

Defining a Zero Harm Positive Safety Culture by applying mindfulness based high-performance, thinking strategies.

Final Report

South 32 – Appin Mine



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Executive Summary

Safety management has evolved into a sophisticated function essential for good business outcomes. That said, simple, reoccurring injuries still occur despite extensive analysis of their cause and implementation of practice-based solutions. The analysis of the mental processes involved in these accidents has led to a new safety management approach based on human belief systems and the mind's function.

This research project focuses on the utilisation of mindfulness and high performance thinking strategies, as a way to embed a safety culture that aligns to zero-harm outcomes.

The project involved both leadership and workforce roles in this process. The workforce component, (Mindsense Safety – Worker) involved a fusion of risk management training and team-based workshops to assist workers to define the best version of their team, and condition their skills, values and beliefs to create a self-established positive safety culture. The mindful safety leadership component (Mindsense Safety – Leader) utilised workshops and one-on-one coaching to enable leaders to embed, support and inspire their workforce groups in the context of the desired safety culture.

Evidence collected over the six-month project period found that the Mindsense Safety Program improved the safety culture, improved leadership/ workforce alignment, improved safety leadership, and lessened the impact of the unstable workplace environment (undergoing restructuring) on the incident frequency rate.

The program did not mitigate all injury-causing factors, but did introduce a level of safety resilience within the project group compared the control group. The program also functioned to minimise cultural impact during a highly challenging business period.

The Global Safety Index cultural measuring program used to monitor cultural and leadership trends, worked well to track cultural data in real time and provide evidence of the program impacts.

Key Results

- **A16.4 improvement in the Safety Culture Index relative to the control group.** The project group increased their SCI by 5.1 whilst the control group decreased by 11.5.
- Improved safety resilience against incident causing factors with a **2.93 times reduction in incident frequency rate relative to the control group.**
- All key cultural drivers were improved in the project group whilst the control group decreased in all areas. Some project group drivers doubled where control group drivers were quartered.
- An increase in leadership/ workforce alignment relative to the control group, which exhibited degradation in leadership/ worker alignment.
- Significant improvement in the key safety drivers in the project group relative to the control group, primarily in the areas of work environment perception and management communications.
- The program was unable to stop an increase of incidents occurring within a high change, restructuring environment.



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Project Background

Introduction

Worker safety is a key component in any good business. The ability to preserve and maintain the health of a company's human resources is paramount. In 2009, worldwide, a worker died at work every 15 seconds⁽¹⁾. Over 500,000 safety incidents were recorded in Australia during 2009⁽¹⁾. The cost of mismanaged safety in Australia is estimated at \$60 billion. The argument for safety is not only ethical but clearly economic⁽²⁾. Fast forward to 2012 and the picture is not improving. The International Labour Organization estimates 2.3 million diseases and 474 million accidents are experienced annually by workplaces. They also estimate the social and economic costs of these accidents and diseases is approximately 4 percent of Global Gross Product⁽¹⁾⁽³⁾.

There have been large improvements in safety over recent decades with data to support these improvements. To look specifically at coal mining, the rate of injury within the industry has reduced markedly, but data indicates a plateauing trend over recent years. All the key incident frequency rates (Fatality, Lost Time Injury, Total Recordable Injury) have plateaued. Perhaps more concerning is the Serious Bodily Injury (SBI) Frequency Rate, which has almost doubled in the past year. This is despite increased rigour in regulatory framework and governance, along with a solid commitment by industry and government to reduce safety incidents⁽⁴⁾.

In 2015, the most common injury factor was the interaction of workers with their environment. The most common injury type was hand injuries, primarily from a crushing mechanism. These are simple injury types with easily understood mechanisms. A large amount of effort and resources are applied to this type of injury yet, the fact remains that they keep reoccurring. It appears that the previous safety approaches, however complex and sophisticated, have failed to address these simple injury events.

Historical Approaches to Safety Management

Recent work looking at the history of safety management has allowed a theoretical framework to be created to clarify the evolution of safety in the workplace⁽³⁾. Pillay has proposed that there are five progressive ages of safety management.

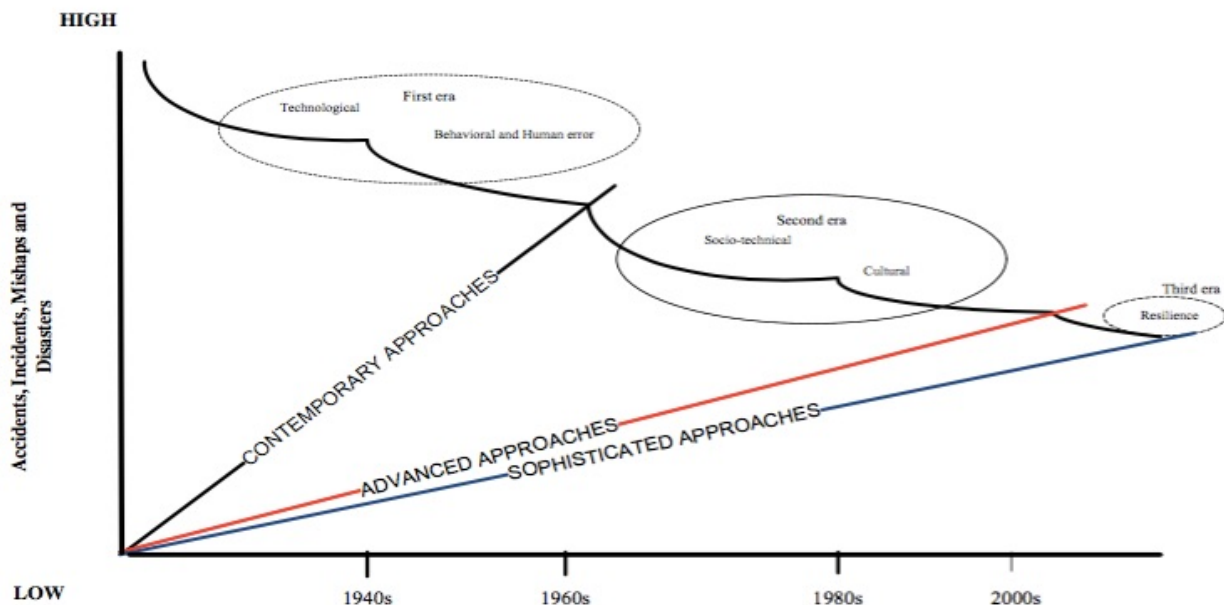


Diagram No. 1: The Five Ages and Three Eras of Safety⁽³⁾

The ages have evolved from a theoretical approach to safety management, to a human behaviour and human error approach, followed by socio-economic and cultural age culminating in an age of safety resilience. Pillay further simplified these ages into three distinct eras; the contemporary era, the advanced era and the sophisticated era.

The increasing complexity of the world's worksites will require more sophisticated solutions, but when talking about how people interact with these environments, added complexity may in fact be counterproductive. Given the simple incident types discussed above, the definition of sophistication in safety may require rethinking.

Leonardo Di Vinci said "Simplicity is the ultimate sophistication". In the case of hands being crushed, the actions, the equipment, and the method are all relatively simple. The most complex part in this equation is the impetus behind these actions, that is, the thought processes of the worker. With almost all safety systems where we rely on human behaviour, the assumption is made that a worker is knowingly conscious, clearly perceiving and rationally acting⁽³²⁾. To question if this is a flawed assumption may offer a powerful insight that could shift the way we approach safety.

The workings of the mind, it's nature and it's role in creating incidents is a key focus for this project.

Resilience and the Mind

When resilience is discussed, particularly with regard to humans, the discussion often centres on psychology, mental strength, and more recently, the area of mindfulness. Resilience training

programs often involve emotional management techniques to ensure people remain mentally capable to manage their life. From a workplace perspective, resilient workplace programs engage in mental health initiatives in an effort to improve such factors as employee productivity, job satisfaction, motivation, cohesion, retention, conflict management and absenteeism.

Recent work in the area of leadership is finding that mental management is having profound effects in the area of managing stress (both in teams and on the leaders), managing reactive emotions, increasing attention memory, empathy, and in increasing a leader's level of perception of reality ⁽³⁰⁾. The mental management tools discussed, centre primarily on mindfulness and its ability to deliver leadership outcomes. Pillay's proposed resilience era in safety, given how resilience is managed in society, may be better expressed as an era in safety mindfulness.

An introduction to Mindfulness

There are several definitions for mindfulness with a common thread involving being "present" in the current situation. Dr. Jon Kabat-Zinn ⁽¹¹⁾, who is largely credited for bringing mindfulness to western culture, defines mindfulness as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally".

