY

Only issues affecting the Lonmin South African operations were addressed in the case study. Significant interventions on occupational health, HIV Aids and other medical conditions affecting the wellness of the workforce were not addressed in this case study. All the information contained in this case study was obtained from Lonmin's annual reports between 2006 and 2016.

2 SAFETY ADVOCACY

2.1 GLOBAL REPORTING INITIATIVE

Lonmin subscribed to the Global Reporting Initiative's 2002 guidelines since 2002: Mining and Metals Sector Supplement to ensure completeness in reporting material risks in a transparent way that is comparable, inclusive and relevant to the stakeholders (LON 2006-1).

2.2 THE INTERNATIONAL COUNCIL ON MINING AND METALS

Lonmin had been a voluntary member of the International Council on Mining and Metals (ICMM), a Chief Executive Officer led organisation representing leading international mining and metals companies since 2005. Lonmin committed to implementing the ten principles through the Sustainable Development Framework. The company was actively participating and influencing the global policy debates on issues such as human rights, climate change and mining in protected areas.

In 2006 Lonmin shared the ICMM common platform with industry to communicated challenges and engage with stakeholders on issues of common concern at an international level. The company remained a member of the Dow Jones Sustainability Index and the FTSE4Good Index series. These indices provided benchmarks for those who believed that sustainability-driven companies created long-term shareholder value by taking a more systematic and holistic approach to the management of sustainability risks and the realization of sustainability-related opportunities. The rating process for these indices also provided the company with valuable insight regarding the sustainability issues of its peers and international stakeholders (LON 2006-1).

In 2007 the company commenced the implementation of the ICMM's Sustainable Development Framework and the public reporting of material risks. The Lonmin Chief Executive Officer was serving as chair of the ICMM and the Vice President Sustainability was the chairperson of the Executive Working Group (LON 2007-1).

In 2008 the Lonmin Safety, Health, Environment and Community Policy was reviewed and became the Safety and Sustainable Development Policy. This policy formalised the commitment to safety and sustainable development and was aligned with all principles of the ICMM. Lonmin supported the ICMM goal of establishing a global sustainability benchmark for the mining industry (LON 2008-1).

2.3 EXTRACTIVE INDUSTRIES TRANSPARENCY INITIATIVE

Lonmin endorsed the Extractive Industries Transparency Initiative, a coalition of governments, companies, civil society groups, investors and international organisations. It aimed to strengthen governance by improving transparency and accountability in the extractive sector (LON 2008-1).

2.4 UNITED NATION'S GLOBAL COMPACT

In 2008 Lonmin became signatories to the United Nation's Global Compact, which is a voluntary initiative. The Compact is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption (LON 2008-1).

2.5 DEPARTMENT OF MINERAL RESOURCES

2.5.1 SECTION 54 NOTICES

In 2008 there was a renewed stance by the Department of Mineral Resources (DMR) on safety in the mining industry. Marikana received 17 Section 54 notifications and Limpopo received 3 notifications, which resulted in temporary closure for inspection of the individual shafts. It was evidenced by the growing prevalence of safety closures across the industry. It was expected that the issuing of Section 54 notices would continue in 2009. However, Lonmin supported this renewed focus on safety by the government (LON 2008-1).

In 2009 Marikana received 35 Section 54 notifications, which resulted in a loss of 5% of underground production. The increased attention came at a high economic cost. The challenge was to improve on the industry-leading safety record in order to reduce the impact of these stoppages on the operational and financial performance. Lonmin continued to support the attention paid by the DMR to enforcing improvement in the design and application of safety standards in the industry. The company implemented several initiatives to assist in better managing inspections by the DMR. It included a review of relevant procedures and the roll-out of a union consultation and communication plan relating to Section 54 stoppages (LON 2009-1).

It was Lonmin's view that producers who were able to deliver the strongest safety performances should benefit from fewer interruptions and higher productivity. There was an argument for the DMR to sponsor and lead a co-operative process with PGM producers and organised labour to agree procedures to achieve a consistent application of monitoring measures and remedies, without jeopardising the pursuit of improved safety and reasonable economic returns.

In 2010 the DMR issued 17 Section 54 notifications at Marikana, compared to the 35 notifications in 2009 which was a reduction of 42%. The continued focus on safety, and a more pragmatic approach from the DMR resulted in fewer and less severe Section 54s issued. A collaborative relationship was developed with the employees and the DMR on safety matters.

In 2011 Lonmin was issued with 27 Section 54 notifications at the Marikana operations which was an increase from the 17 notifications issued in 2010. Production was again stopped at the Mining Division in April, after the sixth fatality, to undertake an underground workplace safety audit conducted by senior company leadership (LON 2011).

In 2012 Karee, Middelkraal, Easterns and Westerns in the first half of the year was impacted by an uncharacteristically high number of Section 54 safety stoppages, which were also seen across the whole South African PGM mining industry during this period (LON 2012).

In 2013 there was an improvement in the safety environment at Lonmin. The number of Section 54 stoppages as well as the subsequent number of shifts lost as a result of these stoppages decreased. Lonmin continued to engage with the DMR at various levels of management and the relationship with the DMR continued to improve as a result of this engagement (LON 2013).

In 2014, 20 Section 54 stoppages were imposed at operations. This figure was higher than the 18 Section 54 stoppages in 2013 as shown in Figure 2. Lonmin was committed to building relationships with the DMR and participated in forums in which industry, labour and government representatives discuss expectations and shared objectives on safety stoppages.

Lonmin's legal licence to operate required demonstration that its safety and health practices were compliant. The DMR functioned as a regulator of performance in the form of assessments, site inspections and, when necessary, work stoppages. Lonmin engaged with government representatives regularly on company matters and participated in industry forums. The company continued building relations with the regulators (LON 2014).

In 2015, 36 Section 54 stoppages were imposed at the Lonmin operations. The Section 54 stoppages occurred more frequently and were also enforced broadly and took longer to lift after the initial safety issue was addressed. Lonmin continued to engage with the DMR proactively to build sound relationships and also participated in various forums between the mining industry, labour and government that discuss expectations and shared objectives on safety stoppages.

Lonmin continuously engaged with government around the shared responsibilities implicit in minimising job losses, safety stoppages and the financial status of the company to ensure that the respective roles and responsibilities of each party was clear (LON 2015).

In 2016 Lonmin had 50 Section 54 stoppages imposed. The section 54 stoppages were enforced more broadly and were taking longer to lift in the first nine months of the year. The safety stoppages affected production, had a negative impact on

safety routines and care had to be taken to safely shut down work areas so that workers did not enter a work area that was hazardous on their return.

Collaboration between Lonmin, the regulator and unions started to show results, as Lonmin experienced a reduction in the duration and frequency of Section 54 stoppages and more localised application of the stoppages in the fourth quarter of the year.

Lonmin engaged with the DMR around safety on an ongoing basis and the CEO had a standing appointment with the Principal Inspector of the DMR after every quarterly results to discuss business performance and, in particular, safety performance. These meetings offered context of the realities facing the company and were very useful for Lonmin to understand the regulators' concerns and priorities. The Principal Inspector attended the September 2016 SHE Committee of the Board meeting to be part of the company's highest level deliberations around safety. The company believed that achieving 'Zero Harm' required all members of the Tripartite alliance to share in a common vision (LON 2016).

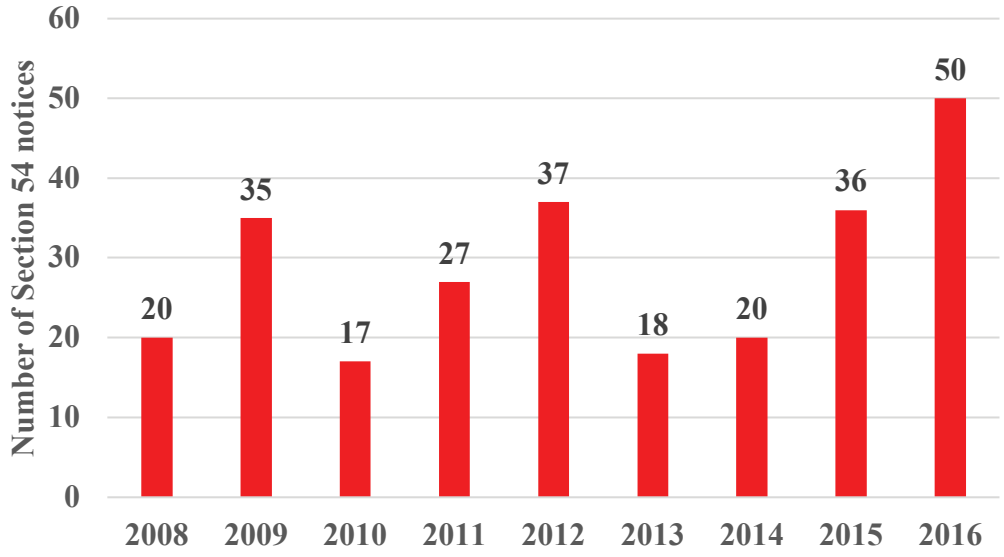


Figure 2 Number of Section 54 notices issued between 2008-2016 (LON 2008-2016).

2.6 CHAMBER OF MINES OF SOUTH AFRICA

In 2007 Lonmin was a member of the Chamber of Mines of South Africa (COM) (LON 2007). In 2013 Lonmin adopted the Mine Industry Occupational Safety and Health (MOSH) leading practices and was in the process of rolling out the following initiatives:

- Proximity Detection System (PDS);
- Noise-induced Hearing Loss (NIHL) mitigation measure, and
- Bolts and netting (LON 2013).

In 2014 Lonmin was represented on several industry-wide forums to learn what worked elsewhere. The company participated in MOSH leading practices roll-out, facilitated by the COM. It led to the adoption of several safety initiatives at operations and this platform of shared knowledge remained beneficial for the company. The company participated in various forums such as the Health Policy Committee, Mine Health and Safety Council, and Global business coalition on health (LON 2014).

In 2015 Lonmin participated in a number of forums to learn from others and benchmark safety performance, including the Mine Health and Safety Council (MHSC), the Chief Executive Officer-led Fatal Elimination Committee, the MOSH initiative, leading practice days and the sharing of learnings from Section 54 among industry peers. Lonmin's involvement with the MOSH programme led to the implementation of bolting and netting protocols to address fall-of-grounds, proximity detection systems to minimise the risk of vehicle-related accidents and winch signalling devices to reduce winch accidents (LON 2015).

In 2016 Lonmin rolled out the proximity detection systems as part of the MOSH initiatives. Lonmin participated in the Chief Executive Officer 'Zero Harm' Task Team through the Chamber of Mines (LON 2016).

2.7 ASSOCIATION OF MINE SAFETY PROFESSIONALS OF SOUTH AFRICA

In 2012 the President of the Association of Mine Managers of South Africa

(AMMSA) proposed that an association of mining safety professionals be established. It would focus on safety improvements and to drive capacity-building amongst safety professionals. The Head of Safety (Mining) at Lonmin was appointed to lead this project and would provide guidance on what the leading practices were for safety and drive standardisation across the industry (LON 2012).

2.8 Association of Mine Managers of South Africa

In 2016 Lonmin participated in the efforts of the AMMSA addressing safety and health concerns in the mining industry (LON 2016).

2.9 Other institutions

In 2007 Lonmin participated in numerous local and international working groups to ensure the contribution in establishing global good practice, including the International Platinum Group Metals Association. Lonmin adopted the position statements on Climate Change, Mining in Protected Areas and the Extractive Industry Transparency Initiative (LON 2007).

In 2008 Lonmin became signatories to the United Nation's Global Compact, which is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption (LON 2008).

In 2016 the company participated in other industry bodies where safety and health was a key discussion point, these included the Bushveld Safety Forum, the Mine Ventilation Society of South Africa, and the North West Tripartite Forum. The Doctors in the Health and Wellness Department belonged to the Medical Mining Doctors Association and participated in shared learnings, best practice and peer performance benchmarks (LON 2016).

3 INSTITUTIONALISE 'ZERO HARM' AS A BUSINESS IMPERATIVE

3.1 LONMIN CHARTER

In 2006 the Lonmin Charter outlined the values and mission of the company, which was honoured in the business practice. The mission included:

- To grow and build a portfolio of high quality assets;
- To deliver the requirements of the South African broad-based socio-economic Mining Charter, and
- To build a value-based culture, which was founded on safe work, continuous improvement, common standards and procedures, community involvement and one that rewarded employees for high performance.

Lonmin was committed to the values and principles and believed that the business success dependent on them. The values were:

- 'Zero Harm'. We are committed to 'Zero Harm' to people and the environment;
- Integrity, Honesty & Trust. We are committed ethical people who do what we say we will do;
- Transparency. Open, honest communication and free sharing of information;
- Respect For Each Other. Embracing our diversity enriched by openness, sharing, trust, teamwork and involvement;
- High Performance. Stretching our individual and team capabilities to achieve innovative and superior outcomes, and
- Employee Self-Worth. To enhance the quality of life for our employees and their families and promote self-esteem (LON 2006).

3.2 SAFETY, HEALTH, ENVIRONMENT AND COMMUNITY POLICY

In 2007 Lonmin committed to meet the vision and value of 'Zero Harm'. The commitments included in the policy were:

- Implementing and maintaining effective safety, health and environmental management systems that drive continual improvement and contribute to the

well-being of employees and communities;

- The identification, assessment and management of risks to employees, contractors, the environment and communities in which Lonmin operated.;
- Integrating safety, health and environmental management systems in planning, designing, operating and decommissioning of operations in a way that enhanced all aspects of sustainable development;
- Contributing to biodiversity conservation and integrated land use planning during all the stages of operations;
- The reduction, re-use and recycling of waste to prevent pollution, minimise final disposal and promote the efficient use of natural resources;
- Upholding ethical business practices and meeting or exceeding applicable legal and other requirements;
- Maintaining transparent consultative relationships with all stakeholders through effective communication channels;
- Respecting the fundamental human rights of all stakeholders;
- Developing partnerships that will contribute to the long-term social, economic and institutional development of our employees and our host communities, and
- Regularly reviewing our performance and publicly reporting our progress against set objectives and targets (LON 2007).

3.3 Safety and Sustainable Development Policy

In 2008 the SHEC Policy was revised and approved to become the Safety and Sustainable Development Policy outlining business commitments. It was underpinned by a number of discipline-specific policies, management standards and guidelines, covering the areas of environmental management, employment as well as social and community issues (LON 2008).

3.3.1 The Safety and Sustainable Development Management Standards

The Safety and Sustainable Development Management Standards provided a risk management framework, which outlined the minimum operating requirements for

the company. The standards focused to deliver on policy commitments in a methodical and consistent way and were aligned with the requirements of South African National Standards, ISO 14001 and ISO 9001 and OHSAS 18001. The line managers were accountable for the implementation of these standards and responsible for the implementation of supporting systems and procedures (LON 2008).

Sustainable Development

In 2006 Lonmin committed to incorporating and integrating the components of Sustainable Development into the overall strategy, business decisions and operational procedures. It was believed that these components were interrelated and that the solution to the myriad of social, environmental and development challenges that faced the company and host communities. It was about balancing operational development with creating value in the communities and the environment (LON 2006).

In 2007 Lonmin embedded the principles of sustainable development into the business during the ensuing years. The Chief Executive's Committee decided to dismantle the traditional safety, health, environment and community structures of Lonmin and institute separate Safety and Sustainability Centres of Excellence.

The intention of this restructuring was to increase the visibility around both the second and third components of the Lonmin business strategy to create a culture of safe production and to ensure long- term sustainability of the communities impacted by the operations. It was believed that by focusing beyond the boundaries in the areas of Environment, Health and Housing the company would support the long-term sustainability of community development programmes and create a positive shift towards the Sustainability vision of uniting with the communities to liberate their potential to experience quality of life.

Lonmin restructured the operations, which included restructuring the traditional Safety, Health, Environment and Community (SHEC) reporting structure and organisation into one that recognised both the importance of safety to the

organisation and the need to more broadly integrate the approach to sustainability into the core operations (LON 2007).

The company formed a new Safety Centre of Excellence (CoE), which reported to the President of the South African operations. The Safety CoE would be responsible for the development of the Group safety strategy, systems, processes and procedures to ensure the company met the safety goal of no serious injuries or fatalities in the operations by 2010.

A Sustainability CoE responsible for housing, community development, health and environment reporting to the CEO was created during 2007. The Sustainability CoE developed an integrated strategy to achieve the vision of uniting with the communities to improve their quality of life and to contribute to the transformation of South Africa's social, environmental and economic conditions. It would facilitate a single focused delivery structure for the community development programmes (LON 2007).

In 2008 Lonmin completed the review of the Safety and Sustainable Development Management Standards to incorporate best practice, legal requirements and principles and position statements of the ICMM. A number of corporate guidelines for the implementation of the Lonmin minimum requirements outlined in the Standards was finalised. The company had objectives and targets in place, supported by discipline specific strategies, objectives and targets that provided the framework for continual improvement. This process was augmented by the necessary management systems for communication, training, auditing and review.

The sustainability strategy encompassed eight key elements that was believed would cause a significant difference in the lives of the employees and the communities impacted by the operations. It was aligned with the South African National Framework for Sustainable Development and contained the relevant elements of the United Nations Millennium Development Goals. The strategy was specifically focused around the issues that threaten the long-term sustainability of the mining operations and the communities. It was believed that addressing these issues was a priority and would ensure that the company maintained the license to

operate.

Sustainable Development was an integral part of a coherent growth and development framework, which ensured the alignment of policies and strategies orientated around the core beliefs of social equity, natural resource protection and ethics required for the transformation of the South African society.

Lonmin believed that sustainable development was paramount to the future of the company, the employees and the communities where it operated. Contributing to sustainable development helped to create value and reduced operational and financial risk, thereby enabling the delivery of a more consistent performance in the future. The sustainable development efforts continued to focus on the following risk areas:

- Eliminating fatalities and injuries;
- Supporting a skilled and diverse workforce;
- Eliminating Noise Induced Hearing Loss;
- Managing HIV/AIDS in the workplace and community;
- Accessing and managing energy and water resources and minimising the impact on the business, and
- Uniting with the communities (LON 2008).

In 2010 Lonmin aligned the Safety and Sustainable Development Policy with the ten ICMM principles. The Safety and Sustainable Development Management Standards were reviewed against these ten principles and the position statements were included in the guidelines to be used for execution of the standards.

Lonmin remained committed to the values of the Charter and the Safety and Sustainable Development Policy. The company focused on the long-term sustainable changes driven by a strong business case and was determined to adopt a strategic approach to sustainability. The company expected that skills development would translate into improved productivity and reduced skills shortages.

Sustainability was key to the long-term stability of South Africa and therefore the stability of the company. The company integrated safety and sustainable development into the decision-making process during all phases of the operations. It was perceived that it was crucial that this integration and social transformation priorities be implemented in a strategic and coherent manner to protect the legal licence to operate. Additional benefits included enhanced the social accountability, effective risk management, improved operational efficiencies (LON 2010).

In 2012 Lonmin believed that business could make an important contribution to the on-going, global transition to sustainable development. Sustainable development was bolstered by a foundation of good governance and formed an integral part of how business was conducted by adopting sustainable development as a core value. The governance commitments was defined in the Lonmin Safety and Sustainable Development Policy and guided by the Lonmin Sustainable Development Standards aligned with the Ten Principles of the ICMM (LON 2012).

Sustainable development supported the delivery of the corporate objectives through the fostering of a safe production culture, operational excellence and building growth to supply a robust market demand for PGMs. Lonmin's Integrated Sustainable Development approach concentrated on three main focus areas supported by specific strategies and management plans to achieve the corporate objectives. The focus areas included:

- People: Caring for the social well-being through transformation of employees, contractors and communities;
- Planet: Fostering environmental stewardship through resource management, efficiency and impact management, and
- Profit: Enhancing equitable prosperity through resource optimisation, financial performance, product stewardship and procurement processes.

In 2013 the strategic priorities for Lonmin included the quest to be the safest primary PGM producer and to minimise adverse environmental impacts with the

aim to cause ‘Zero Harm’ to people and by integrating the operational and sustainability strategies. Lonmin was determined on earning a social licence to operate from the people and communities who hosted the operations and pursued a number of initiatives to share some of the value the company created (LON 2013).

A steering committee was formed to roll out the Sustainable Development Standards into decision-making processes at all areas of the operations by December 2015.

- Phase 1 of the implementation commenced a gap analysis between Standards and practice. Lonmin conducted workshops on the content and objectives of the Lonmin Sustainability Standards to create a clear understanding of the Standards requirements. The company planned to have audit protocols in place for self-assessments during 2014 and 2015.
- Phase 2 was planned to commence in 2014, which would include a round of internal audits of all mines and processing plants, with the objective of assisting operations to improve internal management systems.
- Phase 3 included an external audit to be completed.

In 2016 sustainability remained central to the business and was dependent on the relationship with the employees and fulfilling the social and community responsibilities (LON 2016).

3.4 SAFETY MANAGEMENT FRAMEWORK

In 2010 Lonmin provided a risk-based management framework for company-wide safety management, continual improvement and alignment with international best practice. At company policy level it included the Safety and Sustainable Development Policy; Safety and Sustainable Development Management Standards, and Fatal Risk Control Protocols (LON 2010).

3.4.1 RISK MANAGEMENT

The Lonmin Risk Management Policy and Risk Management Standard was based on best practice and provided the framework for integrated and dynamic risk

management at the company, subsidiaries and partnerships. The company implemented risk management strategies based on valid data and sound science. The risk management framework was based on a precautionary approach and the company had a bottom up and top down risk management approach targeting strategic risks and operational risks respectively.

Risk management was central to good governance and the timely identification, assessment and management of risks were critical to the success of the business. The company applied the precautionary principle and conducted risk and impact assessment to determine the impact of projects on the wellbeing of the employees and the local communities. Business decisions considered the associated risks and mitigation measures.

In 2006 Lonmin formalised the structure around risk analysis and reporting which initiated a further embedding of risk management into the business. The company had a central Risk Management team who was supported by approximately 70 nominated individuals in the business units. They acted as Business Area Risk Champions and Operational Risk Champions within their business unit. The Audit and Risk Committee of the board monitored progress on the management of risk (LON 2006).

In 2007 Lonmin used a standard risk management framework across the operation to assess risks. Each principal business unit across the Group identified risks that could impede the achievement of their business objectives and these were recorded in a business unit risk register. For each risk, management identified the risk, its causes and consequences. They then assessed the maximum exposure of the risk and look at the effectiveness of controls in place to mitigate the risk. A numerical scoring matrix was used to derive a risk score and priority. Action plans were devised for the significant risks and progress against these plans was monitored frequently.

An Operational Risk Champion who coordinated all of the risk management activity in the business unit supported each business unit. Actions were tracked and closed out appropriately. This structure was supported by a small central risk

management team, which provided expertise to the business units and provides consolidated reports, including a consolidated group risk register, to management and to the Audit and Risk Committee (LON 2007).

3.4.2 SAFETY PERFORMANCE INDICATORS

The company regarded safety performance as a lead indicator of the health of any business. It followed the South African Mine, Health and Safety Act (Act 29 of 1996) in terms of recording and reporting accident statistics. Lonmin measured the Lost Time Injury Frequency Rate and the Severity Rate as key safety indicators.

Safe Behaviour Observations was used as a lead indicator to the safety performance. In many areas of the business the level of maturity increased such that Safe Behaviour Observations were undertaken between peers and even from subordinates to managers (LON 2007).

3.5 GOVERNANCE STRUCTURE

The governance of the company was underpinned by the values set out in the Lonmin Charter and the commitments in terms of sustainable development were defined in the Lonmin Safety and Sustainable Development Policy. The Lonmin governance framework provided strong support for safety management from policies to operational procedures (LON 2007).

3.5.1 THE BOARD

The Board of Directors comprised of 3 Executive and 6 Non-Executive Directors and normally met six times a year. The non-executive Directors were independent and was from a variety of backgrounds with a diverse range of skills and experience. The Board was ultimately accountable for corporate performance and provided strategic direction to the business. Power and responsibility for managing the Group's operations was delegated by the Board to the Chief Executive Officer, who took primary responsibility for the management of sustainable development and safety performance.

In 2010 the Board increased its focus on sustainability risks and was committed to setting and achieving ambitious, but realistic, sustainability targets (LON 2010).

3.5.2 BOARD SUB-COMMITTEES

In 2006 the Board established four committees, each chaired by an independent, non-executive Director. It included an Audit Committee, Nomination Committee, Remuneration Committee and the Risk & SHEC Committee (LON 2006).

3.5.3 AUDITING AND ASSURANCE

The Audit and Risk Committee of the Board approved the annual company-wide internal and external audit plan. Audit findings were updated monthly and progress on corrective management plans were reviewed by the Executive Committee on a monthly basis and regularly by the Audit and Risk Committee of the Board.

External auditing of ISO 14001, ISO 9001 and OHSAS 18001 management systems, at operational level, ensured continuous improvement. As part of the assurance engagement, the company ensured that the assurance providers were independent from the company, had the necessary individual and organisational competencies and that the engagement process was based on best practice guidelines.

An internal team with an external lead auditor audited the 15 SHEC Management Standards. Annual SHEC Management Standards audits were conducted against criteria established to measure the level of conformity, review the effectiveness of the management systems and informed training needs (LON 2008-1).

3.5.4 RISK & SHEC COMMITTEE

In 2006 the Committee consisted of the Chief Executive Officer, two non-executive directors and four senior executives who had significant experience in mining, finance, risk and SHEC matters. The Committee had formal terms of reference which required it to monitor the effectiveness of the Group's attitudes and approach toward, and performance in managing risk, and to provide advice to

management on risk, SHEC and corporate social responsibility matters generally (LON 2006).

3.5.5 Safety and Sustainability Committee

The Safety and Sustainability Committee had been a formal committee of the Board since November 2006. Previously it was a management committee attended by certain non-executive Directors but, in view of the importance of the subject matter, a more structured approach was warranted.

The Chief Executive Officer was the Board member accountable for Safety and Sustainability and was supported by the President-Lonmin South Africa, the Vice President Sustainability, both of whom served on the Chief Executive's Committee. The mandate of the Chief Executive's Committee was to implement strategy and set organisational direction, and to monitor performance. All line managers were accountable for the implementation of the SHEC Management Standards and a material portion of the Group's annual bonus scheme was allocated to safety and sustainability performance (LON 2006).

In July 2007 the Board reviewed its terms of reference of the Committee whose primary purpose was to ensure that:

- Safety and sustainability matters, particularly pertaining to risk and management thereof for incorporation into strategic decision-making processes, including those of potential investments;
- The minimum requirements within the Safety and Sustainable Development Management Standards, supporting guidelines and management systems provide the framework for safety and sustainable development to be incorporated in decision- making at operational level throughout the company,
- All the contractual agreements contained minimum standards for safety and sustainable development performance;

The Committee was authorised to:

- Investigate any matter within its terms of reference;
- Seek any relevant information that it required from any Director or employee of the Group;
- Co-opt any resources it may require to undertake its duties, and
- Obtain independent legal or other professional advice if it considered this necessary.

The Committee comprised of two non-executive Directors and one executive Director and was chaired by an independent non-executive Director. The committee did not have any executive power. The company Directors and operational managers retained their full responsibility and accountability for the management of safety, health, environment and community (SHEC) and corporate social responsibility (CSR) matters in the company. A number of senior executives also regularly attend these meetings, including the Chief Operating Officer and Vice President Sustainability.

The Safety and Sustainability Centre of Excellence provided strategic direction and guidance and ensured compliance to standards through a range of internal and external audits. Additional responsibilities included:

- To assess the effectiveness of management's attitudes and approach towards, and activities in, managing SHEC related risk;
- To review significant SHEC incidents and performance indicators, and
- To report to the Board on developments, trends and/or forthcoming significant legislation on SHEC matters which may be relevant to the company's operations, its assets or employees (LON 2007).

3.5.6 MANAGEMENT STRUCTURE

In 2006 the Chief Executive Officer was supported by a Chief Executive Officer Committee, which comprised of the three executive directors and five senior executives, including the President, Lonmin Platinum.

The President, Lonmin Platinum was in turn supported by an Executive Committee, which included the leaders of each of the Group's business units. The

company established the Chief Executive's Forum, a grouping of around 65 senior managers representing all parts of the business to ensure full alignment and enrolment of management with the Group's strategy and objectives (LON 2006).

In 2008 Ian Farmer was appointed as Lonmin's new London based Chief Executive Officer who spent around half of his time in South Africa. The company restructured the senior management level. Lonmin experienced extraordinary conditions in both the credit and commodity markets, which created exceptional challenges for the mining industry. The headcount of the London office was reduced by one third and transferred certain functions to South Africa.

The organisational structure became overly complex with too many layers of management and poorly implemented shared services structure, which resulted in overhead duplication. The organisational structure was simplified with clear accountability. The simplified organisational structure brought greater management focus and gave the operations more ownership of the functions required to ensure effective and efficient delivery.

In order to simplify the management structure and help remove any duplication, the responsibility for the Shared Business Service functions was re-allocated to line managers within the Mining, Process and Finance Divisions. A new Chief Operating Officer (COO) was appointed with overall responsibility for the operations, reporting the Chief Executive Officer. The Executive Vice President, Mining and the Executive Vice President, Process Division reported to the COO (LON 2008).

In 2009 the company restructured the senior operational management team in order to create a Technical Services function. This function was responsible for the life of mine plan, based on input from all areas of the business, group wide capital expenditure and providing an important check and balance with regard to the technical health of the business.

The Vice Presidents attended Education Workshops to assess the strategic business drivers for sustainability and the portfolio of the Executive Vice

President for Processing was extended to include sustainable development (LON 2009).

In 2010 there were several new Board appointments, which included:

- Cyril Ramaphosa joined the Lonmin Board as a Non-Executive Directors of the company;
- Two other Non-Executive Directors as well as an Executive Director were appointed;
- Shanduka's representatives attended the Lonmin Executive Committee meetings, and
- A new Chairman of the Safety and Sustainability Committee appointed.

The Chief Executive Officer moved from London to South Africa in January 2010 and the company successfully completed the transfer of all London based operational and management roles to Johannesburg. The Executive Vice President: Processing, took over line responsibility for the sustainable development programme. Further changes were made to the structures that would translate into sustainable development being more firmly embedded throughout the company (LON 2010).

In 2011 a Director who was a member of the Board for nine years who chaired the Audit and Risk Committee and was a member of the Nomination and Remuneration Committees, as well as acting as the Senior Independent Director, resigned. Some Executive Committee changes occurred during the year with the replacement of the Executive Vice President (EVP) Processing and the Exco representative for Shanduka (LON 2011).

In 2012 the Chief Executive Officer, Ian Farmer, became ill shortly before the tragedy at Marikana occurred. Simon Scott, the Chief Financial Officer, was appointed by the Board to act as CEO (LON 2012).

In 2013 Ben Magara joined Lonmin as the new Chief Executive Officer. Other significant changes to the Board included the addition of two new Non-Executive Directors, from Lonmin's largest shareholder Glencore Xstrata. Two Independent

Non-Executive Directors one of which replaced Cyril Ramaposa as Shanduka's representative were appointed on the Board. Two Non-Executive Directors left at the AGM and the Chairman of the Board intended to retire as well (LON 2013).

In 2014 Lonmin had several Board and management changes.

- Brian Beamish was appointed as the new Chairman of the board. One non-executive director resigned;
- Lonmin reconfigured the structure and management team members for the challenges and plans ahead;
- It included the appointment of a Business Support Office Executive and a new Chief Operating Officer who replaced two existing roles: The Executive Vice President (EVP) Mining and EVP Processing. It was believed that the change will better align the functions and help with the creation of a common culture and knowledge sharing across the operations;
- The Chief Commercial Officer left the company. The EVPs for Mining and Processing, both left during the year to pursue new opportunities, and
- The EVP for Strategic Business Transformation left the company (LON 2014).

In 2015 the Board and management team was strengthened and brought new experience and focus to both.

- Two Glencore independent directors resigned from the board;
- The Shanduka nominated Board member resigned from Shanduka and as a result from the Lonmin Board. At the time Shanduka did not have a replacement Board member;
- Appointed a new non-executive director;
- There were changes to the senior management team. Appointed another Chief Operating Officer who became an Executive Director, 3rd COO in 3 years, and
- Appointed another Head of Business Support executive (LON 2015).

In 2016 Lonmin had two Board changes.

- Appointment of a Non-Executive Director from Phembani Group Proprietary Limited, which merged with Lonmin's Black Economic Empowerment partner Shanduka Group (Proprietary) Limited (Shanduka);
- The Chief Financial Officer and Director of the company stepped down, and
- A new Chief Financial Officer who also became a Director was appointed (LON 2016).

3.6 LEADERSHIP COMMITMENTS

In 2006 Lonmin remained committed to 'Zero Harm' to people and continued to promote this as an achievable outcome in the behaviour of management and employees. The Lonmin governance framework provided strong support for safety management from policies to operational procedures and the company would continue the drive to improve the safety programmes to ensure the safety of all employees and contractors. The programmes were devised to address safety leadership, a key component in the drive to address at-risk behaviour and improve safety awareness (LON 2006).

In 2007 Lonmin embedded the principles of sustainable development into the business. The company was characterised by a culture of a safe working environment and had the core value as 'Zero Harm' to the employees and contractors with a strong focus on the wellbeing of the employees. Lonmin was committed to:

- Achieving 'Zero Harm' in the operations;
- Eliminate fatal injuries;
- Injury-free workplace as an achievable outcome;
- Implementing the Safety performance appropriate systems and procedures to achieve the SHEC Policy objectives;
- Encouraging positive leadership behaviour, and
- Instilling a culture of care amongst the employees and contractors (LON 2007).

In 2008 safe working practices remained a key priority for Lonmin as well as the

elimination of fatalities and injuries. ’Zero Harm’ was a core value of the business. The company was committed to the wellbeing of the employees and contractors and maintaining a culture of safe behaviour,

Fatalities and serious injuries resulting from falls of ground and material handling remained the key safety risks. The company was committed to honouring the safety values and sustaining an environment that promoted the safety of the employees and contractors.

The Lonmin operating systems were poorly implemented, resulting in weak planning, production control and forecasting. Lonmin introduced a new senior operational management team in the Mining division tasked with implementing and executing improvement programmes to increase productivity and consistency of performance. These programmes gained traction and the key focus areas which included:

- The strengthening of the operational management team;
- An increased focus on development;
- The upgrading of management operating systems at shaft level;
- The completion of a new mining extraction strategy;
- An improvement in the labour management programmes, and
- A new approach to mechanisation (LON 2008).

In 2009 Lonmin embraced the principles of the Mining Charter and pursued actions to advance the transformation agenda prescribed by the South African government. The economic realities imposed by metal pricing, currency exchange rates and general financial conditions could have profound effects on the rate at which mutual aspirations could be realised.

Lonmin remained committed to the values of the Charter and the Safety and Sustainable Development Policy and did not deviate from the belief in the compelling business case for sustainable development and the associated business benefits despite the impact of the global economic downturn on financial flexibility. Lonmin remained fully committed to the values of the Charter and

commitments within the Safety and Sustainable Development Policy. Lonmin believed that it could, and should, operate as a zero-harm business and strived in every way to improve continuously its safety performance, acknowledging that its business was inherently hazardous.

Safety continued to be a major priority for the company and the focus on safety remained undiminished. The company's stance towards safety remained uncompromising and continued to focus on aiming to eliminate fatalities, injuries and unsafe behaviour. 'Zero Harm' to the employees and contractors was a core value of the business and Lonmin was committed to the wellbeing of the employees and contractors and maintaining a culture of safe behaviour.

The company's approach to safety was based on a number of key standards. Visible leadership was crucial to the success in safety and a powerful aid in creating an interdependent safety culture. Safe behaviour observations were used as a lead indicator to the safety performance and the company conducted continuous risk assessments to minimise unsafe behaviour or situations. Safety training and awareness campaigns formed an important component of the safety management systems (LON 2009).

In 2010 the company was disappointed that insignificant progress was made terms the safety performance. Safety remained one of the greatest risks throughout the company. Lonmin was passionate about the health and safety of the employees and it made every effort to ensure that the workplace was maintained to provide a safe environment for the people to work productively. Safety was fundamental in everything the company did and it would always be at the forefront. The road to 'Zero Harm' was a journey and there was always more that could and should be done. The company developed an Integrated Safety Strategy to reflect a shift to a more proactive approach.

Visible leadership was necessary to the success in safety and in creating an interdependent safety culture. Lonmin maintained focus on safety particularly on training and employee behaviour as the company continued the journey to 'Zero Harm'. It was an essential to honour the health and safety values and sustaining an

environment that promoted the safety, health and wellbeing of the employees and their families, contractors and the communities where Lonmin operated.

The business depended on people and by providing a safe and healthy environment the people could contribute to creating and sustaining value. It was believed that a culture of sustained health and safety awareness and proactive action maximised productivity. The company provided adequate and appropriate resources to implement effective management systems and risk management, based on valid data and sound science, during all phases of the operations to ensure the reduction of risks and the adoption of best practices. Continual safety improvement was required to achieve a high level of performance through a framework of setting and reviewing the policy, objectives and targets (LON 2010).

In 2011 safety was a priority, "'Zero Harm'" remained a core value and the company aspired to be the safest Platinum Mine. Lonmin remained committed to the values of the its Charter and was devoted to the business case for integrated sustainable development.

Six fatalities occurred during the year, which resulted in a number of safety stoppages initiated by the company to give the business a serious message that these events must be eliminated. It was believed that the stoppages contributed to making the business more determined to improve its safety performance (LON 2011).

In 2012 the issues of business and commerce were overshadowed by the loss of life, violence, unrest and fear at Marikana. The key operational challenges during 2012 were safety, managing costs and labour relations. The company was determined to continue to be the safest platinum miner in the business as the commitment to 'Zero Harm' remained undiminished and safety would always be the first priority.

Lonmin was the safest primary platinum mining company in the world, but recognised that mining was a dangerous business to be in. A number of Lonmin

shafts set records in South Africa for fatality-free shifts. Since 2009 Lonmin's safety results were impressive for having recorded the lowest industry Fatality Frequency rate, compared to its peers.

In 2012 Lonmin recorded the lowest Lost Time Injury Frequency Rate (LTIFR) in the platinum industry of 4.16 per million hours worked. It put Lonmin in a good position to achieve the 2013 Department of Mineral Resources (DMR) fatality rate milestones. There were a number of factors behind this overall improvement in safety. It required attention to all three key objectives in the strategy, which included fatality prevention, injury prevention and a safe production culture. Collaboration between operations and service departments assisted in delivering the improved results.

Lonmin's approach was that the safety of people was a priority and an integral part of how the core business was conducted and not a separate initiative, campaign, or subsection of thought before work starts. The company aimed to produce safely, constantly measuring forward energy, focused on proactive, sustainable work practices and growth. One of the thrusts was to work towards a safe culture on and off the job, with honest intent for what and how to do it, as well as whom the company was prepared to interact and work with.

Progress was made on the journey to achieving 'Zero Harm', through amongst others, in identifying key learnings from incidents and the implementing of corrective action to mitigate the reoccurrence of safety related events. It included the adaptation and revision of systems, procedures and standards. Safety continued to be one of the company's principal risks, which was deemed to be successful when employees and contractors lived and worked safely. Lonmin remained committed to the value of 'Zero Harm' to people (LON 2012).

In 2013 the Lonmin safety approach was that of 'Zero Harm'. Lonmin recognised that a lot still remained to be done. Lonmin believed this objective was achievable, and that every injury or fatality was preventable. The company improved the lost time injury frequency rate (LTIFR) which was an area where Lonmin consistently performed well. The improved of the lost time injury

frequency rate was ascribed to the belief that was evident across the organisation that ‘Zero Harm’ was achievable.

Falls of ground accounted for most serious accidents and Lonmin had a comprehensive strategy for minimising these incidents, which was re-examined for possible improvement after every accident.

The company focused on the needs of the employees, including housing, healthcare, HIV/AIDS support and working with the employees and unions in re-thinking the employee value proposition (LON 2013).

2014 was another tough year for the Platinum Industry. The South African operating environment was difficult and exacerbated the situation. Relationship building would help Lonmin in future and the company reinforced operational excellence. It was expected that the refreshed management team with the skills and experience would to take the company to the next level.

Lonmin had undergone challenging times in recent years. A protracted strike led to five months of no or abnormal production. The huge impact of a strike of unprecedented length across the South African Platinum Group Metal (PGM) sector resulted in Lonmin losing 391 000 equivalent saleable Platinum ounces. Lonmin applied a disciplined approach to monitoring and securing the operations during the strike to be positioned well for a re-start when the time came. A major logistics operation was put in place around key areas like medical health, strike-related poverty and transport for the start up.

The company had a renewed commitment to fundamental change and continued to believe that ‘Zero Harm’ was possible. The initiatives around employee wellness, financial literacy and counselling as well as the technical solutions around debottlenecking logistics continued to bear fruit (LON 2014).

In 2015 the vision, ‘We dig to improve lives’, remained in place. Lonmin strived to be the industry leader in safety. It was believed that ‘Zero Harm’ was both achievable and realistic. Working safely was even more critical in economically constrained times to protect employees and contractors from harm, but also to

avoid production interruptions from safety stoppages. Each shaft had a safety improvement plan in place to address the specific safety challenges they faced.

The culture transformation initiative 'The Way We Work at Lonmin' was crucial to building a sustainable Lonmin. The initiative prioritised building connections with every employee, making sure everyone understands the need to pull together and what was expected of them. It aimed to foster empathy, care and respect in interactions with employees.

The timeline of some of the strategic actions changed in light of the macro economic reality. The company reduced high-cost production by orderly closure of Hossy and Newman shafts whereas the development of the new generation two shafts was fast-tracked. The company continued with cutting costs and taking sensible decisions on pay freezes and waiving bonuses (LON 2015).

In 2016 the mining industry was forced to an increased focus on financial sustainability in the context of this persistent upward pressure on costs, the extended decline in commodity prices, which compressed margins. The operating environment became more complex which resulting in a 'new normal'. It was a state of increased conflict, disruption and resentment that had to be continually analysed, understood and negotiated. A new model of management and leadership, with the skills to navigate these constantly changing dynamics, was required to address this. Lonmin rolled out a leadership development programme for frontline supervisors that emphasised the capabilities required managing the legal, safety and people management challenges posed by these changes.

The company reorganised the business, which resulted in the reduction of the workforce and focus on the core Generation 2 shafts. Lonmin's priorities were aligned with the safety, job preservation, community investment and broader developmental goals of the South African government. Effective collaboration required not only a shared vision for the future of the industry and the country, but also a clear understanding of and commitment to the reciprocal roles and responsibilities of each party (LON 2016).

3.7 LONMIN STRATEGY

Lonmin's strategy aimed to achieve its vision as the PGM supplier, investment partner and employer of choice, creating shared value for all stakeholders. It had four strategic pillars including operational excellence; enhancing balance sheet strength; people and relationships, as well as corporate citizenship agenda.

In 2007 the Lonmin strategy was threefold:

- To create a culture of safe production, operational excellence and innovation;
- To capture and build growth into the portfolio of high quality assets, and
- To focus on ensuring the long-term sustainability of the communities impacted by the operations (LON 2007).

3.8 INTEGRATED SAFETY STRATEGY

In 2010 Lonmin developed a new Integrated Safety strategy reflecting a shift to a more proactive approach. The strategy focused on lead-indicators and emphasised proactive behaviour. It replaced the Business Area Safety Strategies that was in place up to then. The new strategy was built on a foundation of effective systems, enablers, strong values and a clear understanding of the business risks. The strategy had three safety pillars, which were fatality prevention, injury prevention and a safety culture change.

The new strategy development process examined the level of compliance to the existing policies, standards and protocols at different areas within the company. This was followed by an assessment of the maturity for specific areas. The capacity to mitigate safety risks and compliance with regulations for the respective area. The implementation was based on the outcomes of this assessment, which changed appropriately for the identified gaps in maturity. The new approach was characterised by more robust data collection and risk identification, greater integration and a stronger level of buy-in across the Lonmin.

There was increased focus to improved safety in six areas and tactical measures for each area were rolled out across the business and the individual elements were

driven down through the organisation. The focus areas included mindset, culture, safety leadership, governance, risk assessment management, and compliance. The integration of the Safety Strategy, objectives and targets were implemented throughout the organisation. The company improved the procedures for compiling safety data (LON 2010).

In 2011 the company reviewed and refocused the safety strategy. One of the initiatives was that the Chief Executive Officer and a number of managers spent time with DuPont, who was world renowned for being at the leading edge of sustainability good practice, to inculcate safety into the core values of the Lonmin's management team.

Lonmin held a Safety Summit leading up to the company's participation in the National Safety Summit in July 2011, which was supported by the Department of Mineral Resources as well as many trade unions. At the summit the Chief Executive Officer recommitted Lonmin to zero tolerance towards fatalities and the value of 'Zero Harm' to employees. An outcome of the summit was to establish representative task teams with a primary focus to address different safety issues and enhance the effective implementation of the strategy. Regular feedback was to be given to the Summit Controlling Committee (LON 2011).

In 2012 the hierarchy of safety management included:

- The Lonmin Charter, which outlined the vision and values of the company and governed safety management at a high level;
- Training of Line Management on core principles and development of their safety knowledge;
- The company wide Integrated Safety Strategy with three Pillars: Fatality prevention; Injury prevention and safety production culture, with four enablers: Leadership; Simple systems; Enabling environment and a culture of safety;
- The Safety and Sustainable Development Policy, which outlined the policy commitments to the health and safety values;

- Fifteen Lonmin Sustainable Development Standards supported by protocols and Fatal Risk Control Protocols, which provided a risk-based management framework, continual improvement and alignment with best practice;
- Auditing of the implementation of the Safety Strategy by the Group Safety Department;
- Safety structures and staffing to conduct legal compliance inspections and audits, and
- Implementation of the industry tripartite action plan on health and safety, including the roll out of the National Safety's Summit commitments.

Tactical teams were established for Leadership; Simple Systems; Enabling Environment, and Safe Production Culture, to facilitate and manage certain projects and initiatives to generate and maintain momentum within the safety programme. The projects and initiatives from these teams were intertwined within the 15 Lonmin sustainable development standards (LON 2012).

In 2013 improvements in safety became more and more difficult. The approach was that initially systems, protective equipment and working practices were evaluated, where after a culture of safe working was designed and implemented. However, safety increasingly rested on the behaviours and mindsets of individuals, which was a much harder thing to change. The company believed that keeping people safe was a team effort and that good working relationships led to good working practices. The continual empowerment of employees to exercise their right to withdraw from unsafe work areas was encouraged. These incidents were reported and analysed weekly to address shortcomings and drive improvement.

Safety for Lonmin did not end at the gate to a mine. The company continued to work with employees, Non-Governmental Organisations and authorities to address concerns about crime, stress and substance abuse away from work. Five major projects were explored with the employee, union and community partners and other key stakeholders, seeking to find fundamentally new and more sustainable ways of working. The initiatives included:

- Employee relations and engagement;
- Empowerment and equity participation;
- Exploring alternatives to migrant labour and improved working arrangements;
- Better use of existing invested capital and infrastructure, and
- Living conditions including sustainable housing and human settlements.

The safety strategy rested on three pillars: fatality prevention, injury prevention and safe production. Within each of these pillars the strategy focused on leadership, simplifying systems, creating an enabling environment and creating a safety-conscious culture.

It was believed that a leader makes safety personal and the company strengthening the leaders so as to help them better relate to their teams, and to build stronger relationships between team members. Lonmin educated and empowered employees regarding the importance of knowing their right to withdraw from an unsafe working area. Internal stoppages regarding assessing the safety of an area were mainly focused on the Life Rules:

- Early entry examinations;
- Support installation and geological features;
- Explosives control;
- Winches and rigging, and
- Trucks and tramming.

The company invested in specific initiatives that aimed to provide leaders and teams with the necessary skills to improve levels of quality, operations, cost, people, and safety by translating the business strategy into measurable targets for each team. It was driven through an ongoing approach called Line of Sight. This programme created an environment in which objectives were visually presented on charts in various work areas or waiting places. It promoted continuous improvement as well as the establishment of a culture of teamwork, participation and recognition.

The safety initiatives were guided by the Safety and Sustainable Development Policy, Fatal Risk Control Protocols and the Lonmin Sustainable Development Standards. These Standards provided a risk-based management framework for company-wide safety management, in line with the strategy of working towards improving safety and striving for best practice (LON 2013).

In 2014 Lonmin embarked on a campaign of renewal to unite the internal forces by aligning individual employee success through a shared value structure with that of the company. It was driven by the Chief Executive Officer under the banner ‘We dig to improve lives’.

The Lonmin 2009 safety strategy was strengthened in 2013 incorporating the overarching slogan and vision of ‘Zero Harm to everyone, everywhere, every day’. The company reviewed the safety strategy on an annual basis in line with the overall business strategy to identify strengths, risks and opportunities to improve. The overarching frameworks under which the company operated were the Safety and Sustainable Development Policy, Sustainable Development Standards and the Fatal Risk Control Protocols.

A transformed culture was embarked upon to reach a high level of safety awareness driven by the employees to entrench safe behaviour in the operational DNA. A significant challenge is that the workforce was at different stages of safety awareness and independence. The safety plans needed to be appropriate for these audiences. To transform and empower the workforce, the company would continue with safety training and create awareness that any employee or contractor had the right to withdraw from any unsafe work area. This reinforced the belief that the underlying enabler was a transformed culture, which would drive Lonmin towards ‘Zero Harm’.

Focus was placed on leadership in order to develop strong leaders supported by safety professionals to lead the workforce in the right decision making and behaviour. Lonmin aimed to empower its managers, supervisors and team leaders to play a direct and integral role in the functioning of the workforce through the promotion of Visible Felt Leadership. This approach positioned the leader as an

agent of change who led by example and not by power, and who had a personal commitment with each member of the team to collectively enable a safe and transformed environment in the workplace.

Safety training formed part of the employee and contractor induction. Lonmin's objective was that every individual in the business had a personal understanding of and respect for the importance of safety in the workplace. Entrenching safety principles in the organisation and increasing visibility on safety matters achieved this.

Simple fit for purpose systems were invested in that would record real-time information for trend analysis and incident prevention. Lonmin had an internal audit programme in place for the 15 Lonmin Sustainable Development Standards to improve the safety governance practices. The audit programme continued and the operations completed self-assessments to evaluate their compliance and implementation of the standards. Externally, Lonmin obtained OHSAS 18001 certification at all processing plants. An enabling environment was created to understand risks and optimise control and management, moving beyond compliance to an environment of excellence (LON 2014).

In 2015 the company developed an updated and focused safety improvement plan to curb the increase in LTIs and high-potential incidents. The day-to-day safety was complemented by 90-day safety turnaround action plans that were introduced this year to address the increase in injuries at the operations. Progress on these was reported to the Chief Executive Officer on a monthly basis and these plans were continuously adapted to new hazards or emerging trends. Each shaft had a 90-day safety turnaround action plan in place to address site-specific safety challenges, and the General Manager of each area implemented these action plans.

The company introduced incident review meetings and recall meetings, chaired by the Chief Operating Officer, to discuss and learn from potentially severe incidents and to discuss the lessons learnt from incidents that have occurred. The implementation of these learnings was tracked and reported monthly (LON 2015).

In 2016 a collaborative Tripartite Safety Day was held in July 2016, incorporating the key stakeholders including the DMR and AMCU in continued efforts to prioritise improving safety performance. The Chief Executive Officer supported by the President of AMCU and the Principal Inspector of Mines for the Rustenburg region, reiterated the focus on safety to employees. The company was determined to better the overall safety performance and further enhanced the focus on safety improvements. It was believed that 'Zero Harm' was realistic and achievable.

Lonmin aimed to provide a safe working environment for all of employees, contractors and the communities the company operated in. The company was determined to continuously improve the overall safety performance. The safety strategy was centred on the belief that 'Zero Harm' was possible. The goal was for every person in the business to have a personal understanding of, and respect for, the importance of safety in the workplace through entrenching safety principles, increasing visibility on fatality and injury prevention and encouraging a safe high-performance culture.

'Zero Harm' could be achieved if the risks that led to serious or fatal accidents were managed consistently. This was done through sustaining operational excellence, caring for people and demonstrating good corporate citizenship. Lonmin viewed safety as a proxy for good performance.

Safety Improvement Plans were implemented with an enhanced focus on accident analysis and pro-active preventive measures. Visible Felt Leadership (VFL) as a pro-active measure was accelerated during this year. VFL was senior management being visible in the operational areas confirming that safety was a core belief and showed passion to work safely. Achieving safety goals was an integral aspect of demonstrating operational excellence and the safety strategy was built around the belief that company can operate without accidents. The safety strategy focused on proactive safety management to entrench a culture that influenced safe behaviour.

The company needed to reach production targets to sustain the company and families, but safety always came first. The company ensured that the necessary

controls and procedures were in place to support the safety and health of the workforce as it was a critical element of the business strategy (LON 2016).

4 SYSTEMISE ACTIVITIES

4.1 MANAGEMENT SYSTEMS

The Lonmin management system provided tools to support the management of the business in a systematic and controlled way, with the aim of delivering consistent performance. The company used these tools to implement the Safety and Sustainable Development Management Standards in order to achieve the commitments of the Safety and Sustainable Development Policy in order to deliver robust and sustainable business performance (LON 2006).

4.1.1 SAFETY MANAGEMENT SYSTEM

In 2006 safety system failures were improved by implementing the Six Sigma methodology at operational sites. The company improved the safety data management system and implemented GRISK, a centralised risk management and incident reporting system that would further improve the integrity of the safety data (LON 2006).

In 2007 the SHEC Management Standards provided a risk management framework consistent with the Occupational Health and Safety Standard (OHSAS 18001) (LON 2007).

In 2008 the safety management system comprising the revised Safety and Sustainable Development Policy, Safety and Sustainable Development Management Standards and Fatal Risk Protocols were reviewed. These documents provided a risk-based management framework for company-wide safety management, continual improvement and alignment with international best practice. The safety management systems continually strived to eliminate fatalities, reduce injuries and near miss incidents, encouraged positive behaviour and enhance the training and awareness programmes.

Daily safety breaks in the work place coupled with safety training programmes continued to form an integral component of programmes to improve the safety performance (LON 2008).

In 2011 Lonmin had a Safety Summit which concluded, amongst others that the Safety Management Systems had to be simplified. There was a need to simplify the systems and to provide each level of employee with only the information needed to carry out their core responsibilities safely (LON 2011).

4.1.2 Occupational Health and Safety Standard certification

In 2007 external auditing of Occupational Health and Safety Standard (OHSAS 18001) management systems at operational level ensured continuous improvement. In 2008 Lonmin planned to achieve OHSAS 18001 management system certification at all the operations by 2011 (LON 2007).

In 2010 Lonmin had Occupational Health and Safety Standard (OHSAS) 18001 certification at the Smelter, Base Metals Refinery, Precious Metals Refinery and Analytical Laboratories. The company was aligning the management systems in order to have all operations OHSAS 18001 certified by 2012. The target set in 2009 to have all of operations OHSAS 18001 certified by 2011 was reviewed for OHSAS 18001 certification during 2012 (LON 2010).

In 2013 all Lonmin plants in the Process Division were OHSAS 18001 certified and the Mining Division's safety systems were based on the OHSAS 18001 requirements. The compliance with the OHSAS requirements was important however. Lonmin revised the commitment stated in 2010 to acquire certification for this compliance in the mining areas, due to the administrative costs involved (LON 2013).

4.2 Contractor management framework

Most of the fatal injuries during 2011 were contractors and in an effort to address safe behaviour among contractors Lonmin developed a contractor management framework with the main focus on safety. Future vendor application processes would include a safety, health and environment assessment of potential contractors. Lonmin enhanced the performance of contractors, with a particular focus on their safety performance, through various initiatives including:

- Issuing a 'Lonmin licence to operate' to contractors;

- Pre-qualification assessments of new vendors, and
- Audits in conjunction with the supply chain to ensure that contractors adhered to safety standards (LON 2011).

In 2012 Lonmin implemented the Contractor Safety Management Framework, which set the basis for industry collaboration through standardisation and reciprocity opportunities. The framework covers all aspects of contractor utilisation from pre-qualification to closure (LON 2012).

In 2016 Lonmin conducted compliance audits on contractors and contractor management. Each Mine and Process Unit had a Chief Safety Officer to strengthen interactions between the safety function and operations, increase the effectiveness of safety audits and improve alignment with safety standards, systems and reporting (LON 2016).

4.3 SAFETY AND SUSTAINABLE DEVELOPMENT ROLES AND RESPONSIBILITIES

The Chief Executive Officer was ultimately accountable for the safety of the employees and contractors on site. Line management was accountable for ensuring the effective implementation of the SHEC Policy objectives through supporting systems and procedures. They were also accountable to continuously create and maintain an 'enabling environment' for all workers and for delivering safe systems and places of work. Safety remained the responsibility of each employee and contractor.

'Zero Harm' to the employees and contractors was the core value of the business and the company was committed to the wellbeing of the employees and contractors and maintaining a culture of safe behaviour. The Safety Department specified safety standards and training material as well as audit the implementation of the Lonmin-specific requirements. The Safety and Sustainability Departments provided strategic direction, technical support and provided assurance of compliance to standards through a range of internal and external auditing functions. Line management was accountability for safety and sustainable development. The Safety Department provided the company policy,

minimum safety standards, training material, as well as auditing the implementation of these requirements (LON 2006).

In 2006 all SHEC matters were managed by a Vice President (VP) SHEC and Security, who enjoyed equal status with, and did not report to, the Business Unit leaders of the operations. The VP SHEC and Security was a member of the South African Executive Committee and a member of the Board's Risk & SHEC Committee.