Although there is no universally accepted definition of mindfulness, there can be little doubt that it is a concept whose time has come, with an exponential increase in research occurring in the area over recent years.

There appears to have been a divergence in eastern and western cultural definitions of mindfulness, primarily due to their application. Weick and Putnam ⁽⁷⁾ reviewed the differences, sighting a similar definition to Kabat-Zinn as an eastern definition. The western definition comes from Langer who stated, "mindfulness is a flexible state of mind in which we are actively engaged in the present, noticing new things and sensitive to context" ⁽⁸⁾. A common theme for both definitions is development of attention and internal focus as a way of achieving a result ⁽⁹⁾.

Mindfulness has been used in a range of pursuits such as medicine ⁽¹¹⁾, clinical psychology ⁽¹²⁾, psychological wellbeing ⁽¹⁹⁾, law ⁽¹³⁾, the military ⁽¹⁴⁾, corporations ⁽¹⁵⁾, management schools ⁽¹⁶⁾⁽²⁵⁾, and professional sports ⁽¹⁷⁾.

An important function of mindfulness is generating understanding of how the mind functions. Mindfulness acts to address the basic human condition of consciousness and the ability to mentally focus. Increasing psychological evidence is uncovering that up to 90% of human actions are not conscious, but are sub-conscious patterns and processes that are automated, and go largely unnoticed ⁽³³⁾. These automatic-style operations are executed in different regions of the mind and are enacted in a rigid and mechanical manner.

Automatic processes function well in a stable, predictable environment as they are efficient and require little effort to produce a known result. Placed in more unpredictable environments, automatic processes have limited ability to adapt and will act to hinder rather than assist in producing a result.

Applying this insight into the mind and its propensity towards automation may offer some understanding in respect to simple safety incidents. Given a scenario where a less stable environment evolves in the worksite, if the mind is not aware of it, the mental processes applied may be inappropriate for the situation, and lead to a mismatch of the behaviour to the environment. The simple act of crushing a finger could be a case of not being “conscious” or mindful at a particular time as opposed to knowingly making a mistake.

Mindfulness and Safety


Mindfulness applications in safety is new territory, with only a few studies conducted in this space at this time. Studies have focused on mindfulness as a way to limit mental distractions and increase mental focus⁽²⁰⁾ in the area of driving performance⁽¹⁰⁾. Weick and Sutcliffe developed the concept of High Reliability Organisations (HROs) which are a subset of hazardous organisations that enjoy a high level of safety over long periods of time. They coined the concept of “organisational mindfulness” as a way to deliver this standard of safety performance. Their definition of mindfulness differs from a traditional version, theorising that if five organisational facets are achieved, the effect would generate an organisation that is mindful in the way it operates⁽⁶⁾.

Traditional safety models have focused on attentiveness and having higher degrees of situational awareness. Reason listed attention failure as one of the four human error causes⁽³⁰⁾. In the mindfulness paradigm, attention failure may not be so much a case of attention failure, but a failure to pay attention to the correct facet. For this reason, using mindfulness as a tool to prevent human error is a focus area for this research.

Zero-Harm Organisations

The term zero-harm has been part of the safety landscape for some time. It is increasingly viewed by society as the only acceptable result, making the idea of “budgeting” for incidents difficult to justify.

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 a very low rate of injuries (in fact, zero injuries) over an extended period of time. Safety data suggests this has proven difficult for many worksites to achieve. Weick and Sutcliffe’s definition of a HRO aligns closely to the ideals of zero-harm.

A worksite that achieves a low rate of injuries over a long period of time could be said to have operated in a high-performance manner. An extension to this statement would be that workers at a low-incident worksite could be seen as operating as a high-performance team. 

High-performance teams outperform all other similar teams and they outperform expectations given their composition⁽⁵⁾. Zero-harm teams and high-performance would therefore appear to have the same definition.

The concept of applying high-performance strategies is a key focus of this research project.

High Performance and Mindfulness

The use mindfulness for high-performance outcomes has been common over recent decades. Several studies have been conducted in the areas of elite swimming⁽²²⁾, basketball⁽¹⁷⁾, long distance running, arching and rowing⁽²³⁾. Early work centred on the concept of Mindfulness-Acceptance-Commitment (MAC)⁽²⁴⁾, to achieve optimal outcomes.

It should be noted that all of these pursuits practice a high level of technical competence with repetitive training the technical skills required for each respective disciplines. The safety equivalent for this would be excellent skills in risk management and hazard identification. For this reason, risk management technical skills are an integral part of the research program.

High performance thinking has been used for senior corporate executives to optimise their performance and to maximise business outcomes. Minimal empirical data exists to determine the effectiveness of these programs but qualitative evidence suggests they are effective.

An Australian-based high-performance program is the Mindsense program developed by Michael Duff. Mindsense has been applied at several blue-chip Australian companies for over a decade to achieve performance breakthroughs. The program incorporates both mindfulness and high-performance thinking techniques⁽²⁵⁾.

Mindsense works on the premise that successful people and teams have a strong “sense of themselves”. They have achieved this by working on their “self definition” or “self beliefs” in order to ensure the best version of themselves presents for the situation at hand⁽²⁵⁾. This in turn gives the person or team the best chance at producing their best performance. They also have an intimate understanding on the way their mind functions.

The Mindsense program uses mindfulness to allow a higher level of mental awareness to be maintained. This enables observation of the mind’s automatic workings and habits, and allows the individual to bring conscious thought to automatic processes. Mindsense works on the concept of a dual mind; the conscious and subconscious parts⁽³²⁾. This is consistent with eastern mindfulness processes, and is also supported by Daniel Kahneman’s work, Think Fast and Slow⁽²⁶⁾. Kahneman dual mind explanation, system one and system two, centres more on the nature of each mind type.

The subconscious mind is described as the historical mind. It is the repository of beliefs, values,

habits and the majority of our behavioural patterns that have accrued over time. It would be where a person's "sense of self" resides. Consistent with Wilson's observations, 90% of our behaviours and thoughts could be attributed to the subconscious. Kahneman describes this as the System one mind. He adds that system one thinking is fast acting, doesn't double-check and makes confident assumptions.

The conscious mind deals with the "present" which works to problem solve and think rationally in a singular thought process. Kahneman describes this as system two thinking that by nature works slowly, feels like hard work, and deals with one issue at a time.

Kahneman's description aligns with eastern style mindfulness as well as Duff's definition of the dual minds.

Duff extends on the idea that the subconscious mind requires a level of predictability and will act to keep it this way, avoiding change where necessary⁽²⁵⁾. His definition associates the subconscious mind with our "comfort zone" or our predictability zone. The resistance to change is said to automatically come from the mind itself. Having a force against change within the mind offers explanation for the difficulty people experience when having to break habit and change behaviours. On an organisational level, it may also explain the difficulty encountered when effecting cultural change.

By using mindfulness, individuals gain the ability to observe the dualistic nature of mind, in particular an individual's beliefs. The Mindsense techniques work to consciously observe and then manage these beliefs toward more appropriate beliefs aligned to high performance.

Safety Culture and the Mindsense Safety Program

Although there are variations in the definition of safety culture, all definitions include a component relating to beliefs and values. Uttal's⁽²⁷⁾ definition of "Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioural norms" captures the essence of most safety culture definitions.

James Reason's work in culture noted at least two ways of treating safety culture: as something an organisation is (the beliefs, attitudes and values of its members regarding the pursuit of safety) and as something that an organisation has (the structures, practices, controls and policies designed to enhance safety)⁽²⁸⁾. Both are seen as essential for achieving an effective safety culture.

Reason⁽²⁹⁾ also stated that "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". Given Reason's insights, the "resilience" of a safety culture is paramount and should exist within the common structure of the business. The ideal

situation would be to integrate both interpretations of safety culture into the one model. That is, embedding structures, practices, controls and policies that are designed to align beliefs, attitudes and values of its members.

An attractive aspect of the Mindsense Safety model is that it combines both of Reason's ideals. It works to not only make people mindful of their current beliefs and self definition by utilising mindfulness, it provides a structure to consciously condition these beliefs toward an optimum version of the workforce. It also offers a path of less resistance by giving explanation to the "uncomfortable" aspect of changing our beliefs and values.

Extending this paradigm to a team level, a common set of values and beliefs that embody the future state could be seen as a culture. By defining the "best version of the workforce", we are in fact defining the best "values and beliefs" of that workforce. The best values and beliefs of the workforce would, by definition be the best safety culture of the workforce.

By defining the best safety culture of the workforce, a defined goal is created and the highest-performing culture possible from the current workforce can then be conditioned.

Mindful Safety Leadership and the Mindsense Safety Program

In order to achieve zero-harm outcomes, organisations will have to change the way they function. The current safety data trends support this assumption.

The driving force behind any change in an organisation is leadership. Being able to achieve zero-harm will present new leadership challenges which will need to be considered appropriately.

Heifetz distinguishes two classes of challenge that leaders are likely to face: technical problems and adaptive ones ⁽³¹⁾. Technical problems, though possibly complex and difficult, can be addressed with existing ways of perceiving and understanding; they are known problems with known solutions based on past experience. Adaptive challenges differ from technical challenges because both the problem and the solution may not be recognised and understood within current paradigms. Adaptive challenges call upon leaders to grow toward more sophisticated (or simplistic) ways of seeing and thinking, acting and relating.

Leadership training thus far has tended to focus on retrospective analyses of past action or on future-oriented creations of visions and goals ⁽³³⁾. Given current incident data ⁽¹⁾ and trends, adaptive leadership will be necessary to facilitate the change to a zero incident environment.

Adaptive leaders cultivate the skills of managing themselves if they skilfully work with others to meet the challenge of adaptive problems ⁽³³⁾⁽³⁴⁾. Mindfulness by its nature appears an excellent tool to enable this. Mindfulness would also give increased insight into not only a leader's own thought

processes, but the behaviours and thoughts of their workers.

Duff's application of mindfulness also gives tools for a leader to understand "change resistance". The leader can see resistance as an issue rooted in the nature of mind, rather than a fault within the person's motivation. This insight allows for a more empathetic leadership approach as opposed to the manipulative approach that is often resorted to.

Understanding the nature of mind may also offer solutions to common leadership challenges such as stress management, conflict management, managing reactive emotions, cultivating empathy, making better decisions and being creative and innovative^(s).

Mindful leadership as a tool of embedding a newly defined safety culture was a key component of this research work.

Project Information

Research Site – Appin Coal Mine

The Appin Coal Mine (APNM) is located in the Wollondilly Region of New South Wales, 25 kilometres North West of Wollongong. It is an underground coal mine that started using a longwall mining technique in 1969 and continues to mine use this method today.

APNM is owned by South 32 through its wholly owned subsidiary, Illawarra Coal. Illawarra Coal also owns and operates Dendrobium coal mine, which is located in the New South Wales Southern Coalfields. The company operates two coal processing, one at the Dendrobium Colliery and the other at the North Appin Colliery.

A new operation, the Appin Area 9 Project has effectively replaced the West Cliff Mine. When operational, the Appin Area 9 Project will increase Appin Collieries production by 3.5 million tonnes of coking coal a year, therefore retaining the company's annual production of nine million tonnes annually. The Appin Area 9 Project includes the construction of roads, ventilation infrastructure, reconfigured and new conveyors and other mine requirements.

The mine employs approximately 1500 workers with approximately 40% of these workers being contractors.

Industry downturn and Appin Coal Mine

Over recent times, there has been significant change in the coal mining landscape worldwide. A significant period of growth and expansion has quickly ceased with a severe retraction in demand and coal price hitting the coal industry hard as a whole. Several large mining companies have had large profit down grades, major restructure, mine closures and in some cases, voluntary administration.

Illawarra Coal (South 32) and Appin Coal Mine have not been immune to this with significant change occurring at all levels of the South 32 business. A summary of the major changes that are culturally significant at Appin Coal Mine is detailed in the timeline below.

Date	Event
Pre-August 2014	Significant expansion in the Appin Coal mine with Area 9 project from 700 people to a total of 1500 workers. Plan is to amalgamate both Appin Mine (APNM) & West Cliff Mine (WCM) into one mine. Both mines have been operating independently for an extended period (20+ years) and have developed a unique culture at each site
Pre-August 2014	Severe downturn in the coal industry with a large coal prices retraction. This places pressure on the industry to make changes to reign in costs to operate profitably.
Pre-August 2014	Extensive cultural change programs conducted at WCM in order to arrive at a culture that aligns with Illawarra Coal's just culture aims. This does not occur at APNM at this time.
August 2014	Announcement made to divest Illawarra Coal into a new Company (South32).
August – December 2014	Initiation of process to restructure of Illawarra Coal (BHP Billiton subsidiary) to new South32 structure.
December 2014	Integration of Appin Mine (APNM) & West Cliff Mine (WCM) commences. This involved two mines with specific cultures and structures together to form one mine
December 2014	Small groups transitioned from WCM across to Appin. Significant difficulties were faced by WCM to have their training recognised at APNM when they transitioned across. There was a perceived unwillingness to accept the standards of training from WCM to have been equivalent to APNM.
December 2014	New General Manager announced at Appin Colliery (AC) General Manager was previously working at WCM.

Date	Event
February 2015	New General Manager announces new APNM lead team. The new team has a higher proportion of WCM managers to APNM Managers take on Manager roles under the new structure
February 2015	A “Just Culture” Model is launched at APNM
February/ May 2015	<p>Initiated “Working Together” workshops at ACM as an act to integrate the 2 sites. These involved the “what good looks like creation & experiences” programs. These were held with Appin Coal Mine Lead Team initially, followed by each Manager with their Superintendents, then Superintendents facilitated a similar experience with Supervisors.</p> <p>Town Hall meetings were held for general staff and operator/trades to cover the “Working Together” outcomes.</p>
May 2015	Illawarra Coal divested from BHPB as a part of South 32.
December 2015	Mindsense Safety Program commenced
August 2015 - January 2016	Enterprise Bargaining Agreement negotiated and finalised.
January 2016	Corporate roles for South 32 finalised. Several Senior Managers
January 2016	Headcount reduction of approx. 300 people announced. Approx. 70 employees to be involved and the rest are contractors.
March to May 2016	Restructure processes commenced. All staff jobs are made redundant and new company structure implemented (with 300 less people). All staff roles reapplied for with a change of job description and reduction in wages in some cases.
June 2016	Restructure processes finalised. Safety and training departments have reduced numbers (from 16 people to 2 across the business in 2 years)

Table No. 1: Appin Mine Site Event Log

Typically, this level of change within a workplace impacts on safety culture and on safety

performance. As the change could be perceived as negative, a negative trend in the safety performance and cultural metrics could reasonably be expected during the project period.

Project Method

Project Objective

The project was structured to answer the following questions:

1. Can a worksite define and achieve a zero-harm safety culture utilising mindfulness based high-performance thinking techniques?
2. Can a mine track and benchmark their safety culture in real-time?

Project Set Up

The Mindsense Safety Program was conducted as a pilot intervention in the Area 9 Development section of the mine. The project involved delivering the program to 49 participants in both operational and leadership positions. A breakdown of the project group participants is outlined below.

1	General Manager
3	Senior Managers
4	Superintendents/ Undermanagers
4	Supervisors
37	Operators
49	Participants

A control group was established as a way to capture factors that impact the site's safety culture (and consequently, safety performance). This allowed the impact of the intervention to be measured against a group that did not undergo the program. The control group was selected to ensure that a direct comparison with the project group could be made. The factors considered included:

- Work type (both development crews)
- Work location (both in the Area 9 headings in parallel panels (901 and 902))
- Crew structure (numbers)
- Crew systems (prestart meetings, toolbox meetings, rosters)
- Group demographics (age, tenure, job role)

The control group contained 19 participants in both operational and leadership positions. A breakdown of the Control Group participants is outlined below.

3	Senior Managers
2	Superintendents/ Undermanagers
2	Supervisors
12	Operators
19	Participants

Project Activities

The project was made up of three phases:


Safety Culture Review – conducted November 2015

- Revealed culture related issues onsite that could impact on the project
- Gave an assessment of the maturity of safety systems onsite
- Allowed for customisation of future Mindsense Safety Program sessions

Safety Skills Training – conducted December 2015

- Provided technical risk management skills to manage safety risk. These training programs were aligned to RIIRIS competencies.

Mindsense Safety Program

- Mindsense Safety Worker (Worker/ Leader) – conducted December 2015
 - Involved crew-based workshops in mindfulness and high-performance thinking strategies in order to form a “team cultural code” that embodies the “best version of the crew”. 
 - Prepared of Safe Minds Cards and program materials
- Mindsense Safety Leader (Leader Only) – conducted December 2015 - January 2016
 - Involved extended Mindful Leadership training for leadership positions to “coach” and “embed” the high-performance thinking strategies.
 - Monthly One-on-One Leadership coaching (One hour/ session/ Leader – min 6 sessions)
 - The coaching enabled leaders to embed and champion the Mindsense Safety thinking principals into their workforce.
 - The coaching also allowed for personal development (supported by the Mindsense Safety journal) as well as developing plans to develop their workforce A schedule of sessions conducted is outlined below.