The leaders of each of the business units were responsible for the implementation of the agreed SHEC strategy and standards within the Group. The specialist SHEC unit included experienced specialist managers for each of the areas responsible. The role of the SHEC unit was to:

- Set Group standards and draw up policies and procedures;
- Provide support to the business, and
- Undertake regular audits and other investigations to assess compliance and identify root causes of failure (LON 2006).

4.4 RISK MANAGEMENT APPROACH

Risk management in Lonmin had both a bottom- up and top-down approach with the objective to have employees actively involved in the management of risks to the business and in the work place. The top-down approach involved senior executives of the business reviewing strategic risks facing the business and the ability to meet the strategic objectives. The bottom-up approach involved management within each business unit reviewing risks that may prevent achievement of the business specific objectives.

The reviews were conducted annually and on an ad hoc basis as business changed or the risks changed so as to support business decisions. Progress on management plans was tracked on a monthly basis and internal audits undertaken on a frequent basis. The Chief Executive Committee received a quarterly report on the business risks and progress in mitigating or reducing these risks. A six-monthly report was submitted to the Audit and Risk Committee of the Board, which highlighted the

progress made on risk management and the status of all high priority actions.

The precautionary approach was inherent in the risk management framework. It identified all risks that could affect the company and its partnerships, using a standard framework to assess risks and prioritise actions. It embedded risk management as a line responsibility, while monitoring progress on actions to mitigate the risks on a monthly basis. The company implemented a structure that facilitated continuous improvement and shared best practice. Each risk was identified, assessed in terms of pure risk or the gross financial exposure of the risk. Other aspects of the risk management process included:

- The overall effectiveness of the control environment;
- The shortcomings with the controls in place, the severity and likelihood of the risk occurring;
- The residual risk or risk score;
- The priority of each of the risks, and
- Action plans to mitigate the risk.

Factors taken into consideration in the identification of risks included the company values and commitments, critical business success factors and legislation (LON 2007).

4.4.1 GRISK SYSTEM

In 2006 Lonmin focused on improving the safety data management system as a result of previous discrepancies. The safety system failures were improved by implementing the Six Sigma methodology at operational sites. Apart from daily and monthly reconciliation between the hospital and the safety departments at each operation, the company also designed and implemented GRISK, a centralised risk management and incident reporting system that would further improve the integrity of the safety data (LON 2006).

In 2010 managing organisational risk exposure was paramount to Lonmin and an extensive review of all shaft baseline risk assessments was completed. It resulted in an improvement of all shaft-based risk registers. Lonmin conducted risk

assessments to address unsafe behaviour or conditions (LON 2010).

In 2013 risks due to unsafe events or conditions that could cause fatalities or injuries included falls-of-ground, tramming, scraping and rigging incidents, exposure to various gases, fire, molten metal, electrocution and many other hazards (LON 2013).

4.4.2 SAFETY RISKS

'Zero Harm' to the employees and contractors was the core value of the business. The employees and contractors' wellbeing was the foundation to the success of the business. Poor safety performance had direct cost implications, reputational impacts and could affect the license to operate.

Group management was underpinned by the Safety and Sustainable Development Policy and supported by group targets, standards and guidelines. Associated risks were identified, managed and monitored through the company risk management framework. Lonmin had a zero-tolerance approach to any risky behaviour, an effective and highly trained emergency and response teams, innovative training and awareness initiatives (LON 2006).

4.5 FATAL RISK PROTOCOLS CONTROL

In 2006 the implementation of the Fatal Risk Protocols Control (FRCPs) was a key component in the drive to reduce fatalities. Implementation continued as a priority, but the restructuring of the organisation led to some delays in implementation in new business units to ensure that all managed operations would be fully implemented FRCPs by September 2007.

Safety standards and fatal risk protocols were implemented to make workplace safe. Future action included making sure that the relevant the documents were relevant and understandable to all employees and contractors at all levels of the organisation (LON 2006).

In 2012 FRCP was successfully rolled out across the operations. The relevant and critical FRCP per division was identified and repackaged as easily understandable

critical behaviours for each of the Lonmin Life Rules, via various communication mediums (LON 2006). In 2016 Lonmin focused on FRCP relating to fall-of-ground, scraping and rigging (LON 2016).

4.6 INCIDENT REPORTING AND INVESTIGATION PROCESS

It was Lonmin's view that the company could never operate in a risk-free way and one of the key constituents of the management system was an incident reporting and investigation processes. Lonmin investigated all serious incidents, which could result in the loss of a limb and incidents that could result in multiple fatalities. An industry-standard Incident Cause Analysis Method (ICAM) that graded incidents was used to facilitate the investigations. This rigorous and consistent incident analysis methodology placed emphasis on incident analysis, root cause identification, incident follow up, the prevention of repeat incidents, and effective communication on lesson learned across the Group (LON 2009).

Findings from these incidents informed the drive for 'Zero Harm' and was communicated across the operations. The outcomes of all higher-level investigations were presented to the Chief Executive Committee and the Safety and Sustainability Committee of the Board. The findings from these incidents were critical to the efforts in eliminating fatalities and serious injuries and were communicated across the operations.

In 2006 Lonmin introduced a consistent incident analysis methodology which emphasised incident analysis, incident follow up, the prevention of repeat incidents and effective communication on lesson learned across the Group (LON 2006).

In 2007 the operations were required to report and rate all incidents according to the Lonmin Consequence Severity Table. All potential and actual level high level incidents were investigated using the Incident Cause Analysis Method and were presented to the Safety and Sustainability Committee of the Board (LON 2007).

In 2008 Lonmin continued to investigate incidents through the Incident Cause Analysis Method and include near miss incidents. Findings from these incidents

were critical in eliminating fatalities and serious injuries and were communicated across the operations (LON 2006).

In 2012 the ICAM was reviewed and formalised to align with the Chamber of Mines Culture Transformation Framework requirements for risk management. A simplified tool was developed and adopted by the business, which would facilitate a more effective environment for knowledge sharing. Actions resulting from ICAM investigations on injuries as well as Section 54 or 55 stoppages were managed and monitored via the TeamMate internal audit software system, which was used to track control points raised by internal and external auditors (LON 2012).

In 2015 each fatality was investigated to identify lessons learnt and action plans to prevent a similar accident. These lessons were shared throughout the company. It included issues such as key control for mobile machinery, licensing of machine operators, working under suspended loads, working in no-go zones during scraping and rigging operations and reducing the number of personnel during cleaning operations with winches (LON 2015).

In 2016 each incident was thoroughly investigated, and the lessons learned from each incident was implemented into action plans and shared across operations (LON 2016).

4.7 AUDIT TEAM

In 2006 an internal audit team was trained to improve the quality of the internal audits on the implementation of the Group SHEC Management Standards. The company did not achieve the target for the SHEC Management Standards mainly due to the restructuring of the organisation.

SHEC related internal and external audits were conducted to provide the Risk & SHEC Committee with the assurance that policies, standards and procedures were implemented at operational level. These measures complement the activities of the governance structures to provide management and the executive with the assurance required to confirm that adequate risk controls were in place to ensure

sustained or improving performance or alternatively identify short-comings for timeous remedial action, (LON 2006).

In 2007 SHEC Management Standards audits were conducted against criteria established to measure the level of conformity, review the effectiveness of the management systems and inform training needs (LON 2007).

In 2010 Lonmin performed a baseline assessment of the legal compliance of the Safety and Sustainability Standards (LON 2010).

In 2011 the implementation of the Lonmin safety systems were internally and externally audited in relation to ICMM requirements.

4.8 MANAGEMENT INITIATED WORK STOPPAGES

In 2008 management initiated a large proportion of the safety shutdowns at the operations during the year. It was part of the drive to 'Zero Harm', in order to ensure safe production at the operations (LON 2008).

In 2015 it was believed that management-initiated stoppages were effective in stopping substandard or dangerous work and were a helpful tool as a proactive measure to prevent injuries (LON 2015).

4.9 FORWARD ENERGY SYSTEM

In 2015 the Lonmin Process Operation developed a forward energy system to manage the focus on safety on a continuous basis to prevent harm. The system included safety, health and environment measurements and pre-empted the possibility of increased operational activity and increased risk, which would, triggered management intervention (LON 2015).

4.10 KNOWLEDGE MANAGEMENT

The company recognised the need for continual improvement of levels of safety knowledge and awareness amongst leadership teams. Some of Lonmin's senior leadership attended international best practice training, which resulted in improved communication processes and increased safety awareness amongst

employees.

In 2011 the company introduced cross-site peer reviews within mining and processing in order to encourage the adoption of best practice (LON 2011).

4.11 Personal Protective Equipment Steering Committee

In 2009 Lonmin established a Personal Protective Equipment Steering Committee (PSC) to focus on the standardisation, optimisation and enforcement of personal protective equipment (PPE) company-wide.

The committee comprised of representatives from across the operations, including mining, processing, finance, human capital and supply chain. Since its inception the GPSC contributed to improved health and safety outcomes. The Committee focused on developing a strategic relationship with the service provider to ensure the use of the most appropriate PPE in the different operations.

One of the deliverables of the committee was the establishment of a complaints and recommendation system where employees could report issues with PPE as well as suggest recommendations. The key challenges to increase the efficiency of the issuing system and taking corrective action on employees and contractors who abused the use of PPE remained (LON 2009).

4.12 Emergency and disaster management

The company operated an Emergency and Disaster Management initiative and through the scheme, emergency assistance was available to company operations as well as to communities and other stakeholders in the area. Emergency Preparedness training was also provided to the surrounding community. The initiative offered a continuous and integrated multi-sectoral, multi-disciplinary process for the planning and implementation of measures aimed at:

- Preventing or reducing the risk of disaster;
- Mitigating the severity or consequences of disasters;
- Emergency preparedness;
- A rapid and effective response to disasters, and

- Post-disaster recovery and rehabilitation (LON 2007).

4.13 SIX SIGMA

By 2008 Six Sigma was part of the way that Lonmin had been conducting business since 2004. The programme became a benchmark for Six Sigma in South Africa and to a certain extent worldwide in the mining industry. The Six Sigma process improvements constituted an important component of the management systems, by providing a continuous improvement methodology. The programme won the Global Award for the best Six Sigma programme in manufacturing for two years running.

(*Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving toward six standard deviations between the mean and the nearest specification limit) in any process – from manufacturing to transactional and from product to service.)*

At the time, Lonmin trained 70 Black Belts and 17 Master Black Belts and extended the Green Belt training programme to over 450 people (LON 2008).

4.14 SAFETY MATURITY

In 2015 audits included internal, cross-site and external audits, the results of which were used for tracking the safety maturity of each operational business unit (LON 2015).

In 2016 safety audits were conducted and included internal and external audits that measured the safety maturity of each operational business unit. Cross-site safety audits support learnings across the operations and the sharing of best practices (LON 2016).

5 HUMANISE THE BUSINESS SYSTEMS

5.1 SAFETY CULTURE

In 2007 visible leadership was one of the critical elements of a successful safety culture. Workplace interventions were designed to cultivate constant awareness of

safe behaviour. These included daily safety breaks and safe behaviour observations, where employees observe each other to identify and share best practice (LON 2007).

In 2008 visible leadership was crucial and was a powerful aid in creating an interdependent safety culture. All managers undertook safe behaviour observations and participated with the employees in their areas in daily safety breaks (LON 2008).

In 2011 Lonmin had a Safety Summit in which, it was concluded that Lonmin needed to create a safety culture of safety with a set of shared beliefs about safety. Stressful, unsafe living conditions of many employees contributed to unsafe behaviour in the mining environment and that lack of sleep, poor diet, abuse of alcohol or drugs, or not respecting the inherent high-risk environment of mining all contributed to accidents and fatalities. Lonmin needed to find ways to improve the environment for employees, both at work and in the broader environment, so that they were encouraged to foster a culture of safe behaviour.

Testing for alcohol was introduced for all processing employees as well as random tests at other sections of the operations (LON 2011).

In 2012 safety was considered as part of how business was conducted and not a separate initiative, campaign, or subsection of thought before work started. Lonmin aimed to produce safely, constantly measuring forward energy, focused on proactive, sustainable work practices and growth. The company worked towards a safe culture on and off the job, with honest intent for what and how was done (LON 2012).

In 2013 Lonmin was concerned about the effects that employees' home environments could have on safety, as a result of stress, substance abuse and fatigue. The company focused on fatigue management programmes (LON 2013).

In 2014 the safety and health practices awareness campaigns and training interventions were geared towards creating a work culture that was conducive to employee and contractor wellness and productivity. It included the requirement

that unsafe work be stopped or not undertaken and empowered the workforce to ensure that this expectation was understood and complied with.

Lonmin was constantly exploring ways to improve safety in the workplace to prevent incidents and occupational health risks. The Employee Value Proposition aimed to create a work environment that was conducive to overall wellness and productivity.

Individual safety and health were not isolated to the workplace. Many of the safety awareness and healthcare programmes were expanded into the communities around the operations. The informal accommodation conditions of many of the settlements where employees lived were not conducive to wellness and had an extensive impact on safe and healthy behaviour (LON 2014).

In 2015 the company implemented Section 23, of the Mine Health and Safety Act, booklets and procedures in the operations that equipped team members to exercise their right to withdraw from dangerous workplaces. Internal safety stoppages occurred internally whenever Lonmin's Life Rules were violated.

The focus expanded to proactive safety management, with an emphasis on building a safety culture to influence safety behaviour and mindset. Proactive management included leading measures like safety campaigns, and management-initiated safety stoppages (LON 2015).

In 2016 the company placed increased focus on proactive safety management, safety culture and consequence management. It continued the pro-active safety management procedures, nurturing a culture focused on safety. The goal was for every person in the business to have a personal understanding of, and respect for, the importance of safety in the workplace through entrenching safety principles in the organisation and increasing visibility on safety matters (LON 2016).

5.2 BEHAVIOURAL SAFETY

During 2006 Lonmin increased focus on safety leadership in order to achieve the goal of 'Zero Harm'. A senior management safety day was facilitated by a DuPont

consultant with the objective to improve management visibility in the workplace and to train senior managers on how to conduct audits and inspections in the workplace that would augment the goal of 'Zero Harm'. 860 Employees were trained on Visible Felt Leadership (LON 2006).

In 2007 visible leadership, or leading by example, was one of the critical elements of a successful safety culture. Workplace interventions were designed to cultivate constant awareness of safe behaviour. It included daily safety breaks and safe behaviour observations, where employees observe each other to identify and share best practice (LON 2007).

In 2008 visible leadership was crucial to the success in safety and was a powerful aid in creating an interdependent safety culture. All managers undertook safe behaviour observations and participated with the employees in their areas in daily safety breaks (LON 2008).

In 2012 the company monitored Safe and At-Risk behaviours, and the results used to direct Visible Felt Leadership (VFL) programmes. Learnings from the visits to DuPont operational sites and the outcome of the National Safety Summit were implemented into the business in order to strengthen Visible Felt Leadership (LON 2012).

In 2013 Lonmin continued to roll out the leadership development programme in safety using the DuPont philosophy with the focus on management (LON 2013).

In 2016 the company continued to rollout the Lonmin Safety Leadership DNA programme, which was based on the Du Pont leadership programme. This programme developed the individual's safety competencies, knowledge of the safety theory, how to apply it and practise safety management. The structured workplace coaching was also part of this programme, which was conducted one-on-one to bridge individual competency gaps and to improve safety performance over time. Training was delivered to executive and senior management, union health and safety structures and 16 'train the trainers' candidates (LON 2016).

5.3 SAFETY CAMPAIGNS

Training and awareness campaigns were an essential component in effectively implementing of the safety management systems. The safety campaigns and emergency response extended beyond the boundaries of the operations, including extensive regional road safety initiatives, the impact of life style on the working environment, and community assistance (LON 2009).

5.3.1 COMMUNITY WELLNESS CAMPAIGNS

In 2005 Lonmin launched the Community Wellness Campaigns with the aim of creating awareness amongst employees and communities on wellness and to promote voluntary counselling and testing for HIV. The campaigns continued through 2006 and provided community members with a free health assessment and professional advice on treatment options (LON 2006).

5.3.2 THE LADUMA SAFETY AWARENESS CAMPAIGN

In 2007 the Mining Division developed a learning map to reinforce safe behaviours and adherence to safety procedures in order to achieve a serious injury free workplace by 2010. The theme of football was chosen given the popularity of football across the workforce of the 2010 World Cup in South Africa. The Laduma campaign was developed based around a soccer match learning map, supporting materials to facilitate discussions between Supervisors and their teams around safety and rewards based on the achievement of certain safety goals. The programme was rolled out to the mining operations and it showed early signs of success (LON 2007).

During 2008 the company continued with the implementation of the Laduma safety awareness campaign across the business at Marikana. Aspects of the campaign were dramatised through industrial theatre road shows across the Marikana operations (LON 2008).

5.3.3 TSOKA-VUKA-AWAKE CAMPAIGN

Lonmin rolled out a ten-week ‘Tsoka-Vuka-awake’ awareness campaign, which was believed to contribute towards a united alignment towards tackling the

common safety goals. The Executive Vice President for Mining, who involved the senior management team, initiated the campaign. It was believed that this high level of visible leadership contributed to the success of the campaign (LON 2010-1).

5.3.4 Prevention of Section 54s Campaign"

The "Prevention of Section 54s Campaign" evaluated safety performance against six pillars: It included mind set, culture, safety leadership, governance, compliance, and risk assessment. The campaign indicated the level of achievement in terms of each pillar, what could be done to improve the pillars and ultimately to reduce non-compliances as identified through inspections as per Section 54 of the Mine Health and Safety Act 29 of 1996 (LON 2010-1).

5.3.5 Safety Calendar Campaign"

The 'Safety Calendar Campaign' linked safety talks to specific safety incidents that were more likely to occur at different times during the year. The calendar directed planned task observations relevant to the seasonal risks. It was believed that it contributed to a culture shift towards more preventative risk behaviour (LON 2010-1).

5.3.6 'Aziko Sper' campaign

Lonmin launched the 'Aziko Sper' Safety Campaign to reduce hand and finger injuries. Employees were asked to pledge their commitment to work safely and protect their hands when working with sharp rotating equipment and dangerous chemicals (LON 2016-1).

5.4 Communication system

In 2006 Lonmin piloted a cascade communication system, which was designed to provide direct communication with every employee at every level in a personalized way. The system proved to be a huge success and a feedback loop was developed as part of the cascade process. Lonmin maintained three principal means of communicating with employees, including those not represented by organised labour. These were Lonmin's intranet, 'Platinum Conversations', a staff

newsletter and the Chief Executive's Newsletter, a monthly letter, translated into four languages, which dealt with safety, performance, operational issues and strategic matters (LON 2006).

In 2008 employee engagement continued to be a key focus for the Group. Employees were kept well informed of the performance and objectives of the Group through team briefings, consultation with union representatives and regular newsletters from the Chief Executive, translated into the four key languages. It was supplemented with communications produced by the operations on a shaft specific basis. The company introduced an internal television network at the K3 shaft, which proved to be popular (LON 2008).

In 2015 all safety achievements and initiatives were covered comprehensively in the *Weekly Bulletin*, an employee newsletter that promoted and upheld the values of the company (LON 2015).

In 2016 the importance of safety and the prior day's safety performance was communicated daily to sustain awareness. Weekly safety presentations by mine managers and Chief Safety Officers included a review of all injuries and high potential incidents across the mine, as well as incidents and key lessons from industry peers. Learnings from these incidents was communicated to the teams and followed up with weekly safety briefs and senior management visits (LON 2016).

5.4.1 WHITE FLAG DAYS

In 2015 the company focused on 'white flag' days, which were days that marked no injuries and celebrate the belief in operating without injuries. Daily communication alerts were distributed that summarised the safety performance for the prior day to continuously inform the workforce of the safety performance (LON 2015).

5.5 STAKEHOLDER RELATIONS

In 2008 workforce-related issues were prevalent and there were three one day national strikes during the year. The shortage of skilled workers was an issue, as

international markets and significant national infrastructure projects attracted resources. Lonmin completed a major restructuring programme across the operations, with all personnel levels affected and around 20% of the total workforce leaving during the year. The restructuring programme impacted employee morale and caused some disruption to production for a large part of the year (LON 2008).

In 2009 the labour environment continued to be a significant influence on the performance of producers, from both a productivity and cost perspective. The shortage of key skills remained an issue for the mining industry in general. With these challenges in mind, Lonmin recognised the importance of employee engagement strategies.

Lonmin management took a number of actions, which aimed to stabilise operational performance, improve the position on the cost curve and preserve cash. An extensive restructuring exercise was embarked upon which resulted in around 7 000 full time employees and contractors leaving the business which resulted in the reduction of employment levels by about 20%. The restructuring caused disruptions to operations and the opencast operations at Marikana was closed. Rationalisation of high cost production areas at the underground operations took place and the Baobab shaft at Limpopo was placed on to care and maintenance for the foreseeable future (LON 2009).

In 2011 community relationships had been challenging and considerable management effort was going into building a more effective rapport with community leaders. Community unrest experienced at the Marikana Operations resulted in protest action, which highlighted the need to communicate continually with communities to increase understanding.

An illegal strike resulted in the loss of ten production days and it was the result of an internal union leadership dispute, not through any difference with management. The incident had severe adverse consequences for a large part of the workforce, which resulted in the dismissal of approximately 9 000 employees. Approximately 8 200 of the dismissed employees were subsequently re-employed. Lonmin was

determined to maintain a positive and constructive relationship with the entire workforce.

Poor standards of living and unemployment in South Africa was fanned by resentment of perceived inequality. The Government was increasingly pressured to take action to retain a greater proportion of the benefit of natural resources for local inhabitants.

Safety and labour relations were the two major operating challenges. A part of the operations lost ten production days because of an illegal strike. The incident had severe consequences for a large part of the workforce, however the company was determined to maintain a positive and constructive relationship with the entire workforce.

The biggest challenges to the sustainability of the business included skills shortages and relationships with communities and employees. Considerable management effort went into building a more effective rapport with community leaders. Accelerated investments were initiated to address skills shortages including the training of community members in mining related skills (LON 2011).

In 2012 the Marikana event, in which several people lost their lives, was a defining moment for South Africa's. One of the consequences was the establishment of a platform for critical conversations needed about mining and society (LON 2012).

In 2013 the relationships with employees, unions and the communities all suffered major setbacks due to the Marikana incident. It was essential to have openness, trust and mutual respect to ensure successful stakeholder engagement. In the past, some mining companies delegated much of employee communication responsibilities to human resources practitioners and union leaders, which resulted effective as abdication of the role as managers.

Lonmin concluded a new Health and Safety agreement with all unions. The company elected new safety representatives and reconstituted the Health and

Safety Committees. Lonmin had 12 full-time safety and health stewards and 1 365 safety representatives in the workplace. They represented employees on Health and Safety Committees. The workforce was represented through these committees to help monitor the safety programmes. Topics and issues addressed through these committees included trauma care, material handling, safety behaviour, leadership and safety as well as fatigue management.

The South African mining industry was at a crossroad for decision making to resolve issues and disagreements before they turn into tension and mistrust and required a new collaborative model to be developed. Lonmin was committed to a process of fundamental change to rebuild trust with all the stakeholders. Marikana had a six-week long strike, which was marred by violence. The Lonmin Renewal Plan included the safe start-up of the operations, securing corporate funding, and managing costs. There was a backdrop of the hostilities that existed between rival unions, the breakdown in the relationship with employees, and the difficult economic circumstances that continued to prevail (LON 2013).

In 2014 the Marikana incident, the company experienced a protracted strike when the majority union downed tools on 23 January 2014 and only returned to work on 24 June 2014 after an agreement was reached (LON 2014).

In 2015 the company started a Section 189 consultation process to engage on implementation of the agreed avoidance measures, which included redeployment and re-skilling and voluntary separations. 3 136 employees of the 6 000 affected positions had left the company (LON 2015).

In 2016 the reorganisation of the business, which commenced in 2015, was successfully completed, with a reduction of 5 433 employees and contractors, and 1 426 people were successfully reskilled and redeployed into vacant more productive roles.

Lonmin experienced no labour disputes or work stoppages during the year which as a consequence of the work both the Management and the unions put into building and nurturing effective relationships. The focus was on continuing to

rebuild morale throughout the operations after the reorganisation (LON 2016).

5.6 SKILLS SHORTAGE

In 2008 Lonmin implemented recruitment programmes to attract and retain the necessary skills, as there was a shortage of skilled workers. The company was successful in reducing skilled labour turnover during the year (LON 2008).

In 2009 there was a general shortage of people with mechanised experience in the industry and this would remain a key area of focus. The scarcity of experienced people nationally and globally meant that the industry was always chasing talent and there was an insufficient skills pipeline to address this. This impacted mainly on mechanised Hossy shaft (LON 2009).

5.7 ABSENTEEISM

In 2008 a Zero Tolerance approach to absenteeism was introduced, which was extensively communicated throughout the business, and focused on increasing awareness that persistent absenteeism would result in dismissal (LON 2008).

In 2009 Lonmin pursued labour management improvement programmes, including a number of projects to tackle absenteeism (LON 2009).

In 2014 absenteeism was at 29.3% and a direct result of the strike. The company lost 2.6 million person days due to absenteeism. Employees in the mining operations worked in teams, which affected the ability to function safely and optimally when members were not at work (LON 2014).

In 2016 Lonmin implemented a project to understand and address the challenge of workplace absenteeism. Absenteeism had a substantial impact on safety performance, as it affected the remaining crew members who had to deal with the absence of colleagues. Lonmin initiated a project to identify employees who were repeatedly absent, counselled them and established the reasons behind poor attendance to address the issue on a comprehensive basis.

Follow-up actions included financial counselling, and support through the employee wellbeing service among others. Workshops were with employees and

AMCU to highlight the consequences of absenteeism, both for employees and for the company. Lonmin was moving towards finding solutions jointly with the employees and automating the collection and analysis of absenteeism data in real time to monitor the effectiveness of joint interventions implemented. Measures in place to address absenteeism included linking attendance to bonus payments and the use of buffer labour crews, which was being piloted at a number of the Generation 2 shafts (LON 2016).

5.8 EMPLOYEE WELLNESS

In 2016 the wellbeing of the employees remained crucial and Lonmin extended the nutrition programme from three days to five days a week in support of this. Health and wellness were integrally linked to quality of life, morale, productivity and safety performance. The overall health and wellness of an employee was the outcome of a host of factors, many of which arise outside the workplace. Lonmin's safety awareness and healthcare initiatives include many programmes that extend into the host communities.

The company also piloted a project to assess the impact of daily nutritional supplements on employee wellbeing and to determine whether this has a positive impact on absenteeism (LON 2016).

5.9 EMPLOYEE SURVEYS

In 2008 an employee survey, "My life at Lonmin" confirmed the entrenchment of the value of 'Zero Harm' within the workforce. The results reflected that the single most important value that employees experienced within the company was that of 'Zero Harm'. Lonmin took pride in accepting the commitment to 'Zero Harm' by living a safe day, every day, and ensuring that all unsafe acts were eliminated (LON 2008).

In 2011 Lonmin conducted a culture survey, a progress audit on compliance and safety maturity. Progress was made against some of the safety objectives such as injury prevention when compared to the 2010 baseline (LON 2011).

5.10 ENHANCED MANAGEMENT PERFORMANCE

In 2008 Lonmin initiated a Leadership Development Programme in order to enhance performance at the executive management level. It was a six-week programme extending over eleven months which equipped management employees with leadership skills, promoted high performance teams and created alignment around the Lonmin Operating Model. 118 Employees commenced participation in this course, with a further 82 employees that were due to participate in the course in 2009.

The company commenced with a Front Line Supervisory Development Programme, aimed at equipping supervisory employees with necessary supervisory and management skills, with 90 supervisors successfully completing this course (LON 2008).

5.11 INCENTIVE SCHEME

In 2006 SHEC formed an important part of the Group's reward strategy, with all of the senior executive team having a material proportion of their annual bonus based on objectively measured performance against key objectives (LON 2006).

In 2010 a new incentive programme was implemented for production employees to increase the element of variable pay. It delivered significant efficiency improvements most noticeably towards the end of the financial year (LON 2010).

In 2012 employees were recognised and rewarded for good safety performance. Lonmin reviewed the range of reward and recognition programmes in place that rewarded employees for good safety performances, focusing on forward energy and preventive efforts by means of the Lonmin Corporate Balanced Scorecard.

In 2016 Safety performance formed part of incentive schemes at operational level (LON 2012).

5.12 TRAINING

The company was committed to an appropriately skilled and diverse workforce as a foundation to the success of the business. There was an ever-increasing demand

and competing interests for skilled recruits nationally and within the international mining industry. The development and training of the employees was critical to the establishment of a competent workforce and future leadership for the company. In 2006 human rights training formed part of the induction training for all staff (LON 2006).

In 2008 the company invested in training programmes, and awareness campaigns as it formed an important component of the safety management systems. 118 Employees participated in the six-week Lonmin Leadership Development Programme, 188 employees and 592 community members participated in the Lonmin training programme and 90 supervisors completed the Front Line Supervisory Development Programme.