Position	Feb	Mar	April	May
General Manager	26/02/16	16/03/16	13/04/16	19/05/16
Senior Manager	17/02/16	4/04/16		19/05/16
Senior Manager		16/03/16	13/04/16	19/05/16
Senior Manager	17/02/16	16/03/16	13/04/16	19/05/16
Superintendent	17/02/16	16/03/16	13/04/16	19/05/16
Superintendent	17/02/16	16/03/16	13/04/16	19/05/16
Superintendent	17/02/16	16/03/16	13/04/16	17/05/16
Superintendent		16/03/16	13/04/16	17/05/16
Supervisor			13/04/16	19/05/16
Supervisor		29/02/16	4/04/16	17/05/16
Supervisor				17/05/16
Supervisor			4/04/16	
Advisor	29/02/16	4/04/16	13/04/16	17/05/16
Attendance	54%	77%	85%	92%

Table No. 2: Leadership coaching schedule

The steady increase in participation rate was anecdotally attributed to the perceived value of the program.

Measurement of Project Results

In order to measure the effectiveness of the intervention, the following metrics were undertaken:

- Safety Statistics (Lag indicators – incident data)
- Real-time cultural and leadership data derived from an Online Culture and Leadership Survey Tool

Each measure was recorded for both the project and control groups to allow relative comparisons to be made between the two groups.

Safety Statistics

Injury metrics were measured over the period of the study for both project and control groups. The nature of the available data has meant that the most appropriate incident frequency rate would be calculated as:

$$\text{Incident Frequency Rate} = \text{Injuries} / \text{person} / \text{time period}$$

The goal of this calculation was to compare before and after measures for both the project and control groups. The rate (or percentage) of change would then act as a measure of the ultimate effectiveness of the intervention.

Cultural and leadership data

Two survey types were engaged to measure project impact:

- Safety Culture Index (SCI) - a measure of the cultural make up of a group
- Safety Leadership Index (SLI) - a measure of the safety leadership capability of a group

Safety Culture Index

The survey comprised of 56 base questions and 5 additional customised questions. The nature of the questions related to the site's culture and most questions were not personally focused (that is, about the individual)

The survey contains several key attitude measures, or dimensions:

- Organisational Context
- Social Environment
- Individual Appreciation
- Work Environment

A brief description of each dimension is provided below:

Organisational Context

- Management Commitment
 - Perceptions of management's overt commitment to health and safety issues. Included in this dimension is the way management acts towards a safety issue or incident and their attitude to employee safety
- Communication
 - The nature and efficiency of health and safety communications within the organisation. This dimension covers both upwards and downwards communication about safety.
- Priority of Safety
 - The relative status of health and safety issues within the organisation. In particular, the issue of productivity vs safety is examined.
- Safety Rules and Procedures
 - Views on the efficacy and necessity of rules and procedures. Examines how committed the organisation is to the rules and procedures in place.

Social Environment

- Supportive Environment
 - The nature of the social environment at work, and the support derived from it. This dimension explores the interaction of employees at work in a safety context.
- Involvement
 - The extent to which safety is a focus for everyone and all are involved.

Individual Appreciation

- Personal Priorities and Need for Safety
 - The individual's view of their own health and safety management and need to feel safe, Personal Appreciation of Risk - How individuals view the risk associated with work.

Work Environment

- Physical Work Environment
 - Perceptions of the nature of the physical environment. This dimension examines whether the time and equipment is available for a task to be completed safely.

In addition to these dimensions, 14 key drivers underpin these results.

- Safety Values:
 - Underpinning a strong safety culture is a series of beliefs. This group of Items address the values and beliefs of the employees.
- Employee Involvement:
 - The safety journey is not possible unless employees are involved in the process. These items look at the employee involvement in the safety decisions.
- Just Culture:
 - When employees are blamed whenever things go wrong, the openness and trust required for a complete reporting of all incidents and the development of systems and approaches to make the workplace safer is inhibited.
- Team Work:
 - Represents how well does each employee work as part of a team when addressing the safety of the workplace.
- Hazard/Risk Management:
 - The approach of employees and managers to reporting, finding solutions to and then closing the loop back to the employees for all incidents, near misses and hazard identification.
- Perception of Workplace:
 - Represents the perception the employees have of the workplace, as a safe place to

work.

- Production/Safety Trade-off:
 - The extent to which safety goals and production goals interact. Consistent Application : Represents the perception of whether safety rules and procedures are applied consistently across the organisation.
- Top Down Communications:
 - Represents the effectiveness of management in communicating the safety message.
- Bottom Up Communications:
 - Represents the involvement of employees in communicating incidents, near misses and hazards in the workplace.
- Training Outcomes:
 - Reflects the employees understanding of company's safety message. Systemic
- Approach:
 - Reflects whether the company updates the processes and procedures required to drive safety.
- Work Conditions:
 - Reflects the perception of whether there are enough people, equipment and time to support the safety goals of the organisation.
- Rewards and Recognition:
 - Reflects whether employees are rewarded or recognised for safety behaviours and results

Each question (item) required one of 5 responses as shown below:

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
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This “five response” result was then mapped to another 5 point scale as follows:

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
Very Negative	Negative	Neutral	Positive	Very Positive

Some of the items in the survey were negative items, that is, an agree response would be a negative result for the Safety Culture, and a disagree response would be a positive result.

The SCI was then calculated in three steps:

1. The Positive Index is calculated by adding up all the Positive and Very Positive answers and dividing by the number of respondents, then multiplying by 10
2. A negative index is calculated by adding up all the Negative and Very Negative answers and dividing by the number of respondents, then multiplying by 10.
3. The SCI is the (Positive Index minus the Negative Index) multiplied by 10.

Each answer was scored from 1 to 5 and a SCI was calculated from the results by subtracting the percentage of Disagree and Strongly Disagree from the percentage of Agree and Strongly Agree responses and then multiplying by 100. This results in an Index that ranges from -100 to 100.

Safety Leadership Index

The survey comprised 35 base questions. The questions related to the individual's leadership style, essentially a self-assessment of their skills in this area. As a consequence, the results from the survey are highly subjective and influenced by the leaders' perceptions of themselves.

The SLI reports the level of safety leadership capability as assessed by the survey respondents in this group. Questions are grouped into seven characteristics as shown below:

- Lead by Example
 - How well does the stakeholder lead by example regarding safety in the workplace?
- Set Clear Expectations:
 - Does the stakeholder set clear expectations regarding safety, safety performance, safe behaviours and process compliance with their team and other stakeholders?
- Involve Others:
 - Does the stakeholder actively involve others in safety related – decision making, problem solving, idea generation and attendance of meetings related to safety?
- Demonstrate Care and Commitment:
 - Does the stakeholder demonstrate care and commitment regarding the well-being of employees and contractors?
- Provide Feedback:
 - How often does the stakeholder provide feedback regarding safety to employees, peers and partners? Such as – Individual performance, observed behaviours, possible improvement ideas or general housekeeping feedback?
- Alignment and Awareness:
 - How well does the stakeholder truly understand the hazards and risks in his/her area? Does the individual ensure team members are aware and all share the commitment to a safe workplace?
- Skills and Capability:

- Does the stakeholder monitor applied skills and capabilities, and ensure that he/she and team members continually develop the skills and capabilities to identify and appropriately manage key hazards and risks?

Leadership is described on a 100 point scale as shown below:

Score	Description
20 to 30	Novice
31 to 50	Developing
51 to 70	Capable
71 to 90	Strong
91 to 100	High Performance

The answers given are scored from 1 to 5, 1 being the weakest answer and 5 being the strongest answer. Each characteristic as described above has 5 questions to be answered.

A score (from 20-100) for each characteristic as described above is calculated based on the minimum score of the questions in that area. That minimum is then increased towards the boundary with the next level descriptor based on the score of the other questions in the group of 5.

The same technique is applied to the scores across the 7 characteristics to create an individual score.

Project Outcomes

Safety Culture Review

A Safety Culture review was conducted in late November, 2015. The review involved two days as per the agreed scope. The review revealed a number of issues that were affecting the culture. The major points of concern were:

- General Uncertainly
 - Due to the vast changes that were occurring at all levels of the mine, the workforce was experiencing stress originating from high levels of uncertainty and change.
- Cultural Perceptions
 - The merging of the West Cliff and Appin workforces coupled with the introduction of a learning culture onsite has unsettled the cultural norms. A level of distrust existed due to the management team being perceived to be from a specific culture, creating an “us and them” situation
- Resource Management
 - The mine was stretched in the areas of equipment availability and manning
- Planning
 - The merging of systems between the two mines had disrupted the normal planning

processes. It was proving challenging and had aspects of inefficiency

- Variation in Leadership and Accountability
 - Stemming from the mine management structural changes, clear management alignment was found to be lacking and was being worked on within the senior leadership team
- Change Management
 - The systems around change management were not coping with the large amount of change. As a result, organic change approaches were being conducted.
- Communications and Feedback
 - This was a key issue across all levels of the business. The communication systems were struggling at a time when the need for information was particularly high.
- Training
 - The issues in training related mainly to the leadership and supervisory levels with variation across different areas of the business.
- Mine Standards
 - The melding of the two mine's systems had meant that a clear standard for operation was not yet finalised. This was frustrating the workforce as it was difficult to manage work quality.
- System Implementation and Effectiveness
 - The systems on site were in various levels of maturity and functionality.

Incident Data

Given the nature of the project and control groups and limited data on working hours, the comparison of most value is the injury per person frequency rate. An assumption was made that the hours worked per person before the project is the same as the hours worked during the project.

The table below shows a comparison of the project group and control group Incident Frequency Rates. The data is categorised into two measures; before and during the project.

Group	Incidents Before (26 months)	Incidents During (6 months)	No. of People	Incidents/ Person/ Month (Before)	Incidents/ Person/ Month (During)	% Variation
Control Group	29	7	49	0.023	0.0294	+26.1%
Project Group	10	3	19	0.021	0.023	+8.9%

Table No. 3: Project Group vs. Control Group - Incident per Person per Month Frequency Rate.

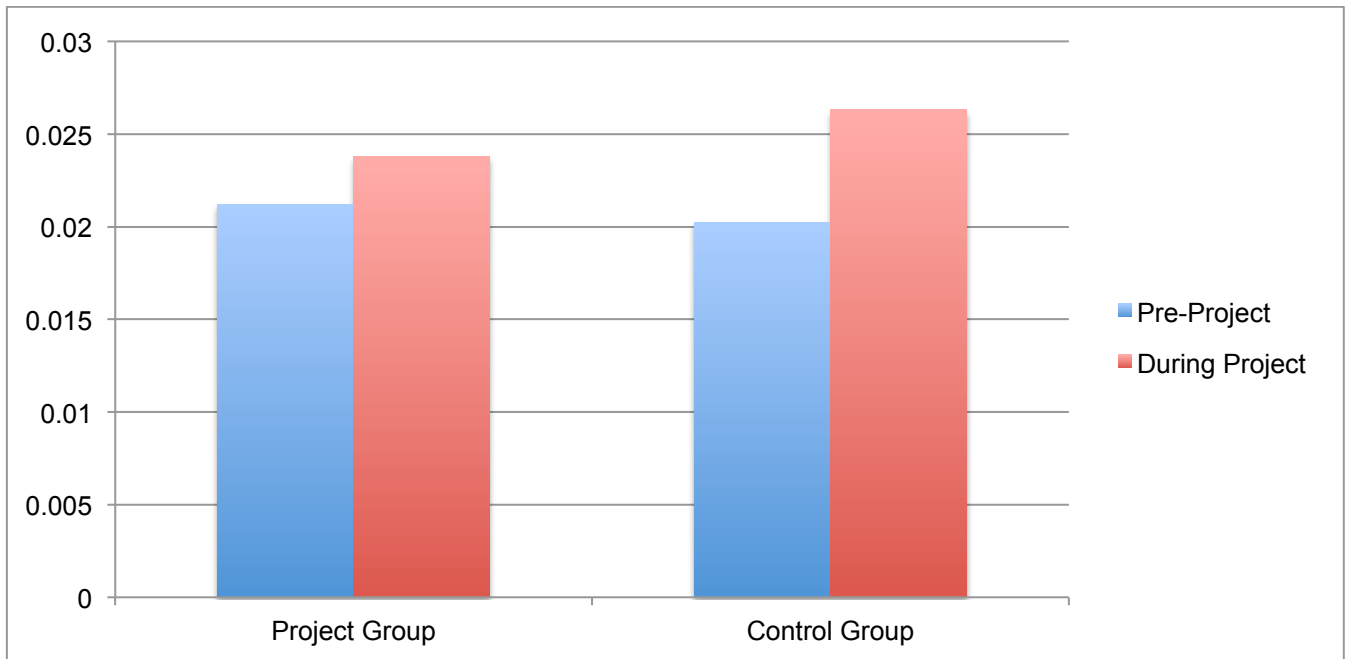




Chart No. 1: Project Group vs. Control Group - Incident per Person per Month Frequency Rate.

The data shows that both the project group and the control group incident rate rose during the project period. The results indicate a 26.1% increase in incident rate for the control group compared to an 8.9% increase in incident rate for the project group. This would indicate that the project group exhibited more resilience against the incident-causing forces within the business over the period.

The cause of the incident increase could be from various sources. Detailing the causes of each incident was not within the scope of this project, but given that the project and control groups have had similar construct and environment, the gap in results could reasonably be attributed to the Mindsense Safety program.  

Survey Data Summary

Three (3) surveying events were conducted for both the project and control groups:

- Initial Surveys (SCI and SLI) November 2015
- Pulse Surveys (SCI only) March 2016
- Final Surveys (SCI and SLI) June 2016

Safety Culture Index - Survey Data Summary

SCI Survey Participation Rates

Initial SCI Cultural Survey:

- Project Group: 49 employees (41 responses - 83.7% participation rate)
- Control Group: 19 employees (13 responses - 68.4% participation rate)

Pulse SCI Cultural Survey:

- Project Group: 49 employees (32 responses – 65.3% participation rate)
- Control Group: 19 employees (11 responses – 57.8% participation rate)

Final SCI Cultural Survey:

- Project Group: 49 employees (33 responses – 67.3% participation rate)
- Control Group: 19 employees (11 responses – 57.8% participation rate)

Participation rates were best in the initial survey and plateaued in the final two surveys.

Comparison of Safety Culture Index (SCI) Results

Control Group	SCI Before	SCI During	SCI After	SCI Change	Project vs. Control
SCI Index - Total	61.3	24.17	50.0	-11.3	16.41
A. Management Commitment	64.42	43.75	56.82	-7.6	11.7
B. Communication	60.26	29.69	36.36	-23.9	19.97
C. Safety as a Priority	76.92	90.63	59.09	-17.83	17.48
D. Safety Rules and Procedures	50.77	-81.25	40	-10.77	24.37
E. Supportive Environment	69.23	85.94	59.09	-10.14	5.68
F. Involvement	66.67	-12.5	50	-16.67	26.73
G. Personal Priorities	95.38	90.63	96.36	0.98	0.18
H. Personal Appreciation of Risk	44.87	-3.13	37.88	-6.99	14.53
I. Work Environment	36.54	-1.56	26.14	-10.4	27.19
Project Group	SCI Before	SCI During	SCI After	SCI Change	
SCI Index - Total	43.16	29.69	48.27	5.11	
A. Management Commitment	35.67	36.36	39.77	4.1	
B. Communication	48.37	45.45	44.44	-3.93	
C. Safety as a Priority	57.93	90.91	57.58	-0.35	
D. Safety Rules and Procedures	16.1	-36.36	29.7	13.6	
E. Supportive Environment	59.76	81.82	55.3	-4.46	
F. Involvement	39.43	-54.55	49.49	10.06	
G. Personal Priorities	87.32	90.91	88.48	1.16	
H. Personal Appreciation of Risk	39.43	-36.36	46.97	7.54	
I. Work Environment	17.68	4.55	34.47	16.79	

SCI Survey Results – Project and Control Groups

The following SCI Spider Chart comparison before and after the program.