The company had highly trained surface and underground rescue teams, fire fighters and emergency medical services available on a twenty-four-hour basis to support the operations (LON 2008).

In 2009 the company developed a new training strategy for the business to refocus the training budget on better value adding initiatives that would help to address skills shortage challenges (LON 2009).

In 2010 the company invested significant resources, time and effort on training and education. There was a focus on upgrading the safe production training programmes and increased safe behaviour observations. Behavioural and cultural issues were addressed which were fundamental to a good safety performance (LON 2010).

In 2011 safety training included simulator training for drivers and the toolbox topics were translated into appropriate languages. The skills that identified as those necessary for the development of safety leadership included transparency, integrity, communication, management style and beliefs.

The initial action taken towards building leadership safety competence in Lonmin was to send the entire executive team and many senior managers, including the Chief Executive Officer, on a DuPont safety management training course. The

focus areas for development of leadership was to improve the knowledge of safety, embed the principles of care and integrate safety in the business with the emphasis on the personal commitment to safety (LON 2011).

In 2012 after the strike Lonmin invested many hours in safety training before re-opening operations in order to minimise the risk of any safety failures, either underground or in the surface works (LON 2012).

In 2013 Lonmin continued with individual development programmes, succession planning and retention strategies for scarce skills. There was focus on bursaries, graduate development, mentorship programmes and an internship programme to assist students who needed to complete their practical work in order to obtain tertiary qualifications and preference was given to HDSA applicants.

Lonmin launched an artisan's training college. The company continued with portable skills development training programs to help drive productivity improvements (LON 2013).

In 2014 one of the consequences of the prolonged strike was that safe behaviour was potentially unlearned over the long periods away from work. Employees required extensive retraining before they could return underground or to the plants safely. 1 030 Supervisors, managers and team leaders underwent preparatory training on how to engage with returning employees proactively and positively once the strike came to an end (LON 2014).

In 2015 safety training forms part of induction for employees and contractors. Lonmin's objective was for every person in the business to have a personal understanding of, and respect for, the importance of safety in the workplace. It was achieved by entrenching safety principles in the organisation and through increasing visibility on safety matters.

Contributing factors to the increased injuries included similar or repeat injuries occurring, employee behavioural challenges, and frequent safety stoppages. A programme was developed to empower front line supervisors in order to enhance safety and production performance (LON 2015).

In 2016 1 428 employees were reskilled and redeployed into vacant, more productive roles. Training on safety and health practices was delivered to all employees and contractors at induction when joining the company and when returning from annual leave. The training included risk awareness and controls, the standardised approach to critical tasks and procedures, information on TB, HIV/Aids and nutrition, and section 23 of the Mine Health and Safety Act, No 29 of 1996 (LON 2016).

6 OPERATIONALISE THE SAFETY MANAGEMENT SYSTEM

6.1 IMPACT OF THE 2014 STRIKE.

The 2014 work stoppages posed a risk to operational safety. Heavy infrastructure and equipment were not designed to remain inactive for lengthy periods. Lonmin continued running maintenance and performance checks on all active shafts and plants throughout the strike.

The majority of employees passed their health and fitness assessments however, 11% of employees were declared temporarily unfit. This was due to a combination of a 30% increase in defaulters on chronic medicine provided by the company. The full impact that those months without regular medication would have on the workforce was to be determined. A number of projects were deferred as a result of the strike and the impact of the strike extended to communities, suppliers and employees (LON 2014).

6.2 MINING METHODS

In 2008 the mechanisation strategy changed as it failed to significantly improve productivity from the two fully mechanised shafts. The company switched to hybrid mining at Saffy shaft, where conventional stoping methods were introduced, whilst maintaining mechanised development. This conversion process presented some challenges in that the shaft's development footprint was specifically designed for mechanised mining. The upgrading the infrastructure of the shaft, including the installation of ore passes and drop raises rectified it. The mining layout was designed for mechanised mining and had to be re-aligning to better suit conventional mining methods. The company faced challenges in the recruitment and training of skilled crews to adapt to the change in mining method.

At Saffy shaft improved productivity mainly as a result of substantial management effort and focus as well as the utilisation of the extra-low-profile equipment. Management also focused on improving operator and supervisors' skills, as well as upgrading management operating systems. Significant changes were made to the shaft's mining layout and upgrading the shaft's infrastructure by

implementing a new communication network backbone, installing new strike conveyors and constructed a new maintenance workshop at the shaft. The mine built team-work and trust within these new crews, thereby ensuring that Saffy's workforce remained stable and maintained the shaft's strong safety culture.

The K4 shaft would be developed as a hybrid mine when it was planned to come into production in 2010. Hossy shaft would continue to be run as a fully mechanised shaft while continuing to achieve satisfactory levels of productivity (LON 2008).

In 2009 it was recognised that the Bushveld Complex was a mature geological environment and mines in the area would continue to deepen over time, with many of the easier to access reserves becoming steadily depleted. This was expected to have a consequent impact on industry costs, grades and recoveries in the future. Lonmin was in the fortunate position of having access to relatively shallow reserves and resources (LON 2009).

In 2010 Hossy shaft continued with the fully mechanised proof of concept project at. The key drivers to Hossy's improvements were enhancements to the mining layout and infrastructure and equipment upgrades. Management continued with the development and training initiatives in core areas.

The management structure at Marikana was revised into four discrete business units, which would improve accountability and help drive performance. Saffy continued to perform extremely well, despite the multiple challenges faced by shaft management in converting from fully mechanised to hybrid mining during the year. The mechanised mining team faced challenges around machine reliability, the availability of replacement parts and the supply of trained artisans. The company had ongoing programmes to address these issues (LON 2010).

In 2013 the Saffy shaft production was slower than planned as it continued to face poor ground conditions and followed a process of stringent roof support systems. Hossy shaft increased tonnes, despite continuing challenges relating to machine reliability, the availability of replacement parts and retention of trained

artisans, which negatively affected the mechanisation of this shaft. The introduction of hybrid mining continued to deliver positive results. The roll-out of the hybrid crews was further pursued.

The Theory of Constraints management philosophy was used to debottleneck Rowland Shaft. The programme delivered promising production output, which increased towards year end. It was planned to integrate this philosophy into the mining operating model and was rolled out to all operations. The best practice teams undergone extensive training, and which assisted in the roll-out.

The company investigated alternative shift cycles to the eleven-day per fortnight shift cycle that would be advantageous for all stakeholders. A number of options were investigated and explored and those that had the greatest probability of success was further refined for consultations with the unions during 2014 (LON 2013).

6.3 LONMIN LIFE RULES AND RESPONSE TRIGGERS

The Lonmin Life Rules and Response Triggers ‘Allert ‘initiative which meant Apply Lonmin Life Rules and Triggers, was developed specifically for Lonmin as a tool to provide guidance on how to manage the risk of falls of ground. It aimed to empower people at the rock face, and focused on improving the following capacities:

- Entry examination;
- Geological hazard identification;
- The treatment and support of geological features;
- Withdrawing people from unsafe conditions;
- Requesting assistance from specialists, and
- Making a decision as part of a functional team.

A system was put in place to raise the warning of a potential hazard to a team leader with a higher skills level should a team not know how to deal with it. All supervisors attended a rock engineering course as part of the initiative and high-risk areas was visited by a senior official more frequent to verify whether the

correct controls were in place to mitigate the risk of fall of ground incidents (LON 2013-1).

In 2014 Lonmin required all supervisors to attend a rock engineering course during implementation of the 'ALLeRT' initiative to assess the safety of underground conditions effectively. 795 crews were trained which enabled them to apply the 'ALLeRT' initiative (LON 2014-1).

In 2015 the Lonmin Life Rules, another proactive tool, focused specifically on those risk areas that cause the majority of fatal or serious accidents. These Life Rules were a set five non-negotiable rules that employees must follow when working underground or in the plants. The application of these rules was regularly audited and measured per mining area. The Mining Life Rules was expanded to include out-of-stope hazards such as trackless mobile machinery (LON 2015-1).

6.4 PRODUCTIVITY PROGRAMMES

In 2009 productivity programmes were instigated by the Mining management team which included initial steps taken to revise incentive programmes for the productive employees to increase the element of variable pay. Consultations were initiated with the recognised unions to increase the number of shifts worked (LON 2009).

6.5 ENGINEERING CONTROLS

In 2008 the company increased focus on equipment availability, with better maintenance and quicker repair times achieved, supported by improved mining standards and conditions. The company enhanced the roof-bolting initiative in order to help prevent fall of ground incidents (LON 2008).

In 2009 fatalities and serious injuries at the operations resulting from fall of ground, use of track bound mobile equipment, scraping and rigging were the key safety risks. Following a number of underground locomotive collisions, research was commissioned to seek an engineering solution as part of the measures to minimise possible collisions. Locomotive anti-collision devices were installed on a number of locomotives on a trial and test basis. The principle of the operation

used radio frequency transmitters and receivers that triggered alarms in the driver's cabin warning the driver of the close proximity of another locomotive. Further investigations were underway to establish if these transmitters could be placed at strategic hazards or obstructions in haulages to trigger alarms.

Lonmin commenced the removing of technical bottlenecks through the Half Level Optimisation programme and the implementation of operating systems at each shaft (LON 2009).

In 2010 the removal of technical bottlenecks and the implementation of improved operating systems at each shaft was implemented and remained an area of further opportunity (LON 2010).

In 2014 Lonmin stopped the use of conventional light duty vehicles for underground applications. Special built emergency and service vehicles were designed and ordered, and the Lonmin Standards was changed to incorporate the new designs (LON 2014).

7 SAFETY PERFORMANCE

Lonmin had 31 fatalities between 2007 and 2016 as shown in Figure 3.

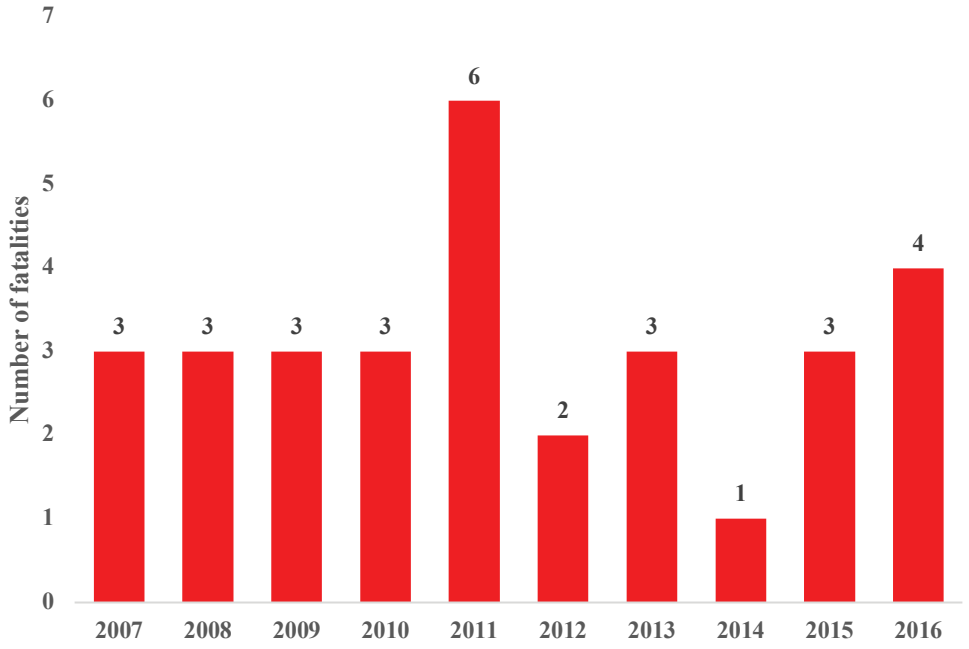


Figure 3 31 Fatalities at Lonmin between 2007-2016 (LON 2007- 2016).

The lost time injury frequency rate improved significantly from 10,8 injuries per million hours worked in 2007 10 4,97 in 2016 as is shown in Figure 4.

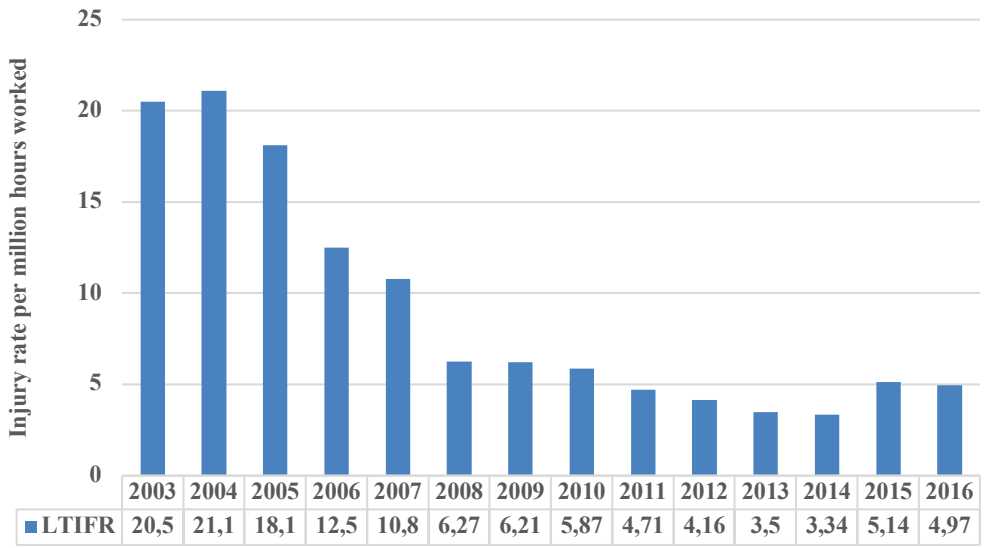


Figure 4 Lost time injury frequency rate between 2003-2016 (LON 2006-2016).

8 SUMMARY

In 2006 Lonmin was the world's third largest producer of Platinum Group Metals. The company had been a voluntary member of the International Council on Mining and Metals (ICMM) since 2005.

A senior management safety day was facilitated by a DuPont consultant with the objective to improve management visibility in the workplace. A structure around risk analysis and reporting was formalised which initiated a further embedding of risk management. Lonmin remained committed to 'Zero Harm' to people and continued to promote this as an achievable outcome in the behaviour of management and employees.

Safety system failures were improved by implementing the Six Sigma methodology at operational sites. The implementation of the Fatal Risk Protocols Control (FRCPs) was a key component in the drive to reduce fatalities (LON 2006).

In 2007 visible leadership was one of the critical elements of a successful safety culture. Lonmin embedded the principles of sustainable development into the business. The mining operations in South Africa were highly unionised and a single union represented the vast majority of the workers. The Mining Division developed a learning map to reinforce safe behaviours and adherence to safety procedures in order to achieve a serious injury free workplace by 2010.

The company used a standard risk management framework across the operation to assess risks. External auditing of OHSAS 18001 management systems at operational level ensured continuous improvement. SHEC Management Standards audits were conducted against criteria established to measure the level of conformity, review the effectiveness of the management systems and inform training needs (LON 2007).

In 2008 South Africa experienced an outbreak of violent attacks on foreign nationals and Eskom declared *force majeure* on electricity supplies. Lonmin restructured key parts of the business, with a view to aggressively cutting and

better managing costs, while at the same time increasing management's focus on delivery against plans. There was a lack of mine ore reserve development that would impact the production during the year and would continue into 2009.

Lonmin completed the review of the Safety and Sustainable Development Management Standards to incorporate best practice, legal requirements and principles and position statements of the ICMM. Safe working practices remained a key priority for Lonmin as well as the elimination of fatalities and injuries. 'Zero Harm' was a core value of the business.

The company continued to investigate incidents through the Incident Cause Analysis Method and include near miss incidents. Management initiated a large proportion of the safety shutdowns at the operations during the year (LON 2008).

Lonmin was plagued by the issuing of Mine Health and Safety Act Section 54 stoppage notices by the Department of Mineral Resources between 2008 and 2016. A significant turnover of Board members as well as senior management occurred during the same period (LON 2008-2016).

In 2009 Lonmin operated in an extremely difficult pricing and currency environment with revenues declined dramatically by over 50%. Management took immediate decisive action through the closure of unprofitable operations, the reduction of costs and the restriction of capital expenditure.

The company embraced the principles of the Mining Charter and pursued actions to advance the transformation agenda prescribed by the South African government. An industry-standard Incident Cause Analysis Method (ICAM) that graded incidents was used to facilitate the investigations (LON 2009).

In 2010 the company was disappointed that insignificant progress was made in terms the safety performance. Lonmin developed a new Integrated Safety strategy reflecting a shift to a more proactive approach and aligned the Safety and Sustainable Development Policy with the ten ICMM principles.

The operations had been largely restored and the company could look forward to

improving on the work practices and disciplines that were introduced into the operations in order to drive efficiency and productivity. (LON 2010).

In 2011 Lonmin held a Safety Summit leading up to the company's participation in the National Safety Summit after which the safety strategy was reviewed and refocused. It was concluded, amongst others that the Safety Management Systems had to be simplified.

Lonmin delivered a solid operational and financial performance. The company introduced cross-site peer reviews within mining and processing in order to encourage the adoption of best practice (LON 2011).

In 2012 the Marikana event, in which several people lost their lives, was a defining moment for South Africa. The issues of business and commerce was overshadowed by the loss of life, violence, unrest and fear at Marikana. One of the consequences was the establishment of a platform for critical conversations needed about mining and society.

The company implemented the Contractor Safety Management Framework, which set the basis for industry collaboration through standardisation and reciprocity opportunities. The ICAM was reviewed and formalised to align with the Chamber of Mines Culture Transformation Framework requirements for risk management (LON 2012).

In 2013 Lonmin continued to roll out the leadership development programme in safety using the DuPont philosophy with the focus on management. Improvements in safety became more and more difficult Lonmin adopted the Mine Industry Occupational Safety and Health (MOSH) leading practices. All Lonmin plants in the Process Division were OHSAS 18001 certified and the Mining Division's safety systems were based on the OHSAS 18001 requirements.

The South African mining industry was at a crossroad for decision making to resolve issues and disagreements before they turn into tension and mistrust and required a new collaborative model to be developed. (LON 2013).

In 2014 the Lonmin brand was negatively impacted on due to the Marikana incident, the protracted strike of 2014 and the media reporting about the Farlam Commission of Inquiry. The majority union downed tools on 23 January 2014 and only on 24 June 2014 an agreement was reached for the return to work. Lonmin embarked on a campaign of renewal to unite the internal forces by aligning individual employee success through a shared value structure with that of the company (LON 2014).

In 2015 the company developed an updated and focused safety improvement plan to curb the increase in LTIs and high-potential incidents. Lonmin strived to be the industry leader in safety and it was believed that 'Zero Harm' was both achievable and realistic. Each fatality was investigated to identify lessons learnt and action plans to prevent a similar accident. The Lonmin Process Operation developed a forward energy system to manage the focus on safety on a continuous basis to prevent harm. The company was dominated by unprecedentedly low metal prices and correspondingly low profitability (LON 2015).

In 2016 the company continued to rollout of the Lonmin Safety Leadership DNA programme, which was based on the Du Pont leadership programme and placed increased focus on proactive safety management, safety culture and consequence management. A collaborative Tripartite Safety Day was held incorporating the key stakeholders including the DMR and AMCU in continued efforts to prioritise improving safety performance. The wellbeing of the employees remained crucial and Lonmin extended the nutrition programme from three days to five days a week in support of this.

The company rolled out the proximity detection systems as part of the MOSH initiatives and participated in the Chief Executive Officer 'Zero Harm' Task Team through the Chamber of Mines. Sustainability remained central to the business and was dependent on the relationship with the employees and fulfilling the social and community responsibilities. Safety audits were conducted and included internal and external audits that measured the safety maturity of each operational business unit (LON 2016).

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Appendix G

The Implats safety journey between 2007 and 2016 case study.

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1. IMPLATS COMPANY BACKGROUND

In 2006 Implats' primary operation was the wholly owned Impala Platinum, Marula Platinum and Two Rivers in the South African Bushveld Complex. Implats had interests in Zimplats (86.9%) and Mimosa (50%) in Zimbabwe. Implats also had an investment in platinum producer, Aquarius Platinum Limited (8.6%), and its subsidiary Aquarius Platinum (South Africa) (20%) (IMP 2006).

Impala Platinum, Implats' primary operation, comprised the mining and mineral processing operations which were situated on the western limb of the Bushveld Complex, north of Rustenburg in North West Province, as well as the refining operation located in Springs, east of Johannesburg. Impala Platinum's mining operation included 13 operating shafts, five decline shafts and two new vertical shafts.

In 2007 Implats acquired Afplats, which resulted in significantly increased the asset base (IMP 2007). In 2008 the operating environment was one of the toughest years that the company experienced. Some of the challenges faced were safety, the power crisis, industry-wide skills shortages, escalating input costs and socio-political issues. The combined effect was a supply shortfall from the South African producers, with a more significant impact expected on medium to long term supply growth prospects (IMP 2008).

The first half of 2009 was dominated by the US sub-prime crisis, which sparked the near-collapse of the global financial system and plunged the world into recession. The speed and depth of the economic decline far exceeded forecasters' worst expectations (IMP 2009).

In 2010 despite a disappointing safety performance for the Group, several operations delivered world-class safety achievements. The lack of mining flexibility meant increased mining in remnant areas with the concomitant reduction in productivity. The company was also in a transition period of older infrastructure reaching the end of its life and new infrastructure being started up. This situation would remain an issue for the next three to four years. The relative

inefficiency of the operating environment would also improve as older infrastructure was closed (IMP 2010).

In 2012 Implats faced challenges on many fronts, which included the social, and workplace turmoil the industry found itself in that demanded lasting solutions. The subdued state of the markets required the company to act with restraint while doing everything possible to improve production efficiencies, preserve cash and extract maximum value from the capital expenditure. Implats implemented safety improvements and with the added internal safety stoppages, resulted in substantial costs. However, the Chief Executive Officer (CEO) was confident that it would pay handsome dividends in terms of lives saved and injuries spared. Implats joined the Chamber of Mines of South Africa (COM) as a full member (IMP 2012).

2014 was a watershed year for the South African platinum sector. After the turbulence of the two previous years, each of which had been seen as the most difficult and challenging in the sector's history. Implats had an even more challenging year. The continuing combination of tough market, operational and social conditions, suggests the need for some fundamental changes in elements of the business model and in the nature of some of the relationships.

A crippling five-month strike across the platinum belt in Rustenburg, a subdued global Platinum Group Metals (PGM) market, an ongoing rise in unit production costs, and a further reduction in margins and productivity put the company at significant risk. The company also faced continuing challenges around access to skills, infrastructure and certain resources, such as electricity and water, as well as growing expectations from a demanding set of disparate stakeholders (IMP 2014).

In 2015 the Implats South African operations reported 210 fatality-free calendar days, which equated to over eight million fatality-free shifts (IMP 2015).

In 2016 the Chief Executive Officer resigned. Both 8 Shaft and the 12 Shaft mechanised sections, which were identified as loss-making in the low-price environment, were closed as planned at the end of December 2015. The company

had major safety incidents as safety-related events at 1 and 14 Shafts in which nine workers sustained fatal injuries. Four employees died when fumes following a fire overcame them occurred in the main underground decline at Impala Rustenburg 14 Shaft (IMP 2016).

1.1 LEADERSHIP CHANGES

In 2006 Fred Roux was the Chairman and Keith Rumble was the Chief Executive Officer. In 2007 the company experienced leadership changes at corporate and operational level. Fred Roux remained as Chairman and David Brown was appointed as the new Chief Executive Officer (IMP 2006).

In 2008 Implats appointed an executive responsible for safety, health and environment at a group level who would drive goal setting, strategy development, performance management and reporting (IMP 2008).

In 2009 the group's internal management structures were reviewed, and redefined and new structures put in place. This was largely as a result of a comprehensive review undertaken during the prior year, in conjunction with external management consultants (IMP 2009).

In 2012 David Brown left as Chief Executive Officer on 30 June 2012 and Terence Goodlace took over as Chief Executive Officer on 1 July 2012 (IMP 2012).

In 2015 Dr Mandla Gantsho took over as Chairman and in 2016 Terence Goodlace, the Chief Executive Officer, resigned (IMP 2015).

1.2 EMPLOYEE RELATIONSHIPS

In 2007 operations were interrupted by sporadic industrial action (IMP 2007).

In 2009 the company experienced 2 weeks of industrial strike action by the workforce followed the 14-shaft tragedy after 9 employees died in a fall of ground accident (IMP 2009).

In 2012 the Rustenburg section an unexpected 6-week illegal industrial action, which started without any notice and resulted in a loss of production of some120 000 ounces. The industrial action was accompanied by large scale intimidation and physical assaults which resulted in 86 employees were injured and four people lost their lives. Management had to adjust to the reality of a multi-union environment in future (IMP 2012).

In 2013 Implats worked with Chamber of Mines, government and labour representatives to find sustainable solutions to industrial relations challenges in the country. Significant progress was made in advancing the employee relations strategy. A new recognition agreement was concluded in July 2013 with AMCU for the Rustenburg operations. The principles of the agreement provided a clear framework to advance the election of shop stewards for wage negotiations and to progress the Health, Safety and Environment (HSE) Agreement. The framework and design of the draft HSE agreement took account of past experience and to align employees and their representatives more directly with the 'Zero Harm' vision (IMP 2013).

In 2014 AMCU was then the majority union in the platinum belt, and its direct challenge to the traditional dominance of the ANC-aligned National Union of Mineworkers (NUM), ushered in a new era in the history of industrial relations in South Africa (IMP 2014).

1.3 SCOPE OF THE CASE STUDY

Only issues affecting the Implats South African operations were addressed in the case study. Other significant interventions by Implats on HIV Aids and other medical conditions affecting the wellness of the workforce were not addressed in this case study. All information in the case study was obtained from the Implats Annual reports for the period 2006-2016.

2 SAFETY ADVOCACY

2.1 MINE HEALTH AND SAFETY COUNCIL

Various mining industry stakeholders collaborated for some time on affecting the culture changes needed to achieve better safety results. The Mine Health and Safety Council (MHSC), developed a framework that would guide the sector towards attaining 'Zero Harm', an initiative, which Implats supported.

The Minister of Mineral Resources and other stakeholder principals signed off the approved Culture Transformation Framework (CTF) on 18 November 2011. The Culture Transformation Implementation Model consisted of five pillars: Leadership; Risk management and Accident Investigation; Bonus incentives and adopting Leading Practice and Eliminating Discrimination.

As part of implementing the Implats Leadership Summit Action Plan it was agreed that the CTF be supported with a view to significantly improving the culture of health and safety across the mining sector (IMP 2012-1).

In 2015 the tripartite MHSC agreed a new set of sector-wide health and safety milestones. The milestones were developed in national collaboration with all stakeholders and agreed upon by the principals. These efforts would ensure learning and participative culture where all were treated with care, respect and dignity. These milestones included commitments to:

- Eliminate fatalities by December 2020;
- Achieve an annual 20% reduction in lost-time injuries;
- Eliminate silicosis, pneumoconiosis and noise-induced hearing loss;
- Reduce the TB incidence rate in mines to or below the national TB incident rate by December 2024;
- Meet clear targets on implementation of the approved culture transformation framework, and
- Launch a centre of excellence to transfer knowledge and technology of quick win projects.

Implats embraced the occupational health and safety milestones and considered these milestones an important tool to transform the culture of health and safety in the workplaces to control risks with the intent to further accelerate the Journey to 'Zero Harm'. The company was committed to delivering on these targets through continued focus on embedding an effective culture in the organisation, supported by investment in the physical environment (IMP 2015).

2.2 CHAMBER OF MINES OF SOUTH AFRICA

In 2012 Implats joined the Chamber of Mines of South Africa (COM) as a full member with a view to participating in and contributing to multiparty health and safety initiatives. Implats acknowledged that the company leadership, strategy, management style and systems contributed to its safety performance, as the company did not previously actively participate in industry initiatives to work towards 'Zero Harm'.

Several mining industry leaders publicly recognised that very significant changes were required if mining were to improve health and safety. Although the South African mining industry fatalities reduced by more than 62% since 2003, a step change was required if the industry was to deliver on the 2013 milestones and thus enhance its credibility as a caring industry. Implats came a long way on the safety journey to 'Zero Harm' but it struggled to reach the 2013 milestone of world-class safety performance.

The Implats CEO became actively involved in the COM Chief Executive Officer's "Elimination of Fatalities" team. The Implats management was actively participating in tripartite including government, industry and labour efforts to achieve sustainable safety improvements within the sector (IMP 2012-1).

In 2013 Implats commenced implementing leading practice on the adoption of new technology as advocated by the COM. The company used the CTF to enhance the safety culture. A gap analysis was undertaken to determine how Implats progressed against the CTF and would in future measure its performance against the detail of these pillars and their subsets (IMP 2013-1).