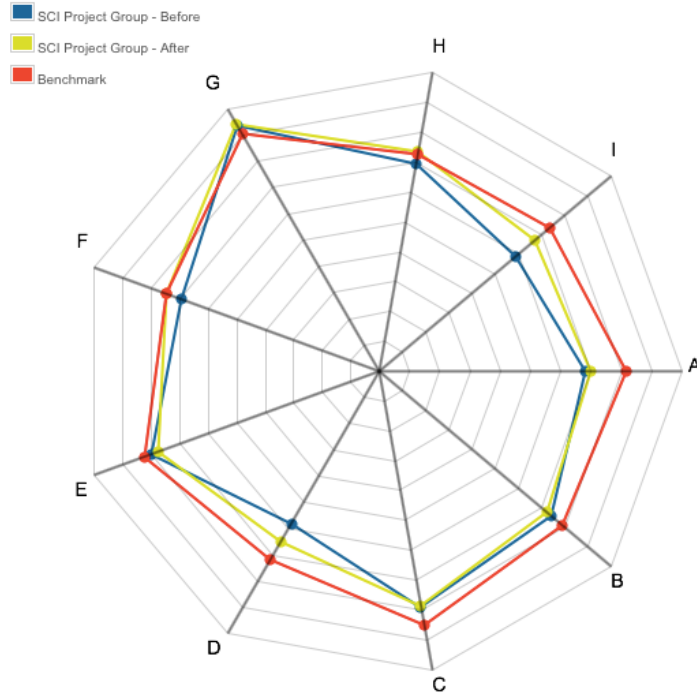


Chart No.2: Project Group SCI (Spider Diagram) - Before and After

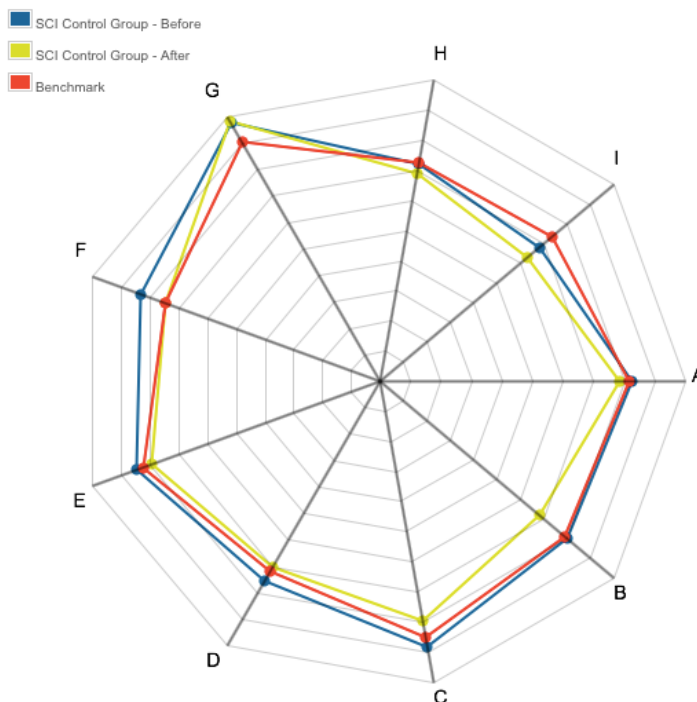


Chart No.3: Control Group SCI (Spider Diagram) - Before and After

The following charts show Heat Map comparisons before and after the program. Each box links directly to a question from the survey.

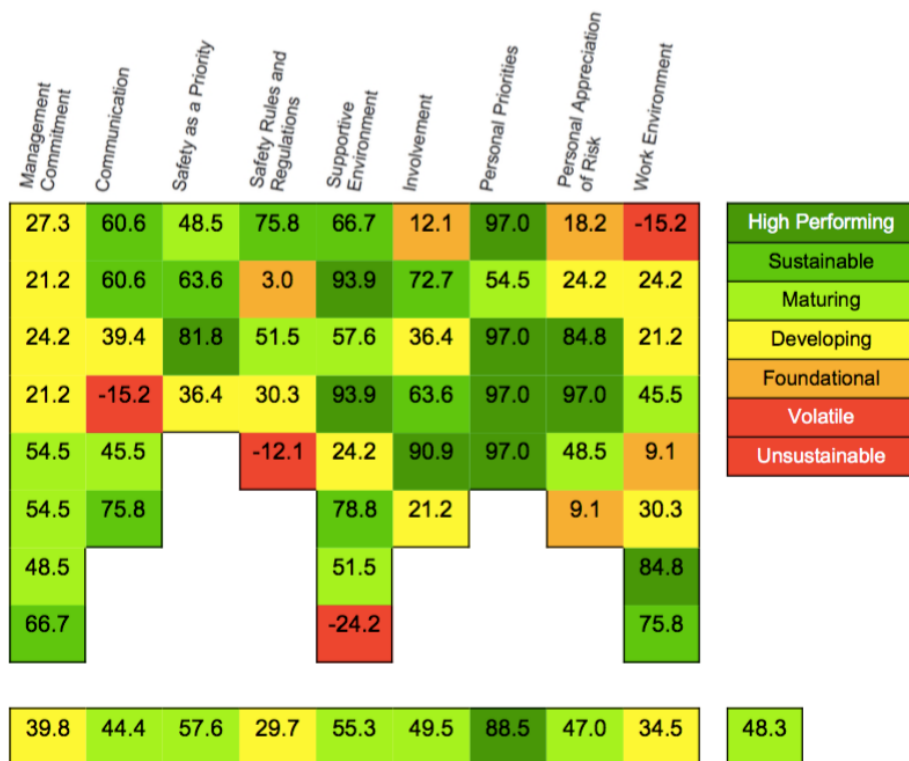
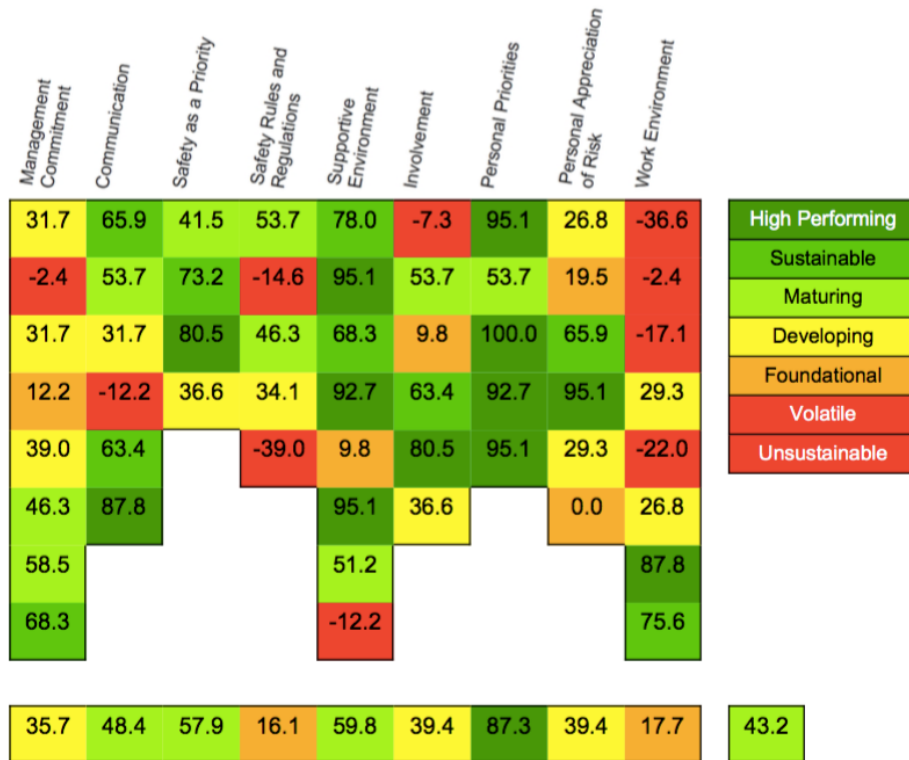


Chart No. 4 & 5: SCI Heat Map for Project Group – Before and After

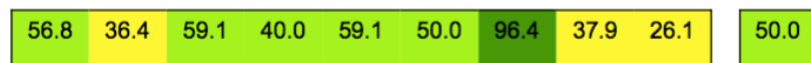
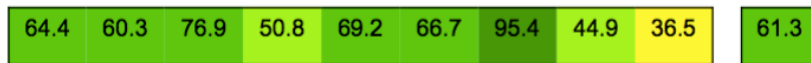


Chart No. 6 & 7: SCI Heat Map for Control Group – Before and After

The following shows a Key Driver comparison before and after the program for both the project and control groups.