In 2014 the required change in the Implats safety culture was to be achieved through leadership and using the CTF. Implats continued to work through the COM in finding common solutions to some of the challenges faced by the industry and to seek strategic alignment to the relevant national imperatives outlined in the National Development Plan (IMP 2014-1).

In 2016 Implats continued to work with the COM, industry bodies, relevant government departments, political leaders, labour representatives and community organisations to find solutions to some of the collective societal challenges it faced. An important objective was to ensure full strategic alignment with the relevant national imperatives outlined in the President's Framework Agreement for a Sustainable Mining Industry, Operation Phakisa, the Mining Charter review process, and the Leaders' Declaration on the Mining Industry Commitment to Save Jobs. This review demonstrated valuable progress in meeting both the letter and the spirit of these initiatives and showed commitment to contributing to the growth and stability of the industry and country (IMP 2016-1).

2.3 Department of Mineral Resources

2.3.1 Section 54 stoppages

In 2007 the Department of Minerals and Energy (DME) issued 16 section 54 orders, in terms of Section 54a of the Mine Health and Safety Act (MHSA), concerning non-compliance with regulations regarding product health and safety to Impala Rustenburg as shown in Figure 1. All of these issues were resolved to the satisfaction of the DME (IMP 2007).

In 2008 14 Section 54 instructions were issued by the Department of Mineral Resources (DMR) at Impala Rustenburg resulting in 26 days of lost production at various shafts, and two instructions at Marula resulting in the loss of six days of production (IMP 2008).

In 2009 the DMR imposed 46 instructions for the cessation of sections of operations, which resulted in the loss of 126 days of production at Impala

Rustenburg and six days at Marula. Implats' operations engaged proactively with the DMR on these closures and rapidly addressed issues raised by the DMR.

A Section 55 instruction was given to Impala's Rustenburg operations in February 2009 as, in the opinion of the DMR, insufficient progress had been made with the rockdrill silencing programme. This programme was subsequently accelerated so as to address the DMR's concern (IMP 2009).

In 2010 the DMR imposed a number of instructions for the cessation of sections of operations, or entire operations as a result of safety-related issues and particularly after fatal incidents, which resulted in the loss of 187 days of production. The various operations continued to engage proactively with the DMR on these closures and rapidly addressed issues raised (IMP 2010).

In 2011 a total of 58 section 54 instructions were issued stopping work at sections of or all of operations, resulting in the loss of approximately 158 days of lost production at Impala's Rustenburg operations and 17 days of production at Marula due to shaft closures. It was recognised that that these actions were relevant and necessary to improve safety and health across the industry (IMP 2011).

In 2012 a total of 131 Section 54 stoppage instructions were issued at Rustenburg and Marula, resulting in a combined 292 days of lost production. The DMR adopted a more aggressive approach to dealing with serious safety incidents and fatalities in the mining sector in response to what they perceived as the mining sector's failure to take their obligations more seriously to provide safe working environment for their employees and contractors.

The company was supportive of Section 54's issued and was pleased that the DMR implemented a risk-based assessment for determining the scope and duration of these Section 54's. The combined effects of the Section 54 stoppages and industrial action on total output were dramatic with the company achieving a mine-to-market production of, a 13% reduction on the previous year.

The incidence and duration of Section 54 safety notices in 2012 revealed a distinct disjoint between management's perceptions of what constituted effective safety interventions and performance and the perceptions of officials of the DMR. The Section 54 stoppages and the illegal industrial action reduced the ability to manage the relationships with two key stakeholders.

The company was resolute in its efforts to improve the safety of the workforce and the Board articulated to management its unwavering belief that 'Zero Harm' was attainable in a mining operation. The result achieved was not commensurate with the effort applied and the company should be doing a lot better than it was doing. It was clear from the public utterances that the Minister of Mineral Resources and the DMR did not perceive the commitment and effort as reflective of a company that took seriously its obligation to provide a safe working environment (IMP 2012).

In 2013 a total of 65 Section 54 stoppage instructions were issued in 2013 resulting in approximately 261 days of lost production at the Rustenburg operations, and 21 days at Marula. The company continued to engage actively with the authorities on these stoppage instructions, including challenging them legally where it was deemed necessary. Implats supported all safety work stoppages where its condition or behaviour has been identified that posed a direct danger to safety.

Extending these stoppages beyond the scope of the risk was problematic. In certain instances, a stoppage had a negative impact on safety performance. Although the absolute number of instructions decreased this year, the duration of stoppages increased. The company was given two fines from the DMR relating to stoppage instructions and subsequently requested a formal review of these fines (IMP 2013).

In 2014 a total of 52 stoppage instructions were issued by the DMR, which resulted in the relevant shaft being closed for a period resulting in a loss of approximately 205 days of production at the Rustenburg operations, and 29 days at Marula. The company continued to engage actively with the authorities on

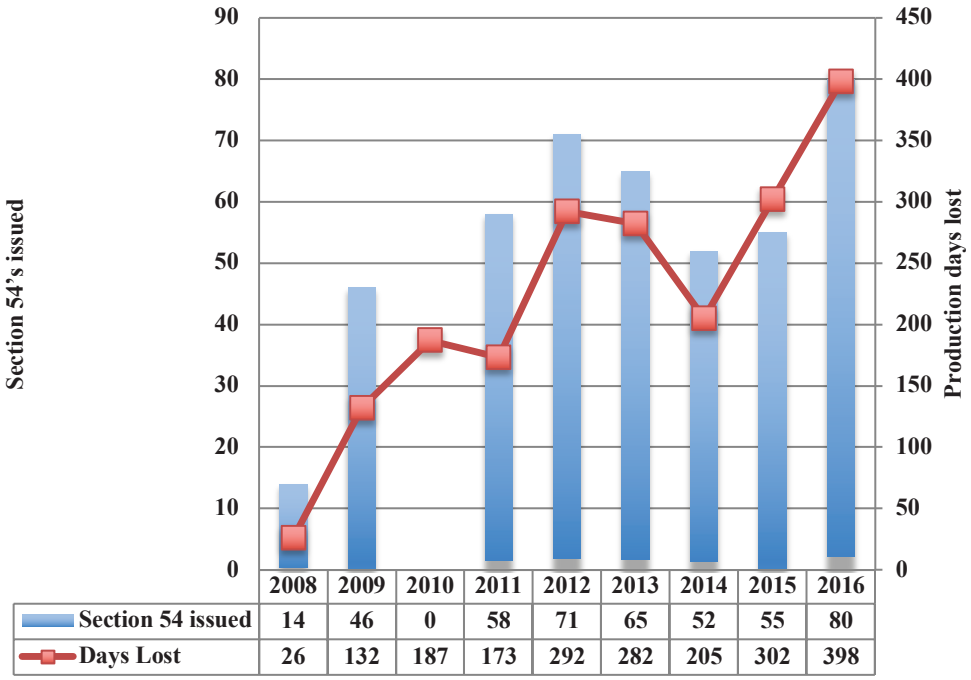
these stoppage instructions, including legal challenges. While Implats support all safety work stoppages where its condition or behaviour was identified that posed a direct danger to safety, extending these stoppages beyond the scope of the risk was problematic and in certain instances may have had a negative impact on safety performance (IMP 2014).

In 2015 a total of 55 Section 54 stoppage instructions were issued in 2015 resulting in the relevant shaft being closed for a period. The shafts collectively lost approximately 260 shaft days of production at Impala Rustenburg, and 42 days at Marula. Implats supported all work stoppages where there was a direct danger to the safety or health of the employees. However, the somewhat reckless issuing of section 54 stoppages that were extended beyond the scope of the risk was problematic and severely compromised the sustainability of profitable mining in the country. It was essential for the mining sector to provide employment that the country badly needed.

The Group continued to actively engage the DMR to highlight the impact of these stoppages on both safety and productivity/profitability, especially in an environment where Implats remained totally committed to ‘Zero Harm’ and the need to preserve jobs in this current cyclical downturn. Where it was felt this to be unjustified the company challenged the authorities legally. Implats supported all safety work stoppages where its condition or behaviour was identified as posing a direct danger to safety. However, in certain instances the stoppages had a negative impact on safety performance.

In February 2015 the Implats’ CEO joined other platinum group CEOs in a meeting with the DMR Minister to highlight the negative impact that unjustified work stoppages were having on productivity and profitability. While it was made clear that none of the CEOs were opposed to Section 54 notices, they expressed concern with cases where inspectors were stopping shafts for administrative issues and noted also instances of insufficient training of DMR inspectors (IMP 2015).

In 2016 a total of 80 Section 54 stoppage instructions were issued resulting in collectively loosing approximately 398 shaft-days of production across Implats. The company supported all safety work stoppages where there was a direct danger to safety and continued to engage actively with the authorities on these stoppage instructions as shown in Figure 1 (IMP 2016).



	2008	2009	2010	2011	2012	2013	2014	2015	2016
Section 54 issued	14	46	0	58	71	65	52	55	80
Days Lost	26	132	187	173	292	282	205	302	398

Figure 1 DMR Section 54 notices issued *(2010 Section 54's issued was not disclosed)* (IMP 2008-2106).

2.3.2 PRESIDENTIAL AUDIT

In 2008 the Presidential Safety Audits took place at Implats. The company welcomed any initiative, which served to improve safety performance and that of the mining industry. It was believed that by uniting forces of companies, the unions and government the required progress could be made. The outcome of the audits were used to develop the programmes and processes that would take industry forward as it collectively strived to improve safety. There was no room for finger pointing from any side as incidents and unsafe conditions were the collective risks, and all were equally part of the solution towards the common goal (IMP 2008).

2.3.3 Framework Agreement for Peace and Stability in the Mining Industry

The company continued to advance initiatives under the Deputy President's Framework Agreement for Peace and Stability in the Mining Industry signed by stakeholders in February 2013. These initiatives reflected Implats's commitment to the future growth and stability of the industry and included legislative issues, taxation and social and labour challenges (IMP 2013).

2.3.4 Department of Mineral Resources mining, minerals and development board

In 2009 Implats actively participated in external initiatives related to its industry. The company served on the government task team reviewing the mining charter in 2009 and contributed to policy development. Implats was involved in the sustainable development committee of the mining, minerals and development board of the DMR in providing input to the department's strategic focus on sustainability issues (IMP 2009).

2.3.5 Mine Health and Safety Act

In 2009 the amendments to the Mine Health and Safety Act of 1996 (MHSA) had far-reaching implications for safety and health management and, in particular, for the accountability of management for incidents. Additional measures and systems were put in place to ensure alignment with the requirements of the amendments (IMP 2009).

2.4 International Council on Mining and Metals

Implats was not a member of the International Council on Mining and Metals (ICMM). In 2016 Implats reviewed material unwanted events and were following ICMM practice guidelines to develop a critical control management system to ensure line management focuses on the controls aimed at preventing these events (IMP 2016).

2.5 OTHER ASSOCIATIONS

Implats aligned itself to reporting according to:

- In 2006 Implats committed to incremental reporting in terms of the Global Reporting Initiative Framework and Principles (IMP 2006);
- In 2008 Implats became a signatory to the United Nations Global Compact Principles (IMP 2008), and
- In 2013 Implats addressed security issues by implementing the Voluntary Principles on Security and Human Rights, following the 2012 events at Marikana (IMP 2013).

3 INSTITUTIONALISE 'ZERO HARM' AS A BUSINESS IMPERATIVE

3.1 IMPLATS' VISION

In 2006 Implats' vision was to be the world's best platinum producing company, delivering superior returns to shareholders relative to its peers (IMP 2006).

3.1.1 IMPLATS' CODE OF VALUES

The group adopted a code of values governing the manner in which it did business with its stakeholders and, in particular, covering business integrity and development, and safety of employees. The process whereby employees committed themselves to these values resulted in the development of the principles of that code into a 'value statement', which interpreted those values in a practical and easily understandable form. All employees and directors were required to adhere to the ethical standards contained in this code.

Between 2006 and 2012 the Implats values were:

- Safeguarding the health and safety of the employees and caring for the environment in which the company operate;
- Acting with integrity and openness in all that was done and fostering a workplace in which honest and open communication thrives;
- Being a responsible employer, developing people to the best of their abilities and fostering a culture of mutual respect amongst employees;
- Promoting and rewarding teamwork, innovation, continuous improvement and the application of best practice;
- Being accountable and responsible for all actions as a company and as individuals;
- Improving the company performance continuously and creating sustainable value, and
- Being a good corporate citizen to the communities in which employees live and work (IMP 2006-2012)

In 2013 Implats updated the company values, which included:

We respect all our stakeholders, including: Shareholders; Employees and their representative bodies; Communities within which we operate; Regulatory bodies; Suppliers and customers; Directors and management; All other interested and affected parties; The principles of the UN Global Compact; The laws of the countries within which we operate; company policies and procedures; Our place and way of work; Open and honest communication; Diversity of all our stakeholders, Risk management and continuous improvement philosophies.

We care for: The health and safety of all our stakeholders; The preservation of natural resources; The environment in which we operate, and the socio-economic well-being of the communities within which we operate.

We strive to deliver: A safe, productive and conducive working environment; A fair working environment through equitable and competitive human capital practices; On the development of our employees; Positive returns to our stakeholders through an operational excellence model; On our commitments to all stakeholders; On our capital projects, and quality products that meet or exceed our customers' expectations (IMP 2013).

3.2 SUSTAINABLE DEVELOPMENT POLICY STATEMENT

In 2009 a number of Policy Statements were revised, and new policies drawn up line with the group's revised approach to sustainable development and taking into consideration new commitments made by the group. The group adopted an overall Sustainable Development Policy Statement, which has drawn on international good practice including the principles of the ICMM and in compliance with legislation (IMP 2009).

3.3 OCCUPATIONAL HEALTH AND SAFETY POLICY STATEMENT

In 2012 the Implats group had site-specific HSE policies, procedures and standards which aimed to ensure that the activities complied with legislative requirements. The updated HSE Policy read as follows:

"Implats is a PGE-focused mining company that strives towards world-class health and safety performance. The company aims to prevent all incidents and

accidents at its operations in a reasonably practicable manner and strives to minimise hazards inherent in the working environment. The company is committed to safeguarding the health and safety of all our stakeholders and striving for 'Zero Harm'. Implats was committed to:

- Continually improving occupational health and safety performance through the setting and achievement of goals and taking into account evolving stakeholder expectations, best practices, scientific knowledge and new technology;
- Providing a working environment that is conducive to good health and safety;
- Managing risks in the workplace and ensuring that there is adequate surveillance of workplaces and employees;
- Complying with applicable legal requirements and with other requirements to which the organisation subscribes. In the absence of relevant occupational health and safety laws the company will apply best practice standards and procedures;
- Ensuring that appropriate resources, training and personal protective equipment are provided to improve occupational health and safety;
- Ensuring that employees and contractors have the relevant skills to perform work-related tasks in a safe manner and that they are aware of their individual health and safety obligations and rights;
- Following a consultative, transparent and constructive approach in interactions with stakeholders, and
- Employees and contractors working on Implats operations play a fundamental role in achieving occupational health and safety objectives through: Taking ownership of, and participating in, occupational health and safety management programmes and initiatives and complying with standards and procedures; Exercising their right to work in a healthy and safe environment and their duty to withdraw from an unhealthy or dangerous situation (www.implats.co.za, accessed 22 June 2017)

3.4 GOVERNANCE

3.4.1 AUDIT AND RISK COMMITTEE

The Audit and Risk Committee was chaired by an independent non-executive director, which oversaw Group risk, issues and assessed the recommended mitigation measures and actions.

The board had ultimate responsibility for establishing a framework for internal controls designed to effectively provide reasonable assurance against material loss, including appropriate risk management and good corporate governance frameworks and systems. Implats established key controls that focused on critical risk areas identified by line management, facilitated by risk management and assessed and evaluated by the internal auditors. The controls were designed to provide a cost-effective assurance that the company's assets were safeguarded and that liabilities and working capital were efficiently managed. The established organisational policies, procedures, standards, guidelines, structures and delegation frameworks clearly defined and provided appropriate levels of direction, accountability and segregation of responsibility which facilitate self-checking and monitoring mechanisms.

The internal audit team was responsible for independent objective assurance focused on the systems of internal control that resulted in better risk management and good governance as well as achievement of set business objectives (IMP 2009).

In 2010 Implats implemented a group-wide non-financial reporting system after the development of consolidated group-wide reporting principles and definitions. The company had a greater acceptance and understanding of sustainability management and reporting, resulting in a significant decline (90%) in high-risk findings. The reporting of non-financial risk issues was elevated to the Group Audit and Risk Committee for oversight and the involvement of internal audit in the assurance process (IMP 2010).

In 2011 two new members were appointed of the Audit and Risk Committee. The Committee comprised of independent non-executive directors only. The Chief Executive Officer, Chief Financial Officer, the Head of Group Internal Audit and the external auditor attend meetings of the Committee by invitation only (IMP 2011).

3.4.2 Safety, Health and Environmental Audit Committee

A board appointed Safety, Health and Environmental (SHE) Audit Committee was in place since 1988. The HSE committee, chaired by an independent non-executive director, guided strategy, assessed the adequacy and appropriateness of HSE policies, standards and procedures, and reviewed Group-wide performance on a quarterly basis. The committee also investigated and reviewed all major incidences and fatalities that occurred.

In 2006 the role of the Safety, Health and Environmental (SHE) Audit Committee were to monitor and review health, safety and environmental performance and standards. The SHE Audit Committee supplemented and gave support, advice and guidance on the effectiveness or otherwise of management's efforts in the areas of safety, health and the environment. The committee, which met at least once a quarter, consisted of three independent directors, one executive and a consultant. The Chairman was an independent non-executive director. The committee meetings were held alternately at operations, coinciding with visits to sites of SHE importance / relevance or at Implats' head office.

At all meetings, Implats' overall performance in all areas of safety, health and the environment were critically appraised. Internal Audit regularly reviewed reporting systems to ensure that accidents and injuries sustained by employees/contractors were reported timeously and effectively. Issues relating to safety, health, environment, and HIV/AIDS were considered by operation based management and the Executive Committee (IMP 2006).

In 2007 Implats revised the terms of reference in that the committee comprised of four Implats directors, of which three were non-executive directors, the chief executive officer and an external consultant (IMP 2007).

In 2011 safety and health enjoyed significant Board, executive and operational guidance and support (IMP 2011).

In 2012 the South African mining industry made the management of health, safety and the environment (HSE) a key strategic objective and as such the HSE Committee supported the Board. Through formal terms of reference, the Board mandated the HSE Committee to monitor and review the Group's health, safety and environmental standards. The responsibilities of the Committee in terms of its terms of reference included:

- Reviewing the adequacy and appropriateness of the safety, health, environmental and quality systems, policies, standards, codes of practice and procedures of the Group;
- Monitoring HSE performance in accordance with stated goals and objectives, including measurement against South African and international norms and benchmarks;
- Monitoring the HSE management function and recommending improvements where considered necessary;
- Reviewing the HSE element of the company's business plan and approving the HSE section of the Integrated Annual Report, and
- Having the right to institute investigations into matters where inadequacies have been identified, or as directed by the Board (IMP 2012).

In 2013 the HSE committee, guided strategy, assessed the adequacy and appropriateness of the Group and site-specific HSE policies, procedures and that standards were in place to ensure that the company complied with legislative requirements and supported the vision of 'Zero Harm' (IMP 2013).

3.4.3 SUSTAINABLE DEVELOPMENT COMMITTEE

In 2009 the Sustainable Development Committee was charged with overseeing the overall performance of the Group's key non-financial indicators and supporting Board committees, such as the SHEQ, Transformation and Audit and Risk Committees. The performance was reviewed through the Executive Committee, in line with the strategies employed. The Committee also advised the Board committees which, in turn, provided oversight and gave input to the review of strategic imperatives to ensure relevance in the pursuit of organisational objectives (IMP 2009).

Managing sustainability did not take place in isolation but was influenced by and considered the primary stakeholders in the business. This included unions, which were represented in the management structures of operational committees and had set agreements in place. The committee continued to ensure the implementation of strategic performance objectives (IMP 2011). In 2011 Implats were committed to:

- Developing policies in line with agreed principles, supported by sound systems and processes;
- Complying with the governance of risk principles included in the King III Report;
- Recognising that risk management is a systematic way of protecting business resources and income against losses such that strategic and operational objectives can be achieved;
- Preventing all incidents and accidents at its operations in a reasonably practicable manner and strives to minimise hazards inherent in the working environment;
- Safeguarding the health and safety of all stakeholders and striving for 'Zero Harm';
- Responsible stewardship of natural resources and the ecological environment;
- Striving to minimise potential negative social impacts while promoting opportunities and benefits for host communities;

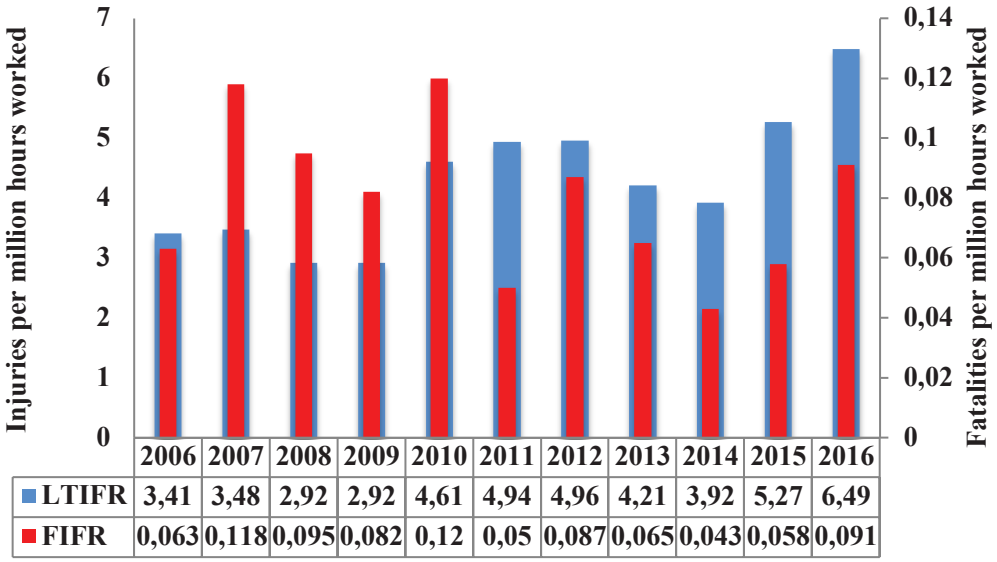
- Upholding the human rights of employees and communities in line with legislation and the United Nations Global Compact.
- Engaging with stakeholders in a transparent and timely manner through formal and informal engagement structures;
- Continuous improvement of its business processes by accurately measuring, monitoring, evaluating and reporting in a transparent manner to stakeholders on performance, and
- Sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs

In 2015 sustainable development issues were addressed at board level, through the Social, Ethics and Transformation (SET) committee, established in 2004 and restructured in 2012. The SET committee, was chaired by an independent non-executive director, was responsible for the Group's activities relating to social and economic development, good corporate citizenship, the environment, health and public safety, consumer relationships, and labour and employment issues. The sustainable development issues were informed by the following principal objectives:

- Identify material sustainability issues and risks that have an impact on the business and devise appropriate strategic responses to these risks;
- Align strategic interventions to global best practice, the national and industry agenda concerning sustainable development such as the South African National Development Plan and the Framework Agreement for a Sustainable Mining Industry;
- Ensure compliance to relevant regulatory statutes in countries of operation such as South Africa's Mining Charter and Broad-Based Black Economic Empowerment Act, and
- Ensure that the organisation maintains its social licence to operate in host countries by advancing social transformation and upliftment in affected communities (IMP 2015).

3.5 INTERNAL SAFETY ADVOCACY

In 2007 the safety performance with both the lost-time injury and fatality frequency rates deteriorated. The company experienced a deterioration in the number of fatalities which increased for the first time in five years as is shown in Figure 2 (IMP 2007-2016).



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
LTIFR	3,41	3,48	2,92	2,92	4,61	4,94	4,96	4,21	3,92	5,27	6,49
FIFR	0,063	0,118	0,095	0,082	0,12	0,05	0,087	0,065	0,043	0,058	0,091

Figure 2 Injury rates, 2006-2016 (IMP 2006-2016).

The Board reconfirmed the commitment to safety and a safer work environment at Implats and to a policy of 'Zero Harm' in the longer term and was pursuing this challenge with vigour. The group targeted a first milestone to work for 12 consecutive months without a lost time injury by 2012. Such an objective was achievable as was demonstrated by the safety performance at the Refineries, at Zimplats and at various individual shafts at Impala Rustenburg. Refineries did not a fatal accident for the previous 11 years and Zimplats since 2005.

The company pursued technical and internal investigations to uncover fundamental problems with the way work was conducted, systems in place, or with the people both managing and working at the operation. It indicated that the

company had lost its way in engaging with and motivating people. Inevitably, organisational change interventions had a finite life and had to be re-energised (IMP 2007).

In 2008 the company committed to stop incidents leading to injuries in the workplace, which remained at the forefront of the company's efforts. The board and management team pledged that the company would not relax on safety until the target of 'Zero Harm' was met. The safety of all employees while on duty was a key strategic objective. The group safety policy was based on the key resolutions adopted at the group safety summit held in February 2006. It entrenched the firm belief that mining, and underground mining in particular, could be undertaken without causing injury and harm.

The CEO spent a great deal of time and effort in engaging with management, employees and unions. It was concluded that the safety procedures and policies in place were of a high standard but the company needed to ensure that these were implemented and did not simply remain on paper. All Implats' operations aligned their operational safety strategies and plans with those of the group.

The company believed that the various safety measures implemented at Implats took effect and during the past year as the fatality rate improved by 19% and the lost-time injury frequency rate dropped to below 3 injuries per million hours for the first time ever (IMP 2008).

In 2009 Implats experienced poor safety performance in terms of what was expected and what was believed to be achievable. Eleven of employees lost their lives in work-related incidents as shown in Figure 2 and 3. This level of fatalities represented only a marginal improvement from the previous year. It was disappointing for the company in view of the considerable efforts that were made to eliminate incidents of this nature. Lost-time incidents were maintained at similar levels in relation to the previous year and the company was still a long way off from achieving the paradigm shift that was pursued.

Safety remained the highest priority for Implats, and the company was committed to achieving the vision of ‘Zero Harm’. It was of great concern to the company that safety performance was well below the targets set. The objective of ‘Zero Harm’ by 2012 would be in jeopardy if the uninspiring performance continued, but the resolve to achieve it was greater than ever. However, it was believed that mining could take place without incident. Measures that contributed to safety improvements in previous years were continuing, and new initiatives were implemented to further develop safety awareness and to push safety to the next level of performance.

An improvement in safety performance was required in order to realise the vision of being the world’s best platinum-producing company. The achievement of ‘Zero Harm’ remained the vision for the group. ‘Zero Harm’meant no occupational accidents or illnesses as well as the promotion of employee wellbeing. There were times when this seemed unobtainable, but it was the collective duty as employees, unions and government to work as a team to make this vision a reality (IMP 2009).

In 2010 the company’s vision was working safely with ‘Zero Harm’ and the safety of employees remained the key priority. The company’s intent to create safe working environments remained the focus of the commitment to ‘Zero Harm’in the longer term and it was believed that this would be achieved, with the commitment from every one of the Implats team. The company recognised and embraced the positive inputs from other stakeholders. The calibre of people and their ability to stay focused throughout these difficulties saw Implats emerge as a stronger and more united team, committed to working together with pride. It was only through behaviour and the way work was done that it was demonstrated to team members the importance of safety and following the correct procedure at all times.

Caring for one another and setting the right example to follow, would ensure the safety and wellbeing of the team members and to make Implats a safer place to work. The company’s goal was zero lost-time injuries by 2012. It was

acknowledged that this was an ambitious target, but it was proven possible across the Group, most notably in some of the high-risk underground shafts (IMP 2010).

In 2011 Implats systematically addressed the safety, health and environmental issues at all stages of the product life cycle. The company had specific measures in place to protect the health and safety of those using or delivering Implats products. Procedures for assessing product health and safety were addressed during conceptual development, research and development, product certification, manufacturing and production, marketing and promotion, storage, distribution and supply, use and disposal, or recycling.

The safety performance of the Group remained a disappointment to the Board. The Board believed that all accidents were preventable, and the Board reinforced its stance to management on achieving a 'Zero Harm' workplace. The company could not claim true success until fatalities and other injuries in the working environment were eliminated.

The company stepped up its efforts to change safety behaviour at its operations and the safety strategy focused on closing the supervision gap by focusing on leadership training, changing the Group's safety culture by focusing on behaviour observation, reward and communication as well as zero tolerance for non-compliance to safety rules. Ensuring the health of all employees augmented the strategy and promoting their overall wellbeing as well as addressing the critical skills gap within certain levels of the workforce (IMP 2011).

In 2012 Implats was nowhere near meeting its target of zero lost time injury set in 2007 to be met by 2013 and was unlikely to meet the 2013 safety targets agreed with the DMR (0.03 fatal injuries per million hours worked) in 2003. This ongoing failure to perform on safety was a source of deep regret and the utmost concern to management and the Board. The safety performance demonstrated that Implats had not been able to achieve the level of operational discipline and compliance needed across the Group to meet the safety targets. This was further compounded by the breakdown in the relationship of trust with the employees that management was working hard to foster.

It was believed that companies get the safety performance they demonstrated what they were prepared to accept. Implats was not prepared to accept anything less than ‘Zero Harm’ which required that all employees needed to visibly live this commitment every day. The CEO was satisfied that Implats had the right strategy in place which made the operations safer.

The Implats Board continued to question management about the application of the safety strategy, as safety was not considered a cost but an imperative and a key to the licence to operate. The commitment to safety over production was evidenced by the voluntary safety stoppages that were undertaken and the initiatives aimed at reducing fall-of-ground incidents. Implats did not tolerate injuries and deaths and ‘Zero Harm’ was the only morally defensible objective of any employer (IMP 2012).

In 2013 Implats’ view was that safety and health was an absolute imperative and the Group would continue to drive all of the associated initiatives with conviction (IMP 2013).

In 2014 the Impala Rustenburg team delivered on their safety, health and production plans, but performance was negatively affected by the protracted wage strike. Implats reconfirmed that the health and safety of employees was an absolute imperative and would continue to drive all of the associated safety initiatives with energy. The company continued to strive for zero fatalities and ‘Zero Harm’.

The Chief Executive Officer’s influence was felt in numerous ways, including in particular through his strong and visible commitment to safety and operational issues, and his determination to change the culture in the business and promote a culture of trust, respect and care throughout the company. The board appreciated the leadership and integrity that the CEO provided during the very difficult and protracted strike. Transparent communication was the trademark of the CEO and was highly valued by the board. The board was confident that the company would successfully weather the difficult times that were experienced and continue to generate value for all stakeholders (IMP 2014).

In 2015 Implats' safety strategy was based on achieving 'Zero Harm' and specifically demanded safe behaviour, an inherently safe work environment and leading safety practices. Implats remained committed to achieving 'Zero Harm' across all operations (IMP 2015).

In 2016 Implats experienced its lowest ever 12-month moving average fatal-injury frequency rate. The South African operations reported zero fatal incidents for a nine-month period, which was marred by 11 fatalities subsequently. The board and management would not rest until every workplace was free of all serious and fatal accidents.

Implats understood that the realisation of the safety objectives would only materialise as a result of a sustained and ongoing effort. Health and safety remained priorities and involved every person in the organisation, the leadership of representative employee bodies, and government. The company remained resolute to see a further step change in the safety performance and ultimately achieve the goal of zero fatalities. The company recognised that ensuring the safety and health of employees, contractors and suppliers was essential the company were to respect their most fundamental rights. Good progress was made in advancing safety improvements across all the pillars of the safety strategy which included person and behaviour; safety practices and the safety environment; new technology and engineering solutions, and systems. The Implats view was that with such a large workforce it was in the business of people and not only in the business of mining (IMP 2016).

3.6 THE APPROACH TO SUSTAINABILITY

In 2009 a new Sustainable Development Policy Statement was developed and the group's safety and health policy statement were revised during the year. A change in the group structure had a significant impact on the way in which aspects relating to sustainable development and, in particular stakeholder engagement and socio-economic development, were managed, and integrated within the functioning of the business. Sustainable development did not take place in

isolation as the primary stakeholders influenced it in the business, which included communities, employees, shareholders, business partners and government.

Group sustainable development champions were appointed to key identified areas and made up the group's Sustainable Development Forum. Specialists on sustainable development policy, reporting and stakeholder engagement advised these champions. The Group's Sustainable Development Manager developed and advised on group policy, targets and strategy and reviews performance. Matters dealt with by the Forum were escalated through these structures to the SHEQ Audit Committee and the Transformation Committee, and where necessary to the Board Nomination, Audit and Remuneration Committees.

Operations-based Transformation Committees, Stakeholder and Sustainable Development Committees, Safety, Health and Environment Committees and Union Branch Committees supported the Forum at an operational level. The Forum was responsible to deliver on key sustainable development principles; ensure effective governance, and execution within the sustainable development arena (IMP 2009).

In 2010 there was a clearer appreciation of the role Implats played at different levels in society, including local, national and international, based on the manner in which business was conducted. The company embraced long-term sustainability and the concept of sustainable development, as it became vital aspects of the business. It was an area that became more complex and more regulated over time. The company had a holistic approach to measuring its performance and reporting on the triple bottom line.

Implats was a long-term business, and this determined actions. The business was part of the greater environment and the company's actions were shaped by national and international trends in sustainable development. Sustainability was the cornerstone of every one of the company values and part of the Board's mandate. It directed continued, cost-effective growth; underpinned the approach to attracting, retaining and developing people, and it guided actions in preserving the environment.

In a regulated industry, compliance was always the baseline. By integrating sustainable development into the business strategy, the company steadily moved beyond a reactive, compliance-driven approach to an integrated and holistic view, governed by the same rigorous disciplines that guided the other business processes. The operating framework enabled each of the Implats entities to stay close to their stakeholders within the framework of a group wide approach to managing sustainability, the triple bottom line of economic, social and environmental aspects (IMP 2010).

In 2011 the company recognised the significant impacts it had on the communities in which it operated in order for Implats to retain both its social and its legal licence to operate. The company had to respond to the concerns of these stakeholders, adhere to all legal requirements and conduct the business in a manner that mitigated risk and avoided harm to the stakeholders.

A culture of sustainable practice was critical to the future success of the business. It was believed that there was a fundamental link between sustainable business practice, ethics, governance and the creation of long-term shareholder value. Sustained financial success ultimately related to the integration of all these aspects. Safeguarding the success of the business required the company to not only show achievement on the short-term performance measures but to focus on identifying, influencing and overcoming strategic challenges, which were likely to impact the business over the long term. Never before had the imperative for sustainability been more important. Implats was committed to running the operations in a responsible and sustainable manner such that the business and investments were economically sound and financially profitable; the business practices were technically appropriate and socially responsible, and the business processes were inherently safe and environmentally sound.

The Sustainable Development department undertook the assessment and the Executive Committee gave final approval for it to be undertaken and endorsed its findings. The process assisted in consolidating a Group approach to stakeholders that took into account identified gaps that needed to be addressed (IMP 2011).

In 2012 the safety and health of employees, contractors and suppliers was a fundamental human right and integral to the licence to operate. In order for the company to create sustainable value for shareholders and society it was needed for employees to be motivated and equipped with the requisite skills. It required a work environment which was informed by mutual trust and respect.

The company vision was to be the world's best platinum-producing company, delivering superior returns to the stakeholders relative to the peers. The Board and management were of one mind in believing that cost considerations should at no stage impede the journey towards achieving 'Zero Harm'. Going forward, the market should expect less production rather than more as the company grappled with being safe first (IMP 2012).

In 2014 a survey was conducted among employees to assess their perceptions of the current Implats culture as a part of the change management initiative. It offered an opportunity for employees to provide input into the culture they desired. The results of the survey indicated that there were issues that required further cultural or structural transformation and leadership development. Most of the issues related to health, the viability of the business, and the nature of the interpersonal connections experienced at work. This initiative progressed during 2016 with focus groups at all operations to better understand these issues and to develop appropriate response programmes (IMP 2014).

In 2015 sustainable development fell under the responsibility of the executive committee, which was responsible for reviewing performance in terms of the Group's non-financial indicators. Implats continued to embrace the principles of sustainable development, which focused on responsible citizenship in the process of creating value for employees, shareholders and the communities in which it operated. The company gave due regard to the environment, its social responsibility and adhered firmly to the interests of all stakeholders, which included the consistent communication of sustainable development performance. The value proposition and vision were to deliver timeously, credible, accurate, reliable information based on Group-wide aligned policies, definitions, and procedures (IMP 2015).

In 2016 the challenges that Implats, the mining sector and the region faced during the year reaffirmed that socially responsible behaviour and the pursuit of sustainable development were competitive imperatives for companies and should be recognised as fundamental elements of a company's fiduciary responsibility (IMP 2016).

3.7 THE APPROACH TO SAFETY

In 2006 a safety leadership summit was held to get group-wide commitment to a policy of 'Zero Harm'. A new safety target was set of an lost time injury frequency rate of zero at Impala within five years. It was envisaged that the plateau reached in terms of constant improvements would be breached and that the renewed efforts would continue to drive the company towards the long-term goal of zero injuries. The need for ever-increasing vigilance regarding safety became paramount as mining operations at Impala deepened with the move to third generation shafts where more difficult ground conditions being encountered.

Implats improved the understanding of rock engineering and support systems in order to reduce injuries caused by falls of ground. The company increased emphasis on behaviour-based safety training and the setting of more stringent targets (IMP 2006).

In 2007 it was of particular concern to the group that the significant progress made previously in safety performance was not maintained and the specific targets set for 2007 were not met. Intensive efforts were made to address safety performance, and these included the re-introduction of a strata control course to improve employees' knowledge of geological features (IMP 2007).

In 2008 it was a key strategic objective for Implats to achievement 'Zero Harm'. The group safety policy entrenched the belief that mining, and underground mining in particular, can be undertaken without causing injury and harm. The implementation of 'visible felt leadership' showed positive results in that supervisors and management ensured that safety was not compromised in any circumstances by taking responsibility for employee safety, leading by example, encouraged positive safety behaviour and discouraged negative behaviour. The

intolerance of non-conformance and non-compliance with Implats' safety standards and procedures, were incorporated in operation-specific Platinum Rules.

The company appointed an executive responsible for safety, health and environment at a group level who was responsible for goal setting, strategy development, performance management and reporting. Safety management was the responsibility of line management who was supported by specialist safety staff who assisted with the management and monitoring of safety issues. The involvement of employees and unions in safety issues was a key imperative of the company. An intermediate goal was set to achieve 12 consecutive months free of lost-time injuries by 2012 (IMP 2008).

In 2009 Implats changed the group's management structure to focus on four strategic imperatives of the business, namely:

- Operations, which included all existing mining, processing and refining operations of the group, as well as including the management of safety, health and the environment;
- Growth, which included marketing, new business and projects, exploration, mineral resource management, commercial ventures and business opportunities, and technical services;
- People, which included talent and reward management, employee relations, stakeholder engagements and sustainable development, and
- Finance, which included financial management, services, legal and secretarial.

This approach was developed to ensure that the appropriate level of focus and resources were targeted and available to ensure the achievement of distinct goals, and to enable the group to react swiftly and decisively to any changes in the external environment that could impact the company (IMP 2009).

In 2010 the safety strategy was refined as safety was identified as one of the sustainable development issues as most material in ensuring the sustainability of the business. It was incumbent on the to ensure a world-class safety environment

in order to realise the vision of becoming the world's best platinum-producing company. The safety performance had a direct impact on production performance and the overall business.

The DuPont safety review reflected that the Group needed to adjust its approach to safety, so as to recognise that it operated in a "dependency" culture and a more active and direct enforcement of adherence to the important platinum safety rules was needed. The safety culture of all employees needed to change for Implats to achieve its safety goal (IMP 2010).

In 2011 safety was the number one priority for the Group who remained committed to achieving 'Zero Harm' in the workplace. It was a key strategic objective for the Group to ensure the safety and health of the employees and promoting their overall wellbeing.

There were significant improvements in safety over the years, but it remained a key challenge for the mining industry. The industry as a whole had to do more in order to attain world-class standards and performance and better co-operation between industry, the unions and government would go a long way in achieving this. It was believed that this tripartite alliance would play a pivotal role in improving safety performance across the industry.

Several initiatives were undertaken during the year that resulted in a refocus of the safety strategy. The safety strategy continued to focus on leadership development with the aim of creating a culture of compliance and a belief that it was possible to mine without fatalities. The company continued to change the behaviour of employees by using the monitoring and measuring of lead indicators to enforce full compliance with rules and fostering a culture of zero tolerance for unsafe behaviour.

An integral part of the Group strategy to ensure long-term business sustainability involved a productive workforce. This was done by:

- Understanding the business requirements and strategic challenges;

- Have an effective attraction and skills retention mechanism, particularly of critical skills;
- Manage employee health effectively;
- Provide training and development at all levels particularly at leadership and critical skills level;
- Ensure that the reward and remuneration system was in line with market-related trends, and
- Provide career progression opportunities to employees.

The People strategy focused on:

- Improving employee wellness and technical core skills;
- Increasing expenditure on skills development;
- Improving employee literacy and education, and
- Retaining and developing high performers.

Following the 2011 DuPont assessment, the strategy was aimed at changing the safety culture and ensuring that the appropriate supervisory structures and skills were in place to encourage and support this objective (IMP 2011).

In 2012 the Group remained focused on a strategy to develop safe and effective people. It was to be achieved by promoting employee safety and health, creating and sustaining mutually beneficial relations with employees, attracting, retaining and developing talent and skills.

Policies and procedures on people management issues were established at corporate level and applied at the operations. This was done in order to ensure the continuous development of the employees, in line with business demands, while at the same time offering career progression opportunities with particular emphasis on the historically disadvantaged.

Each operation had a Transformation Committee made up of representatives drawn from management, employee unions, women and people with disabilities, as well as other stakeholder groupings that was engage with to advance

transformation at each operation. Future commitments for achieving safe and effective people included strong focus on cultural transformation for safety and closing the supervision gap.

A commitment to a culture of health and safety was the single most important factor and was central to the future of mine health and safety within the Group. A number of very significant, potentially very beneficial, new safety initiatives were implemented at a sector level and within Implats. It included the introduction of new policies and the development and implementation of a new cultural transformation framework.

The company strived to implement the outcomes of the 2011 DuPont safety intervention and foster an enhanced culture of safety, however the performance showed that much work remained. A 'Zero Harm' working environment could only be achieved if all parties involved in the production processes, including suppliers and contractors as well as the employees and management, bought into a shared safety culture and lived that culture every day. Other initiatives included:

- Implats planned to train 3 200 safety representatives by 2014 and further institutionalise the DuPont STOP process;
- It was planned to equip all underground employees with self-contained self-rescuers, which were purchased, for a full roll-out during 2014;
- The entire centralised blasting system was to be replaced over a two-year period as it offered much-improved levels of safety and reliability of the current blasting operations;
- The replacement of all of its conveyor belts with retardant conveyor belts was to be implemented in 2014, and
- A revised methane management plan and associated initiatives was developed to cater for increased flammable gas intersections being encountered on some of the deeper shafts at Impala (IMP 2012)

In 2013 the safety strategy focused on the develop a culture of safety within the organisation in order to achieve the vision of 'Zero Harm'. Safety received greater

executive focus under the new CEO and the Board approved a revised Occupational Health and Safety Policy.

The safety strategy was developed following external and internal reviews of the existing safety systems and culture, and an analysis of the root causes of fatal, reportable and lost-time incidents. It consisted of three main pillars, which included the cultural transformation framework, technical initiatives as well as effective supervision as shown in Figure 3.

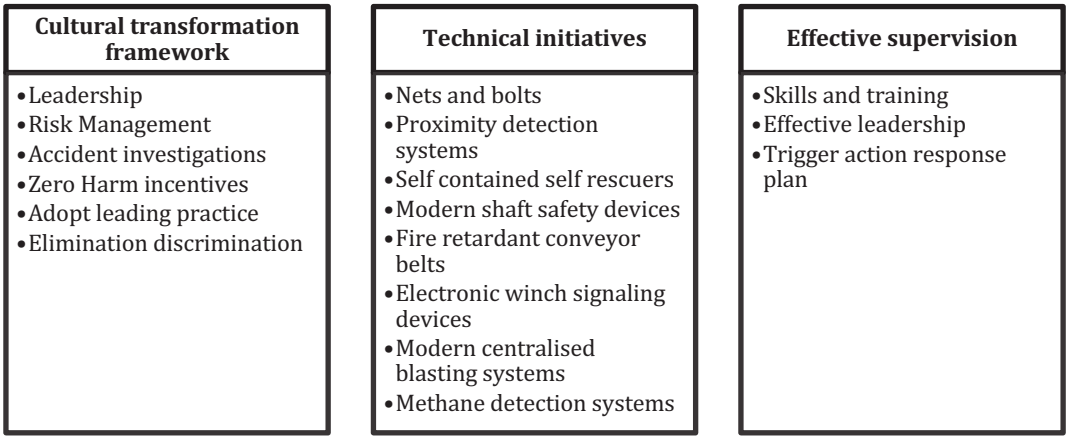


Figure 3 Safety strategy, 2013 model (IMP 2013-1).

The changing of the safety culture included implementing the MHSC cultural transformation framework, embedding the Mining Charter's health and safety commitments and actively participating and supporting the CEO's elimination of fatalities task team initiative.

The focus on effective supervision included the training miners, shift supervisors and mine overseers; normalising the industrial relations environment; implementing the Implats safe production rules as well as the Triggered Action Response Plan (TARP). The TARP formally elevated hazards up the supervisory chain and was developed and rolled out by the MOSH learning hub and corresponded with the Implats Falls of Ground (FOG) Major Hazard Management Plan.

The safety strategy technical focus included the installation of roof bolts and nets; fire retardant conveyor belts; self-contained self-rescuers; electronic winch

signalling devices; proximity detection systems (PDS) for trackless and track bound equipment; vertical shaft bank and station safety devices; locomotives speedometers; new winch return rigs and the development of a methane gas strategy.

The company intended to develop a fully integrated health, safety and risk management plan to increase risk awareness and mitigation at all levels in the organisation. Major hazard standards were to be assessed and an online hazard identification and rectification system was planned to be implemented utilising the IsoMetrix integrated management information system (IMP 2013).

In 2014 the safety strategy involved a number of initiatives, which included active participation in the industry CEO Elimination of Fatalities task team as well as the MOSH task teams. These task teams were focused on falls of ground, mobile machinery and dust in the workplace. Implats continued to build on changing the culture, improving supervision and adopting and implementing various technical initiatives, which aimed to improve workplace safety as shown in Figure 4.

A three-day safety summit was held in December 2014 for all Impala's mining and processing safety representatives. The summit was called following five fatal accidents that occurred shortly after the commencement of work following the five-month strike. Over 600 safety representatives attended the three-day summit, during which good progress was made. The four groupings of issues were further reviewed and included within a subsequent implementation plan on the following issues:

- Identified the critical safe behaviours for the top critical mining and processing risk occupations;
- Agreed to develop a system to formalise the 'Section 23' withdrawals by safety representatives;
- Introduced a 'Buddy Barring' system, involving the second-person observation of the barring process, and

- Highlighted the concern that safety representatives were not being adequately recognised or rewarded for their duties and responsibilities (IMP 2014)

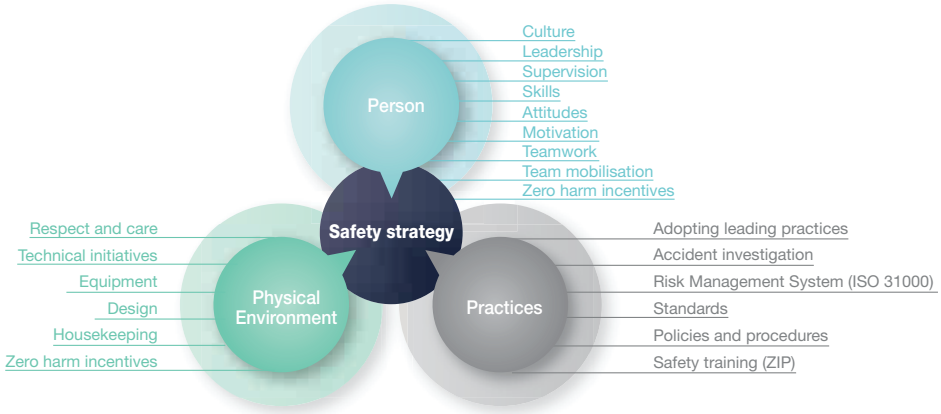


Figure 4 Safety strategy, 2014 model (IMP 2014).

In 2015 while encouraged by some of the significant improvements in the safety performance, the loss of life remained unacceptable. The improvements in safety performance was underpinned by the effective implementation of the safety recognition agreement with AMCU at Impala Rustenburg and Marula, which laid out the agreed responsibilities for management and union representatives on safety issues.

The CEO was determined to see a further step change in the safety performance and was fully committed to achieving the goal of zero fatalities. The Implats safety strategy involved a number of initiatives, which included active participation in the industry CEO Elimination of Fatalities task team as well as the MOSH task teams. These task teams were focused on: Falls of ground; Mobile machinery and dust in the workplace.

The safety strategy was built on changing the culture of the organisation, improving supervision, and adopting and implementing various technical initiatives to improve workplace safety. Implats continued to prioritise several strategic objectives and focus areas for safety.

The company continued to pursue interactions with senior union leadership to gain commitment for safety initiatives in order to normalise employee relations. It promoted the enhanced safety culture through leadership using the CTF. Implats used opportunities presented through the revised health and safety agreement with all employee representative groups to engage more effectively with employees in promoting the right safety culture. It also increased supervision and leadership skills and implement best practice technical initiatives in order to mitigate safety risks in the workplace.

The safety targets were to achieve zero fatalities across all of the operations; achieve at least a 20% improvement in their LTIFR performance in support of the MHSC safety milestones, and strive to achieve 100% compliance with road behaviour, platinum rules and disciplinary action for non-compliance to these rules. Implats continued to focus on ensuring that all operations had behaviour-based safety programmes in place to assist with the achievement of zero fatalities and 'Zero Harm' (IMP 2015).

In 2016 the strategy was informed by external and internal reviews of the safety systems and culture and by a continual analysis of the root causes of all fatal, reportable and lost-time incidents. The safety strategy strived to foster a culture of safety and achieve the vision of 'Zero Harm'. It was about ensuring that the company had the right skills, teamwork, intelligence, knowledge, motivation, attitudes and abilities to achieve 'Zero Harm'. Implats safety strategy was focused to promote a culture shift and mitigate safety risks in the workplace. The following key interventions were planned for 2017:

- Conduct a further 360-degree safety survey of all E level managers and further ZIP safety leadership self-assessments among D and E level leaders every six months;
- Enhance the Section 22/23 withdrawals process with formalised and systematic recording and reporting;

- Include in all injury investigations an analysis to determine whether any human failure factors were unintentional or intentional where applicable, enforce disciplinary action as required by the human failure guide;
- Continue to analyse data sets to identify employees at high risk of having a safety incident, monitor and seek to mitigate the level of risk;
- Enhance the knowledge and competence of the employees, included: providing special training for users of new equipment and communicating and providing training on a revised set of safe production rules;
- Entrench the critical safe behaviours that were rolled out to the five critical occupations, through safety representative and supervisory monitoring interventions;
- Develop critical controls to prevent any of the following unwanted events: conveyor fires, major fall-of-ground collapses, a tailings dam run out, methane explosion, and rolling stock falling down a shaft;
- Continue to implement best practice technical initiatives and assess new technological advances to determine their appropriateness, and
- Continue to pursue interactions with senior union leadership to gain commitment for safety initiatives.

The target was zero fatalities across all operations. Each operation was expected to achieve at least a 20% year-on-year improvement in their LTIFR performance in support of the MHSC safety milestones. The company aimed to certify all operations to the OHSAS 18001(ISO 45 001) standard by 2018 (IMP 2016).

4 SYSTEMISE ACTIVITIES

4.1 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT STANDARD

In 2007 the Group made significant progress towards the implementation of OHSAS 18001 Occupational Health and Safety Standard and aimed to introduce it is as the group safety management system by 2010. Mimosa achieved certification, while the Impala Refineries was on track to implement the system in 2008 (IMP 2007).

In 2011 the Implats safety management system was guided by OHSAS 18001. In 2015 a detailed gap analysis of the occupational health and safety systems at Impala was done to identify potential compliance gaps with OHSAS 18001. Implats planned to have full compliance with OHSAS 18001 within three years (IMP 2011).

In 2016 the safety and health business plan included a specific focus on addressing the findings of the gap analysis. However, it was decided that the OHSAS 18001 would be replaced with an ISO 45001 system by the end of 2016. Zimplats and Mimosa were OHSAS 18001 certified whereas Impala Rustenburg, Marula and Impala Springs aimed for ISO 45001 certification by 2018 (IMP 2016).

4.2 RISK MANAGEMENT

In 2006 the Board had ultimate responsibility for establishing a framework for internal controls designed to effectively provide reasonable assurance against material loss, including appropriate risk management and good corporate governance frameworks and systems. The established organisational policies, procedures, standards, guidelines, structures and delegation frameworks clearly defined and provided appropriate levels of direction, accountability and segregation of responsibility, which facilitated self-checking and monitoring mechanisms.

Implats established key controls that focused on critical risk areas identified by line management, facilitated by risk management and assessed and evaluated by

the internal auditors. The controls were designed to provide a cost-effective assurance that assets were safeguarded and that liabilities and working capital were efficiently managed (IMP 2006).

In 2007 the company remained confident of their ability to manage risk and to create a competitive advantage by meeting or exceeding legislative requirements. Risk awareness and mitigation were vital in ensuring sustainable returns. The group embraced six key strategies:

- Improving safety;
- Growing production and the resource base;
- Cost leadership;
- Capital efficiency and delivery;
- Maintaining a holistic contract with employees, and
- Managing the balance sheet.

The company increased the use of risk assessment and pre-task risk assessment as a tool in safety management. This was used particularly well at Zimplats where baseline and issue-based risk assessments were undertaken in all departments (IMP 2007).

In 2008 risk management and risk mitigation were embedded in the business, both in the management of current operations and in the evaluation of future opportunities. Some of the strategic risks identified included continuous improvement in safety, health and environmental performance towards the goal of ‘Zero Harm’. Other issues identified included organisational diversity, improved employee engagement, participation in all business activities, the attraction, development, retention and motivating the requisite management, operational, technical and business skills and pool of talent.

Other risks included retaining permission to operate and full legal and regulatory compliance in a continuously changing environment; addressing relevant issues regarding corporate responsibility; being recognised as a good corporate citizen in

the communities where the company operated as well as maintaining sound and mutually beneficial relationships with them and the general public (IMP 2008).

In 2010 the risk processes identified that in order to realise the vision of becoming the world's best platinum-producing company, it was required to ensure a world-class safety environment. Safety performance has a direct impact on production performance and the overall business. A DuPont safety review reflected that the Group needed to adjust its approach to safety, so as to recognise that the company operated in a "dependency" culture and a more active and direct enforcement of adherence to the important platinum safety rules was needed. The review showed that the safety culture needed to change in order to achieve the safety goal. Supervisory staff should be seen as safety leaders who not only lived by the standards but enforced the standards as well.

The risk assessment process included the understanding of the context, identifying the risk, analysing the risk, evaluating its impact and implementing mitigation plans. Each discipline did a detailed risk analysis through the risk department, which was reviewed annually (IMP 2010).

In 2011/12 the company risk management process was consistent with the ISO 31000:2009 Risk Management Guidance. Implats aimed to continue to embed a risk management approach throughout the company's business related activities. Each business unit was afforded the ability to control the pace of implementation within set timeframes. Objective-based risk assessments covered the top 60 activities of the company with associated controls and aline management owner (IMP 2011-2012).

In 2014 the company identified a set of objective-based risk assessments that covered approximately 80 of the most important aspects of the Implats business. Each identified risk and its associated controls had a clearly defined line management owner. This process was repeated and reviewed regularly, ensuring that the information remained relevant.

All information was captured into the Group risk repository system that informed the Group risk profile. The Group risk profile was presented on a monthly basis to the Exco and quarterly to the board risk committee, which was separated from the audit committee (IMP 2014).

In 2015 the company completed a third-party review of the baseline risk assessment. The key findings from this review were addressed by implementing an online hazard identification and rectification system across the Group. It provided ready access to the required controls and procedures associated with the 14 identified major hazards across the operations (IMP 2015).

In 2016 Fourteen major hazards were identified at Impala Rustenburg and control standards were developed for each hazard. The company identified the material unwanted events (MUEs) and followed ICMM practice guidelines to develop a critical control management system to ensure line management focuses on the controls aimed at preventing these events. All Impala standards and procedures associated with these major hazards were linked to each hazard and were available electronically (IMP 2016).

4.3 INCIDENT INVESTIGATION SYSTEM

In 2007 Impala implemented a new incident investigation system to assist in understanding the root causes of injuries. In 2009 the company used the increased understanding of the cause of accidents to improve the safety performance going forward (IMP 2007).

In 2010 the main reason behind the cause of accidents remained breaches in the safety rules and work procedures. This was addressed by ensuring that all employees understood the rules and procedures and the compliance requirements (IMP 2010).

In 2011 second and third-party audit teams were established, tasked with conducting independent on-the-job observations and investigations of LTIs. These audit teams mitigated the risk of familiarity and the lack of independence that could occur once a safety officer became part of a team (IMP 2011).

In 2012 Implats undertook a wide-ranging, in-depth self-assessment of previous mining and industry disasters. The review of these disasters helped to inform the Group's risk mitigation processes (IMP 2012).