Chart No. 8 & 9: SCI Key Drivers for Project Group – Before and After

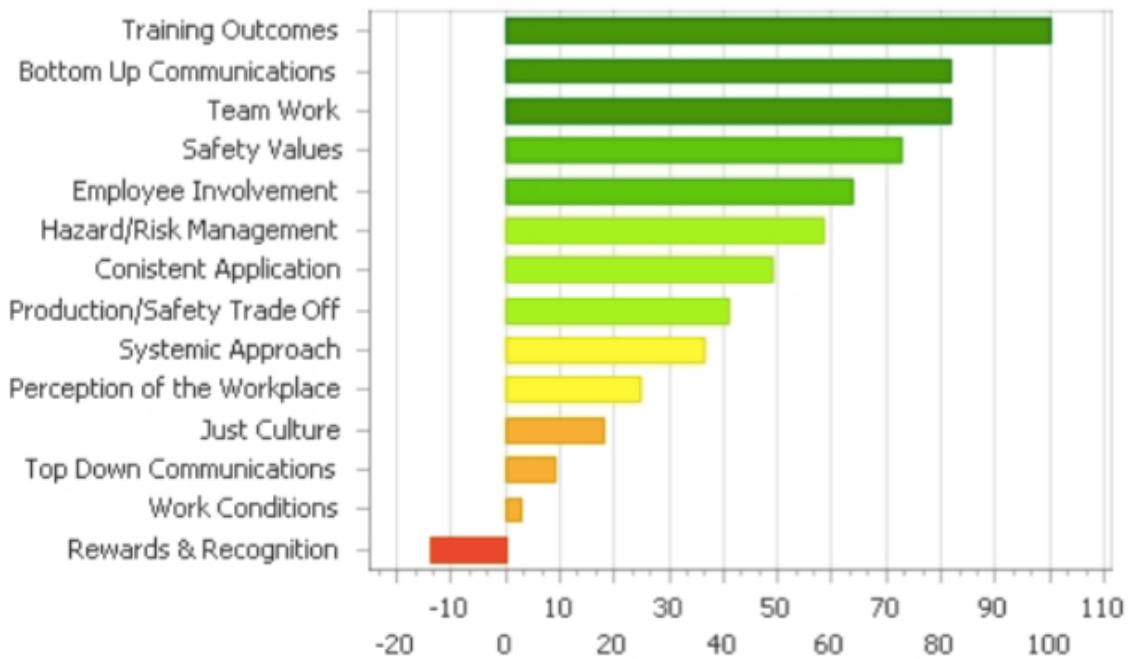
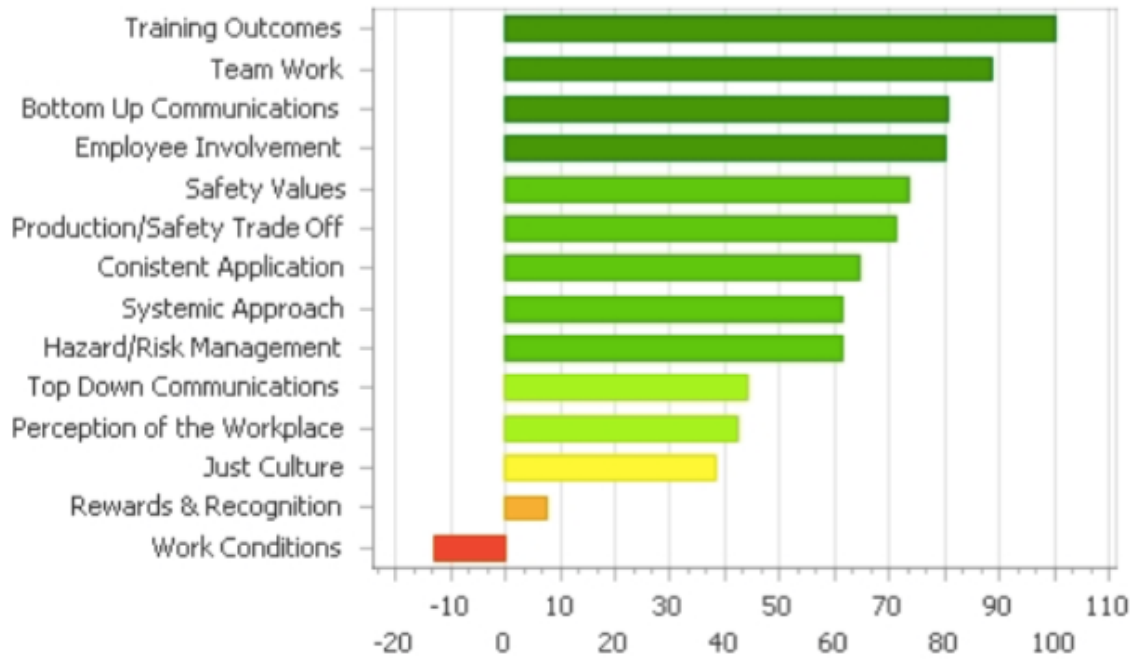



Chart No. 10 & 11: SCI Key Drivers for Project Group – Before and After

The following table shows a comparison of Pulse Question Results to the before and after SCI results. The pulse question results are high lighted in grey.

Questions	Project 			Control		
	Before	Pulse	After	Before	Pulse	After
7. Managers and supervisors express concern and follow up action as required if safety procedures are not adhered too.	58.5	43.8	48.5	76.9	30.0	54.9
11. I receive praise for working safely.	31.7	9.4	39.4	23.1	20.0	9.1
14. I am supported by management to raise safety concerns directly with a person, whom I believe is acting unsafely including those in higher authority.	87.8	50	75.8	100	60.0	90.9
17. Safety rules and procedures are carefully followed by most people I work with on a consistent basis.	80.5	90.6	81.8	61.5	90.0	54.5
23. Focus on safety rules and procedures seems to be inconsistent with some areas having greater focus than others.**	-39.0	-81.3	-12.1	0	-50.0	18.2
27. When team members ignore safety procedures here, I feel it is their choice and none of my business.**	92.7	96.9	93.9	100	70.0	100
29. I can influence and improve health and safety performance here in a positive manner.	95.1	75	78.8	100	90.0	100
32. I am notified of close out actions from safety concerns I have raised.	-7.3	-12.5	12.1	15.4	-70	0
38. Safety is the number one priority in my mind when completing a task.	95.1	90.6	97.0	84.6	90	81.8
48. I am more likely to take risks outside of work than at work.	0	-3.1	9.1	-30.8	-30	0
52. Sometimes I am not given enough time to get the job done safely.**	29.3	28.1	45.5	84.6	30	54.5
53. There are always enough people available to get the job done safely.	-22	-31.3	9.1	7.7	40	9.1

The general analysis of the results showed high variation in the pulse question results compared to the more stable before and after SCI results.

Safety Leadership Index - Survey Data Summary


SLI Survey Participation Rates

Initial SLI Cultural Survey:

- Project Group: 12 employees (10 responses - 83.3% participation rate)
- Control Group: 9 employees (6 responses - 66% participation rate)

Final SLI Cultural Survey:



- Project Group: 12 employees (9 responses - 75% participation rate)
- Control Group: 9 employees (5 responses - 55% participation rate)

A definite decrease in participation results was noted. The reason given for this was the increased workload and challenging priorities placed upon leadership deriving from the  structure. Obtaining SLI surveys from both the project and control leadership groups proved difficult.

SLI Survey Results – Project and Control Groups

The following SLI chart shows a comparison before and after the program. The final column shows a comparison to the incident frequency rate increase during the project period.

Group	SLI Before	SLI After	SLI Change	Incident FR
Control Group	64.27	82.44	18.17	+26.1
Project Group	66.94	74.37	7.43	+8.9

The following SLI Pie Chart comparison before and after the program shows the maturity levels of the different Leaders in both the Project and Control Groups.