In 2016 every lost-time injury was analysed to determine behavioural and control failures and whether breaches of safe production rules were wilful or not. All accident investigations included the human error assessment in the formal accident investigation process. The company monitored and enforced the deemed action required by the 'human failure' guide (IMP 2016).

4.4 SAFETY RESPONSIBILITY

Safety was an integral part of the responsibility of line management at all of Implats' operations. Issues relating to safety wer edealt with by management committees at an operational level, the group's Executive Committee and at quarterly meetings of the SHE Audit Committee.

In 2007 specialist safety personnel were employed at all operations to support line management in managing safety issues, to monitor and audit performance, to undertake regulatory reporting and to develop specific programmes in response to identified needs (IMP 2007).

In 2009 the management of safety and health at Implats was a function of line management, applied with the close involvement of employees and unions. A group-level safety, health and environment executive provided guidance to the group, and specialist safety and health personnel provided the operations with assistance and guidance. The SHEQ Committee, a sub-committee of the board, reviewed the performance on a quarterly basis.

The involvement of unions in safety and health management structures were fully provided for as required by legislation and in terms of recognition agreements between the company and unions (IMP 2009).

In 2010 safety and health at Implats was a function of line management and applied with the close involvement of employees and unions. Supervisory staff were seen as safety leaders who not only lived by the standards but enforced the standards as well. A Group safety, health and environment executive guided the broader Group, while specialist safety and health personnel assist and guide the operations. A SHEQ Board committee reviewed performance each quarter.

Recognised unions were fully involved in all aspects of managing safety and health, from policy development to detailed implementation. Over 5 700 full time and part time safety representatives were actively working with management in an effort to improve safety (IMP 2010).

In 2011 safety and health were ultimately the responsibility of line management, in close association with employees, unions and the DMR. Safety and health agreements were in place at all operations, dealing with standards and procedures, discipline, accident investigations and safety and health planning, ensuring that all employees could and did play a role in safety and health management. a Group Health, Safety and Environment executive guided the Group's strategy, while specialist Group and operational level safety and health personnel guided and support line management in the implementation of this strategy.

The company appointed 85 trained safety officers to ensure on-the-ground supervision as gaps in supervision was a critical hurdle to the achievement of the safety objectives (IMP 2011).

In 2016 the company restructured, and the safety department reduced the central independent team of safety officers that performed a follow-up audit function. At the Impala Rustenburg and Marula operations, line management was consequently responsible for following up and closing out issues identified by the safety audits and stop notes. The central safety department maintained a supportive safety role for all operating areas in the Group (IMP 2016).

4.5 SAFETY AND HEALTH COMMITTEES

Safety and health committees was a requirement of the Mine Health and Safety Act and their effective functioning underpinned the joint responsibility for safety and health at an operational level. The functioning of these committees was regulated by the health and safety agreements which were entered into with the representative trade unions and dealt with a broad range of safety issues including:

- The election of full-time health and safety representatives, safety stewards, and the functions that they should fulfil;
- Procedures for employees to exercise their rights to withdraw from circumstances that they perceive to be dangerous;
- Training of safety and health representatives;
- Procedures for the resolution of disputes relating to safety and health.
- Participation in incident investigations;
- Any other issues relating to safety and health which may arise, and
- All employees were represented in the safety and health forums at an operational level by virtue of the collective bargaining agreements in place

In 2006 Implats was committed to open and transparent communication with employees and employee participation was encouraged through various short-term and long-term initiatives and campaigns. Regular leadership summits facilitated communication between management and employee representatives across the organisation. In addition, representatives of all unions served on key committees such as the Impala HIV/AIDS and Best Practice Committees (IMP 2006).

In 2009 the company enjoyed increased co-operation between management and employees, which included the improved understanding of the causes of injuries and developing strategies to mitigate these incidents in the future. A number of joint safety summits were held at the Impala Rustenburg operations and, for the first time ever, management and unions determined joint safety and health priorities and set targets (IMP 2009).

In 2011 operations-based Safety and Health committees, which functioned in accordance with the MHSA, played an active role in safety and health strategy and performance management (IMP 2011).

In 2012 Implats committed to creating sustainable working relationships with all stakeholders, in particular employees and their representatives. A new employee engagement model with greater focus on the role of line managers was developed (IMP 2012).

In 2013 the company focused on normalising the industrial relations environment as it underpinned the successful delivery of all the strategic objectives. Senior management engaged with supervisors to contextualise the current challenges and to provide support for effective supervision. Implats pursued interactions with senior union leadership to gain commitment for safety initiatives (IMP 2013).

In 2014 the company continued with efforts to normalise the industrial relations environment. Implats used opportunities presented through the revised health and safety agreement with all employee representative groups to engage more effectively with employees in promoting the right safety culture (IMP 2014).

In 2016 the company continued to work closely with all stakeholders including own employees, organised labour and the DMR in pursuit of achieving safe production and ‘Zero Harm’ across all operations (IMP 2016).

4.6 INTERNAL WORK STOPPAGES

In 2011 a catalyst in changing the safety culture was the implementation of internal stoppages, largely by the newly appointed safety officers. The aim was to ensure continuity of advice and audit follow up, which could be lost in a rotational system (IMP 2011).

In 2013 the internal safety stoppage system was fully developed and formalised in the year. There were 3 528 internal work stoppages, which was an annual increase of 51% (IMP 2013).

In 2015 the company continued to mitigate safety and health risks by implementing an internal work stoppage programme. It was a proactive programme that required working teams to stop and fix hazards or sub-standards identified by line management and service departments (IMP 2015).

4.6.1 SECTION 23 ACTIONS

In 2015 all employees were retrained on the rights and on the formal process of Section 23 of the Mine Health and Safety Act, which empowered employees to leave their workplace if it appeared that there was a serious danger to their health and safety. Accident investigations revealed that this did not always occur, even when employees identified possible danger (IMP 2015).

In 2016 the company formalised and systemised the process of Section 23 withdrawals to ensure employees reported any danger and that work was stopped until the risk was mitigated. Safety representatives were trained and issued with Section 23 withdrawal booklets (IMP 2016).

4.7 SAFETY LEADING INDICATORS

In 2016 systems were in place to capture and report on leading safety indicators and measure the following indicators for trends:

- STOP observations performed;
- Pre-work alcohol testing;
- Road behaviour monitoring, and
- Work stoppages on safety audits (IMP 2016)

5 HUMANISE THE BUSINESS SYSTEMS

5.1 SAFETY CULTURE

In 2007 there was a renewed focus on ‘visible felt leadership’. A safety road show was conducted at Impala’s Rustenburg operations to heighten safety awareness and to reinforce the mindset that mining can be undertaken without injury (IMP 2007).

In 2008 Implats perceived that the embedding of a culture of safety awareness at all levels of the organisation was important in its quest for ‘Zero Harm’ (IMP 2008).

In 2009 the company continued with the commitment to promote and create an embedded safety culture through better and more frequent training, improved communications at and between all levels of the organisation and through visible leadership. It was a priority to create and promote a safety culture, which had a broad approach that included safety and health in all aspects of employees’ lives so as to deepen awareness and instil a culture of safety (IMP 2009).

In 2010 Implats engaged DuPont to objectively benchmark the safety management practices against world-class best safety practices. It was concluded that the safety culture was a ‘dependent’ one where the employees still required high levels of supervision in the work situation. The major findings of the DuPont study were incorporated into the safety strategy and plans, which aimed to change the behaviour of management and all employees to one where safety was considered to be the first priority.

The company continued promoting and creating an embedded safety culture through better and more frequent training and improved communications throughout the organisation. Visible leadership remained the key to driving home a safety culture within every employee.

An independent study was also commissioned on the external socio-cultural factors that affected management and employee behaviour in order to improve the safety programmes. This study showed that the legacy and behaviour of South

Africans in general toward discipline, alcohol and drug abuse, violence and the disease burden posed by the HIV epidemic could negatively affect safety behaviour at work and needed to be addressed in the safety initiatives programmes (IMP 2010).

In 2011 DuPont assisted Implats in understanding the impediments to embedding a culture that would make the workplace safe for all employees and contractor employees. DuPont revealed weaknesses in some of the underlying assumptions that informed the safety strategy. The findings indicated that despite a strong 'team' culture and top leadership commitment to safety, there were concerns regarding a lack of respect for the law, procedures and standards; inadequate recognition for daily hazards in a mining operation; ineffective behavioural-based safety audits and poor change management controls. It served as the template for a better informed set of interventions which were designed to lead to significant improvement in the safety performance.

Notwithstanding the new understanding of the mismatches between the strategic intent and the realities, the lost-time injury frequency rate still remained unacceptably high and that eight employees lost their lives while at work.

The company focused on compliance and fostering a culture where safety was a priority for all employees and where there was intolerance towards unsafe work practices and behaviour. Compliance was ensured to the Group's defined safety standards and procedures by changing the safety culture, focusing on behaviour observation, reward and communication.

DuPont undertook an assessment of the change in leadership culture. The results showed that the leadership safety culture improved in all six of the dimensions from the 2009 baseline measured by DuPont. The overall safety culture of leadership progressed from a dependent culture to an independent one on the Bradley curve.

Implats embraced the notion that there was a need to develop and sustain a culture where safety was considered a priority by employees and management alike, and

where non-compliance with safety standards was not tolerated at any level within the organisation. The cultural shift that was needed in the attitude to safety extended beyond the workplace given the tolerance for high risk behaviour in general among South Africans (IMP 2011).

In 2012 the company retained a strong strategic focus on changing the safety culture and closing the supervision gap through a new cultural transformation framework and improved hazard identification and risk assessment system (IMP 2012).

In 2013 the company used the Chamber of Mines Cultural Transformation Framework (CTF) to enhance the safety culture (IMP 2013).

In 2014 the required change in the Implats safety culture was continued through leadership and using the CTF. Several initiatives were placed on hold during the second half of 2014 which was dominated by efforts to manage the union rivalry and resolve the strike (IMP 2014).

In 2015 the CEO with the support of the executive team developed the right safety culture through effective leadership and by demonstrating visible personal commitment. This strong executive commitment was evidenced by the measures taken early in the year following the five fatal injuries that occurred shortly after the return to work after the five-month strike. The CEO and members of the Implats' executive relocated to Impala Rustenburg for two weeks to assess and review the safety plans. A revised business plan was developed with input from internal and external sources. An important aspect of the new plan was the focus on safe behaviour and compliance to standards and, where wilful deviations occurred, the enforcement of discipline.

The company continued to implement the CTF and entrenched the Mining Charter's health and safety commitments. A core goal of the safety strategy was to drive a change in the safety culture across Implats. It was to be transitioned from a measured culture of dependence to independence, and ultimately to interdependence. In the dependent culture, although there was an acceptance of

the need for safe practices, these were generally only followed when effective supervision is present and demands it. In an independent culture, every employee is committed to safe working practices, taking clear responsibility for their own actions. (IMP 2015).

In 2016 the CEO, with the support of the executive team, continued to drive the overarching objective of developing the right safety culture through effective leadership and by demonstrating visible personal commitment.

The company continued to implement the MHSC five-pillar cultural transformation framework and to embed the Mining Charter's health and safety commitments. The focus was on the risks around critical safety behaviours and the need to inculcate an independent safety culture and attitude in every single employee. The company continued to drive a shift from the prevailing "dependent" safety culture towards an "interdependent" safety culture through effective safety leadership and engagement with employees. This would result in an interdependent culture where all employees look after their own and others' safety moving from a dependence on supervision to ensure compliance with safety rules and procedures. The safety leadership self-assessments showed that the company continued to have a "dependent" safety culture in which effective supervision was needed to ensure compliance with safety rules and procedures at all levels, including management (IMP 2016).

5.1.1 CAMPAIGNS

In 2009 the Tsiboga process which involved the concept of an alert meerkat was revitalised. Nine out of the 10 incidents at Impala were caused by non-compliance with safety standards and procedures. The focus remained on leadership and training.

A communication initiative, 'Towards Zero by 2012', was undertaken in order to raise safety awareness levels and to engender a safety culture among all employees (IMP 2009).

5.2 BEHAVIOURAL BASED SAFETY

In 2006 the company increased emphasis on behaviour-based safety training and the setting of more stringent targets due to the levelling off of the safety rates and the higher number of fatalities (IMP 2006). In 2007 Implats put significant effort into training, particularly of new employees and on behaviour-based initiatives (IMP 2007).

In 2008 more than 90% of incidents that result in injuries at Implats had a non-compliance association at a critical stage leading up to the event. Although the emphasis was placed on behaviour, the company failed to modify a deliberate attitude to risk that was sometimes present in certain individuals which led to non-compliance. A culture of non-compliance and the consequences manifested itself in the safety statistics when compared to other countries. The same held true for the road accident fatalities in South Africa

The example set by society at large in South Africa was a likely to be contributing factor as non-compliance with accepted norms and acceptable social behaviour by prominent individuals was often reported in the press. These actions as well as that such behaviour often was unpunished the impression was created that non-compliance was somehow acceptable or condoned. It was an attitude to risk and therefore to compliance that was difficult to gauge. The challenge that faced the company was to modify the attitude of the workforce towards risk and compliance. It was perceived by Implats that until the workforce achieved 100% compliance with safety standards and practices, the ‘Zero Harm’ objective would not be achieved. However, it was believed that behaviour could be modified as was demonstrated by the world-class safety performance of Impala Refineries.

If all employees received the correct workplace safety training and complied with these rules in the workplace, very few, if any, injuries would occur. The company questioned whether the training was adequate or whether the compliance to safety standards was inadequate. Implats consequently focused on better training to improve compliance with safety standards in order to eliminate any such events.

The implementation of 'visible felt leadership' showed positive results. Supervisors and management ensured that safety was not compromised in any way by taking responsibility for employee safety, leading by example, and encouraged positive and discouraged negative safety behaviour (IMP 2008).

In 2009 the company continued with visible safety leadership using behaviour based safety programmes. In 2010 the ongoing challenge the company faced was changing the safety behaviour of everyone to one where safety and health was the first priority (IMP 2009).

In 2011 a behaviour-based safety programme gap assessment was undertaken by DuPont which found that it was no longer effective at the Rustenburg operations and at Marula. Both these operations subsequently customised the DuPont STOP programme and trained the E and D level leaders at these operations and incorporated it into the management key performance indicators (IMP 2011).

In 2013 the company ensured that all operations had behaviour-based safety programmes in place. The DuPont STOP process was fully implemented at Rustenburg and Marula, and all E level employees attended safety leadership training (IMP 2013).

In 2014 the company continued to focus on ensuring that all operations had behaviour-based safety programmes in place (IMP 2014).

In 2016 the analysis of the fatal and lost-time injuries showed that human failure remained a significant factor in these incidents and the focus emphasised improvements to the person and behavioural pillars in particular. This was about ensuring employees had the right skills, team work, knowledge, motivation, attitudes and abilities to achieve ‘Zero Harm’. Visible felt leadership was increased, with D and E level leaders required to increase observations for two to four per month (IMP 2016).

5.3 PLATINUM RULES

In 2009 the Platinum Rules, which were developed for and by different disciplines in 1997 were revised to ensure absolute clarity. By 2010 each work area had a set

of platinum rules, which were the cardinal rules of safety as breaches in these rules could result in serious injuries or fatalities. These rules were enforceable with disciplinary action (IMP 2009).

In 2011 safety and health standards guided practices within working places and were developed in line with best practice and to meet the requirements of the Mine Health and Safety Act (MHSA). A number of processes were put in place with respect to the culture change initiative, including 100% compliance with the non work related Platinum Road Rules. It was believed that the adherence to safety rules extended beyond the workplace and that the road behaviour was a good indicator of the safety behaviour of the mainly supervisory level employees. The rules included the wearing of seatbelts, not talking on mobile phones while driving, keeping to the speed limit, observing stop signs and observing solid white lines (IMP 2011).

5.4 CRITICAL SAFE BEHAVIOURS

In 2015 a set of 'critical safe behaviours' for thirteen critical mining occupations and nine critical occupations at the processing division were developed in collaboration with the HSE representatives. The company developed a training and awareness programme as well as a measurement system, in collaboration with the branch safety representatives, which aimed at encouraging the right behaviours needed to keep one safe (IMP 2015).

In 2016 Implats identified a set of "critical safe behaviours" for the five most critical occupations. These behaviours were entrenched through supervisory and compliance measures. Support documents were developed for the critical safe behaviours for the next five critical occupations, which included rock drill operators, scraper winch operators, locomotive operators, panel operators and trackless machine operators. The training and awareness programme including the measurement system aiming at encouraging the right behaviours needed to ensure safety were rolled out (IMP 2016).

5.5 INTOLERANCE OF NON-CONFORMANCE

In 2008 Implats enforced an intolerance of non-conformance with safety standards no matter how unpopular this was. The intolerance of non-conformance with Implats' safety standards and procedures were incorporated within operation specific Platinum Rules. The supervisors at Marula were trained on applying zero tolerance to non-compliance with safety standards and the constant display of visible-felt leadership (IMP 2008).

In 2009 the company had a strong emphasis on compliance and the issue of zero tolerance around non-compliance was non-negotiable. Almost every fatality that occurred had a non-compliance connotation of some sort. Implats had a work-stoppage rule in terms of which any employee may stop a workplace if it was deemed unsafe in any manner. The company trusted that employees would in future regard the cost of a work stoppage as insignificant compared with the far-reaching implications of a workplace incident. Non-compliance with safety standards was a key factor to be addressed and the company had to ensure that compliance with safety standards was enforced in order to achieve the vision of ‘Zero Harm’ (IMP 2009).

In 2010 the issue of zero tolerance around non-compliance was non-negotiable. A key objective for Implats was to have a safety-conscious workforce that adhered to the company’s rigorous safety standards and embraced the concept of zero tolerance to non-compliance (IMP 2010).

In 2011 all supervisory and management staff were held accountable to ensure that compliance with the standards was taking place on a continuous basis. If standards and procedures were complied with, far fewer accidents would occur therefor achieving compliance was a critical area of focus. The safety rule compliance and road behaviour improved from 35% compliance to over 90% (IMP 2011).

In 2012 the application of the safety standards and procedures remained inconsistent and many clearly avoidable, unnecessary, incidences and fatalities

occurred. This occurred despite the company's best efforts, including initiatives identified from the DuPont safety intervention (IMP 2012).

In 2013 the company did not meet the Mining Charter FIFR target of 0.03 per million hours. A contributing factor was that the company was not able to achieve the level of operational discipline and compliance required to meet the targets in all of the operational areas (IMP 2013).

5.6 ZERO INCIDENT PROCESS

In 2015 Implats' executives and all E and D level production managers attended the Zero Incident Process (ZIP) for Leaders training programme. The programme provided managers with insight into the human behavioural aspects of safety and how to influence this in order to achieve improved safety awareness and performance in their subordinates. Safety-related issues formed a key component of the five-day supervisory leadership training course that was provided for managers, mine overseers, engineers and services managers (IMP 2015).

In 2016 Implats' executives and all senior management and professional qualified production managers attended the best-practice ZIP for Leaders training programme. All managers completed a ZIP safety leadership self-assessment survey every six months aimed at measuring the perceived safety culture among this group of managers. All E level production managers undertook a 360° health and safety leadership assessment tool proposed by the Mining Charter guideline, which entailed assessment by subordinates and colleagues (IMP 2016).

5.7 EMPLOYEE WELLBEING

In 2010 the health of employees was important and as such prevention and treatment campaigns would continue to be emphasized. Implats extended the safety and health programmes beyond the workplace to include road safety, and community safety and health. This would ensure that employees recognised that safety and safe behaviour extended beyond the workplace and became a way of life (IMP 2010).

In 2011 a comprehensive system of occupational healthcare surveillance was launched aimed not only at the early detection and treatment of occupational disease, but also at preventing such disease in the first place. By addressing employee healthcare and occupational health in a holistic way it was aimed to ensure the overall wellbeing of employees and their families.

The healthcare focus extended beyond the workplace into a broad healthcare management strategy that encompassed all life-threatening illnesses and disease, including hypertension, diabetes, TB, HIV/AIDS, malaria, cholera and others. A study that was undertaken at Implats's operations indicated that attitudes towards discipline, alcohol and drug abuse, violence and disease needed to be considered in a holistic approach to employee wellbeing and addressed to ensure a step-change in developing a safety and health-conscious culture. In support of this cultural shift, the company had an unequivocal approach to non-compliance with rules and standards (IMP 2011).

5.8 ALCOHOL AND DRUG TESTING PRACTICES

In 2009 a surface road behaviour and vehicle condition campaign as well as a campaign to eliminate drug and alcohol abuse was launched during the year (IMP 2009).

In 2011 a measure of performance in the zero-tolerance approach was the implementation of alcohol and drug testing practices that randomly tested 10% of all employees on a monthly basis. A disciplinary code dealing specifically with reckless driving, gross safety misconduct and working under the influence of alcohol was implemented. Ongoing monitoring was implemented, progress was tracked, and disciplinary action taken resulting in some employees being dismissed (IMP 2011).

5.9 TRAINING

In 2006 the Tsiboga safety training programme was expanded into the Team Tsiboga programme with a shift in focus from the supervisory level to the individual members of the teams themselves (IMP 2006).

In 2007 the training process took longer than initially planned, as most of the new employees were novices. At Marula, the continued ramp-up of operations required ongoing recruitment and the local employee base's lack of experience in mining, necessitated a significant amount of additional training. The company's focused on training, particularly in respect of basic hazard identification (IMP 2007).

In 2008 the company placed greater and renewed emphasis on the content, frequency and intensity of safety training. This was driven by the skills crisis and high staff turnover levels experienced across the industry. At Marula, all employees received refresher training on the safe disposal of explosives and the safe parking of Load Haul Dumpers (IMP 2008).

In 2009 an internal training audit revealed several shortcomings and opportunities regarding the training programme for employees returning from annual leave. Among the measures taken were steps to ensure that all employees and contractors attend this training (IMP 2009).

In 2010 Implats increased on-site safety training capacity to comply with the DMR requirements. All mine managers and the executives had undergone training and awareness in terms of their responsibilities and accountability with respect to the Mine Health and Safety Act (IMP 2010).

In 2011 the company closed the supervision gap by focusing on leadership training. A number of initiatives were put in place to ensure that all supervisory staff received adequate training and were empowered in this regard (IMP 2011).

In 2012 the company increased training for middle managers (IMP 2012).

In 2013 the company continued to focus on providing technical and managerial training for miners, shift supervisors and overseers, in the belief that inadequate supervision remained a major safety concern (IMP 2013).

In 2014 an ongoing focus was to increase supervision and leadership skills and implement best practice technical initiatives in order to mitigate safety risks in the workplace (IMP 2014).

In 2015 the company continued to place a strong focus on training, which included 139 stoping teams that participated in a five-day team-mobilisation training programme with a focus on embedding the right safety and associated productivity culture. Team mobilisation included a strong safety focus whereby teams were trained in the importance of safe production.

All Implats executives and production managers attended the three-day zero incident process for leaders training programme. This provided managers with insight into the human behavioural aspects of safety, and on how to influence this to achieve improved safety performance.

Approximately 2300 employees participated in the five-day training programme for miners, shift supervisors and mine overseers. Every team and workplace had an elected safety representative. The Mining Charter set a target for 8% of all employees to undergo a 10-day occupational health and safety skills programme. More than 4 000 employees and safety representatives undertook the 10-day Mine Qualification Authority (MQA) occupational health and safety skills programme. This ensured that employees who put themselves forward for election by their team were well versed in health and safety issues (IMP 2015).

In 2016, 3 641 employees participated in a five-day ex-leave training programme that was developed for mine managers, mine overseers, shift supervisors and miners. It included managing a half-level production section safely and effectively with emphasis on the planning processes and with the participation of the multi-disciplined technical teams. The training included information on revised standards and new technology.

The team-mobilisation training which was a five-day course on site, aimed at building trust and enhancing team functionality, committing production teams to action plans and collective accountability for safe production. It was planned to adjust the training to more strongly establish the miner's role as leader. At the time, 316 active teams,12 people in a team, completed the training and the company continued to train a further 245 active teams.

A four-day leadership training course aimed at mine overseers and shift supervisor level leaders incorporated ZIP safety principles and was designed to empower supervisors to lead their teams in safe production. 178 Leaders participated in the programme. After which the ZIP principles were adopted in all safety plans at shaft level (IMP 2016).

5.10 EMPLOYEE PARTICIPATION

In 2007 the company was committed to open and transparent communication with employees and employee participation was encouraged through various short-term and long-term initiatives and campaigns. Regular leadership summits facilitated communication between management and employee representatives across the organisation. In addition, representatives of all unions served on key committees such as the Impala HIV/AIDS and Best Practice Committees. The company enhanced the functioning of the safety and health committees, particularly at Impala's Rustenburg operations and Marula (IMP 2007).

In 2008 the involvement of employees and unions in safety issues was a key imperative of the group. Union recognition agreements were in place, which provided for the establishment of formal safety committees, which commonly comprised joint management/union participation and met at least monthly (IMP 2008).

In 2009 formal safety and health committees, comprising management and union representatives, were active at all operations. Full-time safety stewards and part-time safety representatives were elected by employees and received comprehensive training, which was provided by the company. As more than 70% of employees were unionised, a similar proportion were involved directly and indirectly in guiding the management of safety and health. Agreements and the committees covered a range of issues, including:

- The election of safety representatives and safety stewards;
- Procedures by which employees could exercise their rights to withdraw from circumstances that they perceive to be dangerous;

- The training and development of employees, safety representatives and stewards, and
- Participation in incident investigations (IMP 2009).

5.11 CONTRACT WITH EMPLOYEES

In 2008 Implats was committed to its motto of 'One team, one vision, with pride'. The company adopted a policy of engaging with the employees in order to move towards creating a united, holistic team comprising all employees. This entailed creating cohesion between management and all levels of staff, empowering all and giving each employee a sense of pride in being part of the Implats team. Staff training was an important element of this policy and would have a vital role to play in the retention, replacement and transfer of skills (IMP 2008).

In 2009 the company was determined to see employer/employee relationship growth in a more holistic way so that individuals felt that their personal contribution was encouraged, recognised and rewarded (IMP 2009).

5.12 COMMUNICATION

In 2009 the company continued to focus on safety and health communication. An extensive range of media including billboards, text messaging, email, publications, posters and visible leadership were used, so as to be able to reach all levels of employees in various languages whether they were literate or not. Following an audit on safety communication conducted during the year, measures were introduced to ensure that health and safety committee meetings took place on a monthly basis and that more effective communication processes were implemented (IMP 2009).

In 2011 the safety communication process in place included formal safety communications and a standards briefing system. Management, with the assistance of the health, safety and environment representatives, were responsible for the management of communication (IMP 2011).

In 2013 the Implats-branded safety communication messages were further extended into the immediate communities with the assistance of external communication agencies (IMP 2013).

5.13 SKILL SHORTAGE

In 2007 the company experienced high turnover in staff at certain levels of middle management, including supervisory and skilled categories which had implications for safety and production in terms of the grades and volumes mined. An underlying challenge in developing a mine was that the locally drawn workforce were largely unskilled. Many of the employees, some of whom who were in their mid-30s obtained employment for the first time ever. Training and skills development remained a priority, including capacity building within the new union structures (IMP 2007).

In 2008 the severe lack of skills that was experienced throughout all sectors of the South African economy was the biggest challenge facing the group and the mining industry in South Africa. The retention and attraction of skilled workers reached critical proportions for Implats and various strategies were implemented but these had a profound impact on the cost base going forward.

The high turnover of staff at these levels had a marked impact on team management and short-term planning. The high turnover of artisan staff at Marula affected trackless fleet maintenance (IMP 2008).

In 2009 the skills shortage became increasingly difficult to compete as, all things being equal, an employee would be inclined to relocate to a country where crime was less prevalent, and education and healthcare were better. The vast pool of skills that the industry had become accustomed to diminished significantly as activity in the gold-mining sector declined (IMP 2009).

In 2011 Implats continued to experience a shortage in certain critical skills. Part of the high employee turnover was due to an ageing and ailing workforce, increased competition for skilled resources and inadequate education in the semi-skilled

talent pool. The company's focus remained on critical skills development as well as improving the retention and reward practices (IMP 2011).

In 2012 Implats had to up-skill the entire workforce, in particular the first line of supervision in order to make mining safer. A certain set and level of skills was required to identify risks in a hazardous underground mining environment and then taking the appropriate and timely remedial or avoidance decisions. Work continued to close the supervision gap and that management showed visible and decisive leadership on safety.

Only 40% of the shift supervisors and mine overseers had matric and most of the workforce had much poorer levels of education, which illustrated the extent of the human resources challenges Implats faced. These challenges were compounded in that Implats had to employ new people every year with the opening of new, deeper shafts while closing down depleting ones and coping with an ageing workforce.

It was believed that, as with safety, Implats had appropriate and effective strategies and systems in place with which to uplift the skills, health and the overall wellbeing of the workforce. The company continued to provide leading-edge solutions to address the education, training and wellness of the employees. These efforts demonstrated the acceptance that the company was a people business and that without a meaningful buy-in to the Group's vision and strategy by all, especially employees, Implats would be unable to achieve the objectives.

The company addressed potential skills shortages through in-house technical trainee programmes, capacity-building at supervisory and managerial level, and enhanced people-leadership initiatives. An additional 1% of payroll levy was directed towards creating and entrenching critical skills (IMP 2012).

5.14 INCENTIVES

In 2007 salaries were realigned, and a new incentive scheme was introduced for all employees at Impala's mining and processing operations, in order to counter the high turnover in staff (IMP 2007).

In 2009 a new safety bonus system was implemented in the mining and processing areas to reward the performance of teams that achieve certain periods of time (90, 180, 270 and 360 days) without lost time injuries. There remained a strong link between the bonus system that was put in place for production in 2008 (Ama-Ching-Ching) and safety performance so as to ensure that production was not seen to be more important than safety (IMP 2009).

In 2011 an important feature of the approach in developing the culture was the implementation of a central system of recognition and reward where an analogy was drawn between the dedication and focus required in achieving world-class safety performance and winning a medal at the Olympic Games. This easy-to-understand system provided not only a benchmark across the Group, but also encouraged improved commitment and performance (IMP 2011).

In 2012 the company developed leading indicators and ensured that safety formed a greater weighting in manager and supervisor incentives (IMP 2012).

In 2014 the company increased the safety weighting in short-term incentive schemes (IMP 2014).

In 2015 a new ‘Zero Harm’ incentive scheme, which divided the incentive equally between safety and production, was implemented. The safety component comprised of the leading requirement that nets and bolts be installed on all panels and development ends, as well as the lagging measure of workforce lost-time injuries.

The long-term incentive scheme for D and E levels also included the lagging FIFR three-year performance compared with industry peers. The short-term incentive scheme for E level management was increased to 35%, with a component of lead indicators. Sustainability objectives formed part of the key performance indicators against which the performance of Implats’ management and executives was measured and remunerated (IMP 2015).

5.14.1 MEDAL RECOGNITION SYSTEM

In 2009 a new ‘medal’ recognition system was put in place to promote awareness and understanding. It became apparent that despite ongoing communication related to safety rates and performance, a lack of understanding and interest in conventional safety performance statistics such as LTIFR and FIFR persisted amongst a large majority of employees at the Impala Rustenburg operations.

In an effort to demystify these rates and to stimulate interest and healthy competition, a system of ranking safety performance based on the analogy of an Olympic athlete, was developed. The analogy was of an athlete training to win a medal at the Olympics in 2012. LTIFR targets were linked to a bronze medal (LTIFR of less than 3), a silver medal (LTIFR of less than 2) and a gold medal (LTIFR of less than 1), with LTIFR of 0 represented by a platinum trophy. The company’s overall success was then measured against the number of areas achieving zero, and the number of shafts and areas that were ‘medalist’ (IMP 2009).

5.14.2 PEOPLE PHILOSOPHY

In 2011 Implats recognised that people were central to the business success and the company had to have the Right People, at the Right Place, at the Right Time, doing the Right Things in order to ensure the achievement of ‘Zero Harm’, lowering production costs and to cost-effective delivery of the growth projects.

People management was repositioned as an integral part of the business and continued to build the necessary capacity to drive operational strategic excellence. The leadership team was responsible for ensuring to have the best people, functioning at optimum capacity, in the most effective relationships, because anything less would inhibit the ability to achieve goals (IMP 2011).

5.15 WOMEN IN MINING

In 2015/6 the Women in Mining (WiM) task team met monthly to identify and resolve safety and health issues specific to women. Personal protective equipment

(PPE) for women was trailed for its effectiveness and comfort. Awareness initiatives aimed at improving the safety and security of women working underground was implemented (IMP 2015; IMP 2016).

5.16 DISCIPLINARY PROCESS

In 2016 the company ensured that disciplinary action was taken when there were breaches in safety conditions or behaviours. The disciplinary process was automated where possible, removing a manager's discretion on whether to take discipline or not. Disciplinary action was monitored and reported regularly, and managers were held accountable (IMP 2016).

5.17 MANAGING HIGH-RISK EMPLOYEES

In 2016 an analysis of various data sets including medical, human resources, financial, disciplinary, production highlighted a number of employees who could be at a significantly higher risk of having or causing a safety incident. Steps were taken to mitigate the level of risk, for example through formal counselling. The data analysis and formal monitoring of identified high-risk individuals was ongoing (IMP 2016).

5.18 FATIGUE MANAGEMENT

In 2016 a code of practice for employee fatigue management was developed and communicated to employees (IMP 2016).

6 OPERATIONALISE THE SAFETY MANAGEMENT SYSTEM

6.1 MINING METHODOLOGY

6.1.1 MECHANISATION

In 2006 conventional mining volumes declined with the move to mechanised mining. Mechanised production using low trackless mining vehicles accounted for 13% of total production at Impala in 2006 with 76% and 24% of production from 12 and 14 shafts respectively being achieved. The drilling technology proved to be a success, however, ore removal remained a challenge and required further development.

At Marula Platinum the initial mining plan was modified, and the mining method was in the process of being converted from mechanised to conventional stoping. Interim production was by means of hybrid mining; a combination of both conventional stoping techniques and mechanised cleaning assisted by an ore conveyor belt system. The change-over to owner mining was successfully completed and a key aspect of this process was training, particularly with regard to safety and the implementation of group safety principles which went hand-in-hand with this process. The winches, in-stope roof-bolting and drill jigs necessary for the transition to conventional mining were successfully installed. Around 70% of all stoping was done using drill jigs (IMP 2006).

In 2007 the conversion from mechanised mining to conventional mining at Marula was on schedule. Drill jig technology was being implemented, with improved rates of advance being achieved. Employee acceptance of the drill jig technology was good, as locally sourced employees did not have previous mining experience and did not have to change from previously learnt methods of operation. Emphasis was placed on a team-based approach to drill jigs. Record footwall development and advances were achieved. The problems with the maintenance of the mechanised fleet and poor ground conditions caused a number of delays in the second half of the year (IMP 2007).

In 2008 an improved maintenance programme was initiated at Marula and good progress was made. Some trackless units were rebuilt while others would be replaced during 2009. At the Leeuwkop project additional evaluation work was undertaken on the project, which indicated that mechanised footwall development with conventional stoping would be more suitable for the orebody than the mechanised bord-and-pillar mining method originally proposed. The new mine plan was based on conventional mining methods which involved less risk (IMP 2008).

6.1.2 LACK OF MINING FLEXIBILITY

In 2009 limited face availability at Impala resulted in a lack of mining flexibility. The decline in volumes was also attributed to poor operational efficiencies due to the failure to complete the mining cycle, which was compounded by safety stoppages and poor discipline. This situation was further exacerbated by the slower-than-anticipated ramp-up of the decline shafts. The development of the declines was undertaken in the late 1990s as a capital-efficient way to access deeper mining areas in an environment of limited capital. However, it proved difficult to operate due to the linked to existing operational shafts.

New supervisory structures were put in place to ensure targeted production was met. It included dedicated development sections, better contractor management and enhanced team productivity. The latter was addressed by implementing best-practice initiatives. It was estimated that it would take two years to restore on-reef/off-reef development to the correct balance.

Marula had a difficult year characterised by an unsatisfactory safety performance, a slower-than-expected ramp-up in production, reduced productivity and persistent labour issues. This operation was affected by the economic slowdown. The tonnes milled fell short of the operation’s internal target as the production ramp-up once again fell behind schedule. This failure could be attributed to a lack of adequate on-reef development, which resulted in a lack of face availability and, consequently, limited mining flexibility. Team efficiencies and productivity were

impacted by the introduction of new teams to the conventional mining section as well as safety stoppages and industrial action during the year (IMP 2009).

6.2 NEW TECHNOLOGY

In 2006 the mechanisation strategy regarding new technology had three principal objectives, enhanced safety, improved productivity and reduced costs. R135 million had been invested since 2004 on new technology, such as in-stope roof bolting, drill jigs and cutting machines, and mechanised mining at Impala Platinum.

The production shortfall in 2006 after converting to mechanised mining was exacerbated by a slower-than-expected uptake of the drill-jig technology, which was mainly due to a longer-than-expected learning curve, both technically and operationally. This learning curve involved fine-tuning the technology and consolidating processes around the drills, particularly regarding repairs, maintenance, availability and training.

Investigations and trials into ultra-low equipment, including the ultra-low-profile drill rig and the ultra-low load haul dumper for use in stoping widths of less than 1.3 metres, continued. Following unsuccessful trials during the year, the Alpine reef miner project was terminated.

It was planned to implement a new R90 million blast initiation system based on ‘shock-tube technology’ in 2007 which was aimed at eliminating accidents involving misfired and uncontrolled blasts (IMP 2006).

In 2007 although the drill jig technology contributed positively to efficiencies, the primary aim of this technology, given the accompanying in-stope bolting, was improved safety. The roll-out of in-stope bolting was 90% complete. Employees encountered problems with the acceptance of the technology and there were issues with the weight of the drill, which was consequently been reduced by 20kg. The benefits of the technology were not adequately explained initially to employees and there were fears of job losses among employees. At the time, approximately 20 teams were using the drill jig technology and would continue to do so in 2008.

The equipment was to be further refined and difficulties relating to the use of the equipment were to be ironed out before it was rolled out to the rest of the operation (IMP 2007).

In 2008 Marula committed to the drill-jig technology but the implementation proved to be more difficult than expected. While there was no resistance to its use, there were maintenance problems. The use of this technology was accompanied by the installation of roof-bolts which reduced the incidence of falls of ground. The drill-jig technology at Impala Platinum contributed to improved safety with the completion of the roll-out of in-stope roof bolting on all Merensky panels. However, achievement of the secondary objectives of increased productivity and reduced physical effort was disappointing. Rock-drill operators remained unconvinced of the benefits of this technology and the drill-jigs were consequently been withdrawn. The roll-out of this technology continued at Marula where its viability and efficiency were monitored (IMP 2008).

In 2014 the company invested R148 million in technical initiatives, with the aim of minimising the human element of risk within the operations. In 2015 the company invested R221 million in various technical solutions aimed at protecting all those who worked in the mines (IMP 2014).

In 2016 good progress was made in safety improvements to the physical safety environment at many business units through the implementing of new technology and engineering solutions and significant improvements to practices (IMP 2016).

6.2.1 SAFETY NETS AND ROOF BOLTS

In 2006 the implementation of drill jigs and roof bolting was central to the fall of ground campaign in an effort to enhanced safety. In-stope bolting, which was the primary objective of the roll-out of the drill jig technology, progressed with 35% implementation at all Merensky panels. The roll-out was planned to be completed during the 2007. Roof bolting in all development tunnels were completed and work begun on the development of a new drill jig for UG2 panels to improve tunnel advance. The first prototype was tested underground (IMP 2006).

In 2012 the Implats South African operations committed to installing safety nets and roof bolts at a cost of R200 million (IMP 2012).

In 2013 the installation of nets and bolts were adopted and implemented on 90% of the Impala Merensky Reef horizon stopes and 45% of the UG2 Reef horizon stopes. All development ends had safety nets in use. It was planned to complete the full roll-out of this initiative at Impala in 2014. Nets and bolts were fully implemented at the Marula operation (IMP 2013).

In 2014 the company fully implemented nets and bolts in most operations and successfully installed safety nets in all development ends (IMP 2014).

In 2015/6 all stope panels and all “on reef” and “off reef” development ends at Impala Rustenburg and Marula operations had roof bolts and netting fitted as protection against falls of ground. This initiative was used as a formal lead indicator component of the production bonus and accounted for 25% of the team’s bonus value (IMP 2016).

6.2.2 PROXIMITY WARNING DEVICES

In 2012 Implats planned to equip mobile trackless mining equipment with proximity warning devices (PWD) at 11 and 12 Shafts and install improved shaft safety devices at Impala during 2013. By 2013 the South African operations equipped 79% of the trackless vehicle fleet with PWD’s (IMP 2012).

In 2014 the entire trackless vehicle fleet were equipped with Proximity Detection Systems and it was planned to initiate a programme to install this technology in underground locomotives (IMP 2014).

In 2015 all underground Trackless Mobile Machinery at Rustenburg and Marula were equipped with a vehicle-to-vehicle and vehicle-to-person detection system. The company implemented a pilot project on Proximity Detection Systems (PDS) on track-bound machinery, which included locomotives in three of the Rustenburg shafts. It included front drive technology and vehicle-to-vehicle and vehicle-to-beacon detection. The trial confirmed that successful interface between the PDS

technology and controllers were possible. The company focused on ensuring reliability and addressing identified challenges with hand-held front-drive technology (IMP 2015).

In 2016 all underground trackless mobile machinery was equipped with a vehicle-to-vehicle and vehicle-to-person detection systems. Actions were being taken to meet the DMR requirement that PDS systems be rolled out to surface machinery (IMP 2016).

6.2.3 LOCOMOTIVE SAFETY INITIATIVES

In 2016 a key focus was to improve the locomotive safety initiatives. It was planned to have front driven train technology and proximity detection on all track-bound machinery. Following the installation and evaluation of a pilot project at Impala Rustenburg 16 Shaft, the PDS was rolled out to all locomotives at the shaft and the roll out at 11 Shaft was planned (IMP 2016).

6.2.4 SELF-CONTAINED SELF-RESCUERS.

In 2014 all underground employees were equipped with self-contained self-rescuers (IMP 2014).

6.2.5 CENTRALISED BLASTING SYSTEM

In 2014 the replacement of the entire centralised blasting system continued at Implats. It offered significantly improved levels of safety and reliability over the blasting legacy systems (IMP 2014).

In 2015 a centralised blasting system was introduced at the Rustenburg, Mimosa and Zimplats operations to mitigate the possible risk of an unintended lightning induced blast (IMP 2015).

In 2016 a modern safe blasting system was installed and functional across Marula, Mimosa, Zimplats, E&F, 1, 4, 6 7A, 14 16 and 20 Shafts at Impala Rustenburg operations. Implementation at Shaft 11 was delayed owing to financial constraints (IMP 2016).

6.2.6 FIRE RETARDANT CONVEYOR BELTS

In 2014 the company commenced with the replaced of conventional conveyor belts underground with fire retardant conveyor belts. In future only fire-retardant conveyor belts would be used (IMP 2014).

In 2015 all identified high-risk conveyor belts were replaced with fire retardant conveyor belts and 30% of all other belts were replaced. The company was on track to have all belts replaced by 2017 (IMP 2015).

In 2016 following the major conveyor fire incident at Impala Rustenburg 14 Shaft, several actions were identified to enhance fire prevention controls. Replacing all conveyor belts with fire retardant belts. 62% of the operational belts at Impala Rustenburg and Marula and 70% of all standard belts across the Group were replaced. Planned to complete replacement by 2017. The Code of Practice to manage conveyor belts was reviewed and redrafted with new guidelines promulgated by the DMR (IMP 2016).

6.2.7 FLAMMABLE GAS

In 2014 gas sampling was undertaken to determine the flammable gas emissions at each shaft and a methane awareness campaign commenced (IMP 2014).

In 2015 gas measuring instruments, chargers, auto calibration test units and calibration test stations were supplied and commissioned (IMP 2015).

In 2016 the replacement of gas measuring instruments was completed to all shift supervisors, the shaft HOD team and full-time health and safety representatives. The monitoring of the underground flammable gas emissions at both 11 and 16 Shafts indicated low emissions with no significant change in flammable gas emissions (IMP 2016).

6.2.8 SHAFT SAFETY DEVICES

In 2015 there was progress across the Rustenburg operation with the installation of new shaft safety devices and interlocking winder facilities (IMP 2015).

In 2016 over the previous two years all vertical shaft surface bank areas and underground stations were equipped with a fail-safe and winder interlocked safety device, which would arrest any rail bound moving stock before it gets to the shaft (IMP 2016).

6.2.9 ELECTRONIC WINCH-SIGNALLING DEVICES

In 2015 the Rustenburg operation standardised an electronic winch-signalling device, which gave a 15-second audible and visual warning before it powered the motor. The system also included a facility to trip the winch from any remote area along the length of the gully. All centre gullies were equipped with these signalling and safety devices (IMP 2015).

In 2016 the company standardised an electronic winch-signalling device that gave a 15-second audible and visual warning before it powered the motor. The system also included a facility to trip the winch from any remote area along the length of the gully. Reliability problems were resolved, and roll was being completed in all centre gullies. The roll out of the new signalling devices in stope advanced strike gullies was in progress (IMP 2016).

6.2.10 FIRE DETECTION SYSTEM

In 2015 the underground fire detection system enhancements included the completion of the installation of equipment as part of the expansion of the significantly improved fire detection system at Impala Rustenburg (IMP 2015).

6.2.11 VENTILATION DOOR MONITORING

In 2016 the installation of ventilation door monitoring at shafts continued and at year end, 56% of all shafts were fitted with cable installations and 5% with sensor installations (IMP 2016).

6.3 DECLINE IN THE STANDARD OF INFRASTRUCTURE.

In 2013 the outlook for future the mining infrastructure was that it would lag economic growth and therefore hampered development. Transport,

telecommunications, power and water management were and would remain issues. Contingency measures were required to minimise the impact of a decline in the standard of infrastructure (IMP 2013).

6.4 FALLS OF GROUND AND SEISMICITY

In 2006 falls of ground remained a challenge, and even more so at the deeper shafts. Mining operations took place at increased depths which resulted in the increased potential for seismicity. Risk controls were included in the mine's safety protocols and programmes of which the definition of ground control districts was a vital aspect (IMP 2006).

In 2007 there was a reversal in some of the major gains in safety that had been made in recent years as falls of ground accounted for 62% of all fatal accidents. A task team was formed at Impala's Rustenburg operations which identified six key themes, with 18 projects planned to address the issues identified based on accident analyses and audits.

The fall of ground safety intervention programme was revitalised. It included the implementation of a workplace self-rating system driven by front line supervisors. The barring equipment and practice were reviewed as many lost-time injuries occurred during the process of ensuring that an area was safe. Both the mining cycle and technology in use were reviewed and optimised in line with best practice guidelines to address the decline in production. The revised mining methodology which was aimed at improved grade control and productivity, and cost containment was on trial 11 shaft (IMP 2007).

The system of ground control districts implemented previously was then an inherent aspect of the support standards practice at Impala, in that the ground control districts determined the support standards implemented. The increased incidence of falls of ground was aggravated by mining operations in remnant areas and also by the overall deeper nature of the operation. The management level at which the decision was made on whether or not to mine a remnant area was elevated. The mining methods used in these areas were revised so as to enhance safety. Mining of remnant areas continued, and it was planned to phase

out the contractors operating in these areas during the year. Production from the remnant areas was scheduled to decline over next four years.

In 2008 while the safety performance improved at Impala Rustenburg, particularly with regard to falls of ground, which remained the most significant safety risk. The fall of ground safety campaign was reinforced and involved a newly developed workplace entry examination procedure, including improved barring techniques, ongoing assessment of ground conditions and regular communication with supervisors (IMP 2008).

In 2009 Impala Platinum contributed 56% of the group's production. The number of fatalities doubled year on year, which was unacceptable. The primary cause of the majority of these incidents was equipment-related, whilst two were the result of falls of ground, which was the principal cause of fatal incidents in prior years. This change highlighted the success of the fall-of-ground campaign which was revitalised during the year (IMP 2009).

In 2013 there was a renewed focus on safety during the year and in particular progress on preventing fall-of-ground incidents, with no such fatal incidents reported during the year (IMP 2013).

6.4.1 Triggered Action Response Plan

In 2014 an internal team was appointed to customise the Triggered Action Response Plan (TARP) to manage fall of ground hazards in the workplace. TARP was a system that required the formal examination for known hazards in the workplace and then the formal implementation of appropriate and predetermined action and response measures. TARP required the formal implementation of appropriate and predetermined action and response measures (IMP 2014).

In 2015 TARP training was provided to all teams on all shafts which was focused on the recognition and response to ground conditions. In 2016 regular refresher training was given to ensure that TARP was applied as intended and management was required to check and monitor understanding and compliance by every team.

The system was fully rolled out at Impala Rustenburg and Marula was finalising its roll out (IMP 2015).

6.5 EMERGENCY PREPAREDNESS

In 2014 Implats assessed and improved an emergency preparedness and response plan at Rustenburg and Marula, specifically relating to proto teams, control rooms, refuge bays and self-contained self-rescuers that were areas of concern following the major fire and disaster at Harmony's Doornkop Mine in February 2014 (IMP 2014).

7 IMPLATS SAFETY PERFORMANCE

7.1 FATAL INCIDENTS

101 Employees lost their lives at Implats between 2007 and 2016 as shown in Figure 3 (IMP 2007-2016).

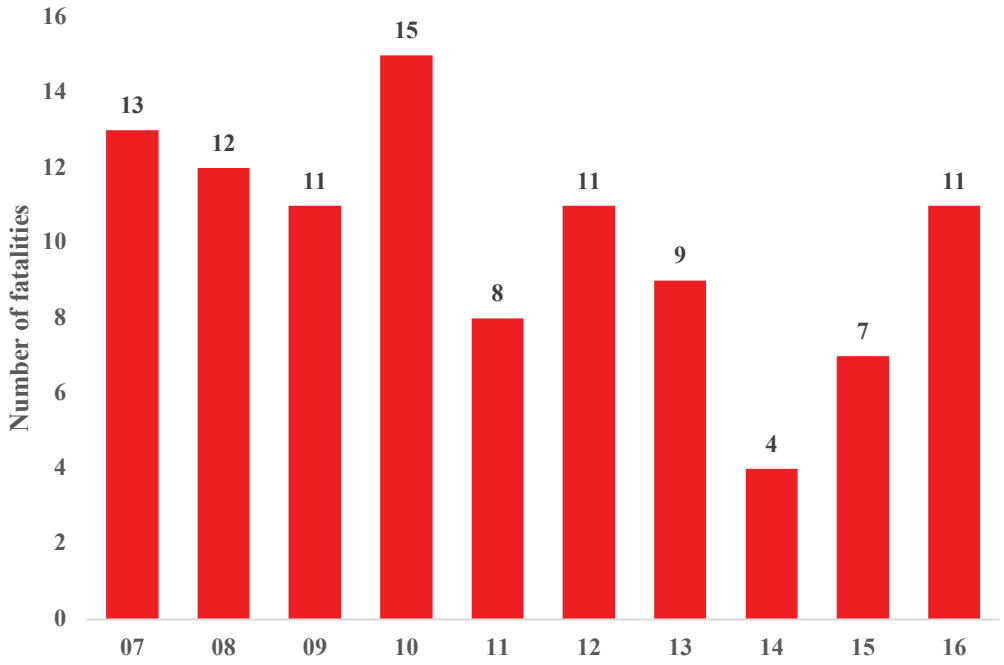


Figure 5 101 Fatalities at Implats, 2007-2016 (IMP 2007-2016).

In 2007 thirteen fatalities occurred, nine fatalities were at Impala's Rustenburg operations, three at Mimosa and one at Marula. The primary cause of fatal accidents was falls of ground (62%), followed by explosives (23%) and gassing (15%) (IMP 2007).

In 2008 twelve fatalities occurred at Implats' managed operations, five at Impala Rustenburg, three at Marula, three at Zimplats and one at Mimosa. The causes of the fatalities were falls of ground (50%), explosives (26%) and machinery (16%) (IMP 2008).

In 2009 eleven fatalities occurred at Implats' managed operations, of which ten fatalities occurred at Rustenburg, and one at Marula (IMP 2009).

In 2010 fifteen fatalities occurred at Implats. On 20th July 2009 nine employees lost their lives in a massive fall-of-ground incident. A further six fatalities occurred, two were due to further falls-of-ground, two from a methane gas explosion and two were underground transport related (IMP 2010).

In 2011 eight fatalities occurred at Implats of which seven fatalities occurred at Rustenburg (IMP 2011).

In 2012 twelve fatalities occurred at Implats, seven employees and five contractors of which eleven fatalities occurred at Impala's Rustenburg operation. Seven of these fatalities were caused by falls of ground, two were caused by truck and tramming incidents, one was from a winch moving incident and one fatality involved explosives. At Marula Platinum one employee drowned in shallow water whilst at work underground (IMP 2012).

In 2013 nine fatalities occurred at Implats, eight employees and one contractor of which nine fatalities occurred at Impala's Rustenburg operation. Three of these fatalities were explosion related, three were scraper related and there was one incident each due to inundation, equipment handling and trucks / tramming (IMP 2013).

In 2014 four fatalities occurred at Implats of which two fatalities were caused by falls of ground, one involved a locomotive and another involved a fatal electrocution (IMP 2014).

In 2015 seven fatalities occurred at Implats, five employees and two contractors. Six of the fatal incidents occurred at Impala Rustenburg and one was at Marula (IMP 2015).

In 2016 nine fatalities occurred at Implats in five separate safety-related incidents at Impala Rustenburg. Three fatalities occurred due to fall-of-ground incidents and four fatalities occurred due to smoke inhalation while making their way to safety after an underground fire (IMP 2016).

8 SUMMARY

In 2007 the Implats Board reconfirmed the commitment to safety and a safer work environment at Implats and to a policy of 'Zero Harm' in the longer term and was pursuing this challenge with vigour (IMP 2007). The company had several economic challenges and leadership changes since 2007. Employee relations had been problematic during the same period which finally resulted in AMCU becoming the majority union in 2014.

In 2008 the operating environment was one of the toughest years that the company experienced. Some of the challenges faced were safety, the power crisis, industry-wide skills shortages, escalating input costs and socio-political issues. The combined effect was a supply shortfall from the South African producers, with a more significant impact expected on medium to long term supply growth prospects (IMP 2008).

The first half of 2009 was dominated by the US sub-prime crisis, which sparked the near-collapse of the global financial system and plunged the world into recession.

The company was plagued by Department of Mineral Resources issuing of the Mine Health and Safety Act Section 54 work stoppage notices. In February 2015 the Implats' CEO joined other platinum group CEOs in a meeting with the DMR Minister to highlight the negative impact that unjustified work stoppages were having on productivity and profitability.

In 2010 despite a disappointing safety performance for the Group, several operations delivered world-class safety achievements. The lack of mining flexibility meant increased mining in remnant areas with the concomitant reduction in productivity. The company was also in a transition period of older infrastructure reaching the end of its life and new infrastructure being started up. Implats engaged DuPont to objectively benchmark the safety management practices against world-class best safety practices. The DuPont safety review reflected that the Group needed to adjust its approach to safety, so as to recognise

that it operated in a ‘dependency’ culture and a more active and direct enforcement of adherence to the important platinum safety rules was needed. The safety culture of all employees needed to change for Implats to achieve its safety goal (IMP 2010).

In 2012 Implats joined the Chamber of Mines (COM) as a full member. It was acknowledged that the company leadership, strategy, management style and systems contributed to its safety performance, as the company did not previously actively participate in industry initiatives to work towards ‘Zero Harm’. The Implats Chief Executive Officer (CEO) became actively involved in the COM CEO’s “Elimination of Fatalities” team.

The management was actively participating in tripartite including government, industry and labour efforts to achieve sustainable safety improvements within the sector. Implats planned to train 3 200 safety representatives by 2014 and further institutionalise the DuPont STOP process; It was planned to equip all underground employees with self-contained self-rescuers, which were purchased, for a full roll-out during 2014. The entire centralised blasting system was replaced over a two-year period as it offered much-improved levels of safety and reliability of the current blasting operations. The replacement of all of its conveyor belts with retardant conveyor belts was to be implemented in 2014. A revised methane management plan and associated initiatives was developed to cater for increased flammable gas intersections being encountered on some of the deeper shafts at Impala (IMP 2012)

In 2013 Implats commenced with implementing leading practice on the adoption of new technology as advocated by the COM. In 2014 the required change in the Implats safety culture was to be achieved through leadership and using the COM Five Pillar Cultural Transformation Framework. Implats’ view was that safety and health was an absolute imperative and the Group would continue to drive all of the associated initiatives with conviction (IMP 2013).

In 2014 the company continued focus on ensuring that all operations had behaviour-based safety programmes in place (IMP 2014). It was a watershed year

for the South African platinum sector after the turbulence of the two previous years, each of which had been seen as the most difficult and challenging in the sector's history. A crippling five-month strike across the platinum belt in Rustenburg, a subdued global Platinum Group Metals market, an ongoing rise in unit production costs, and a further reduction in margins and productivity put the company at significant risk.

In 2015 a set of 'critical safe behaviours' for 13 critical mining occupations and nine critical occupations at the processing division was developed in collaboration with the HSE representatives.

In 2016 Implats continued to work with the COM, industry bodies, relevant government departments, political leaders, labour representatives and community organisations to find solutions to some of the collective societal challenges it faced.

Implats experienced its lowest ever 12-month moving average fatal-injury frequency rate. The South African operations reported zero fatal incidents for a nine-month period, which was marred by 11 fatalities subsequently in the same year. The Chief Executive Officer resigned.

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