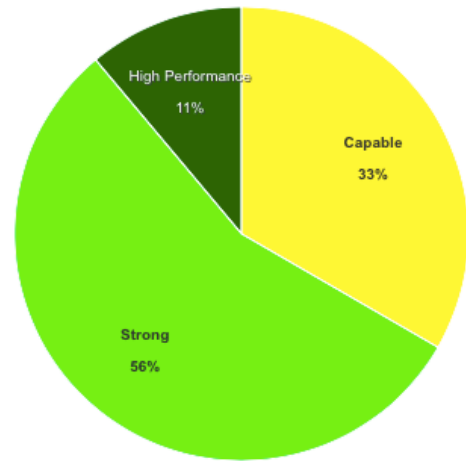
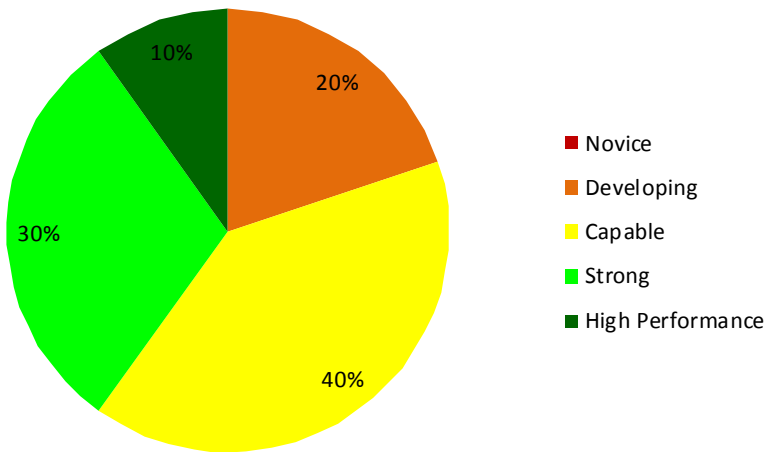


Chart No.12 & 13: SLI Pie Chart for Project Group – Before and After

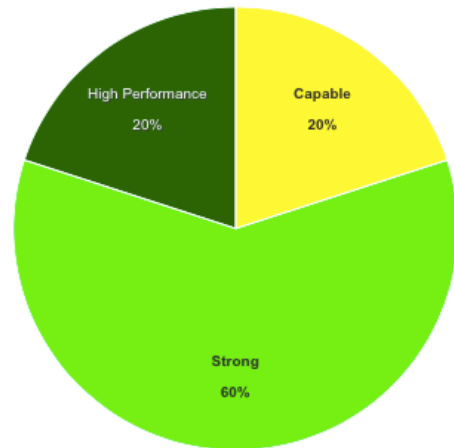
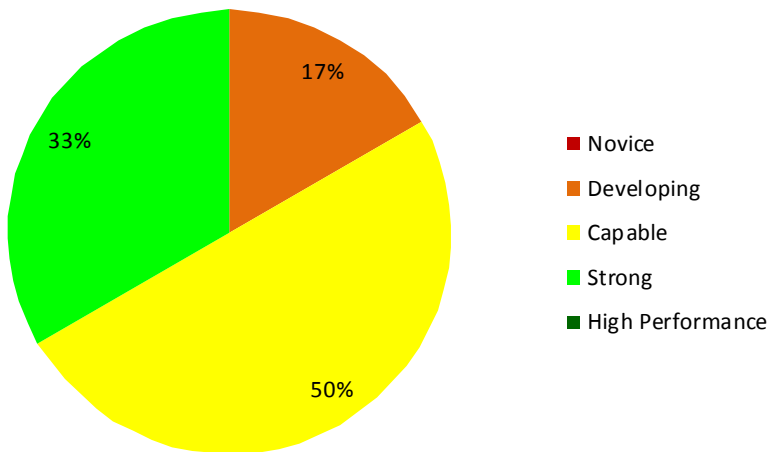


Chart No.14 & 15: SLI Pie Chart for Control Group – Before and After

Workforce Feedback on Safety Culture

Limited written feedback was given from both the project and control groups. The main topics were the following:

- Business standards
- Leadership including:
 - Appropriate treatment of workforce
 - Fostering a connection between management and the workforce

- Empowering the workforce
- Prioritisation of safety vs. production
- Communication including:
 - Consistent messaging from management to workforce
 - Feedback from incidents
- Correctly resourcing of activities (equipment and manning)



The control group comments were consistently negative in their view of leadership. The sentiment related to leadership judging the workforce, not engaging with them and communicating ineffectively.

Project Discussion

The purpose of this discussion is to utilise the various data outlined above in an effort to answer the two project questions proposed. These were:

1. Can a worksite define and achieve a zero-harm safety culture utilising mindfulness based high-performance thinking techniques?
2. Can a mine track and benchmark their safety culture in real-time?

The comparisons will be made to the level of detail dictated by the data and the constraints placed upon it by sample size and participant anonymity.

Can a worksite define and achieve a zero-harm safety culture utilising mindfulness based high-performance thinking techniques?

There has been an impact made by the Mindsense Safety Program. This is evident by the variation in results between the project group and control group across all the metrics.

The safety incidents results show an overall increase in the incident rate for both the project and control groups. The control group incident FR increased by 26.1% whilst the project group increased at 8.9%. This demonstrates that there were forces within the business environment that were strong enough to increase the incident rate onsite. The list of changes indicated in the project background section showed a high degree of change and this may be a cause for the increase across both groups. It also indicates that factors such as safety systems play a major role in safety performance.

The incident FR results indicated that the project group were less affected (or more resilient) to the incident causing factors than the control group. The control group recorded an incident FR increase that was 2.93 times that of the project group. The results also demonstrated that the intervention was not sufficient to overcome all incident causing factors within the work environment. The reason for incident-rate increase could be related to several causes which will not be discussed in detail in this

report. One point was the length of the program (6 months) being quite short. The time taken to enable the change in belief systems to be adopted varies between individuals, but longer sustained immersion generally allows for an opportunity for belief change to occur.

The Safety Culture Index metrics indicated an increase in the SCI in the project group and a corresponding decrease in the control group SCI.

The project group recorded a 5.1 increase in the SCI with the control group experiencing a -11.3 reduction in SCI. This accounts for a 16.4 point difference between the two groups. These results generally parallel the Incident FR results mentioned above.

The individual subsets of the SCI results show that the project group improved in all areas relative to the control group. The area of highest change was in the Work Environment metric with a 26.73 point differential. Given that the work environment of project and control groups was identical during the project, this result could be attributed to perception change. The work environment is seen to be less positive for the control group. This may indicate a level of acceptance in the project group.

The Involvement metric came in as the second highest subset with a relative change of 26.73. This metric related to the extent to which safety is a focus for everyone and all are involved. The next highest change was in the Safety Rule and Procedures area. The rules and procedures are common to both groups so could again indicate a positive perception change for the project group.

Significant relative movement was also recorded in the area of Communications (19.97), Safety as Priority (17.48) and Personal Appreciation of Risk (14.53).

The Key Drivers underpinning the SCI dimensions also showed a positive relative shift for the project group. The project group increased across all areas with the most significant shift occurring in the perception relating to Work Conditions. This driver moved from a “Unsustainable” level of -25 to a Maturing level of 5. In comparison, the control group saw reduction across all areas with the driver of “Rewards and Recognition” moving from “Maturing” to “Unsustainable” level. Just Culture also reduced by almost half which reflects a loss of openness and trust. This driver more than doubled for the project group reflecting an expansion of trust and openness.

The most profound reduction from the control group was in the “Top Down Communication” driver. This driver showed a four-fold reduction and indicates a disconnect in the leadership and workforce.

The Safety Leadership Index results have shown a minimal change within the project group. The project group results show a 7.43 point increase over the 6 month period from 66.94 to 74.37. Interestingly, the control group had a significant increase of 18.7 from 64.27 to 82.44. The relative ratio between the project and control groups shows a 2.51 times increase toward the control group.

Comparing this to the ratio of incident frequency rate, the control showed a 2.93 times increase compared to the project group.

The increase in SLI for the control group coupled with a higher increase in incident frequency rate and lowering in SCI suggests a level of disconnection of the leadership group with the workforce. This in turn has driven a negative safety result. The nature of the SLI questions are self-reflective and may illustrate that the leadership have an unrealistic perception of their leadership. A 180 peer review step is normally evident within the SLI framework but was absent for this research project.

The leadership group would believe their results to be true but the supporting data appears to have suggested otherwise. The poor “Rewards and Recognition” and “Top Down Communication” results in the key drivers section, also support this argument. This is difficult to assess without management of peer review processes in place.

The project group also exhibited an increase in the SLI that, coupled with a lower incident rate increase and improved SCI results, suggests that the intervention has led to stronger alignment of the leadership and workforce. The results also indicate that the leadership are more in touch with the workforce and have arrived at SLI numbers that have more objectivity.

Can a mine track and benchmark their safety culture in real-time?

The Safety Culture Index and Safety Leadership Index metrics have exhibited responsiveness to the intervention.

The SCI has captured specific movements between the project and control groups and has broadly given correlation to the incident frequency rate data collected.

The Safety Pulse Index result showed high variation with overall SCI numbers and as such, appears to be an unreliable indicator as an overall SCI measure. A question-by-question analysis did show closer correlation but was more indicative of a possible trends rather than a definitive measure of SCI.

The Safety Leadership Index appeared to have a weakness in that it is a personal and subjectively focused tool. The subjective nature of the survey exposes itself to personal bias and in an situation of disconnection between leadership and the workforce.

Utilising the additional Manager Review component would definitely reduce the subjectivity. The Manager Review was not conducted for this project.

Correlating the SLI metrics with SCI metrics does allow an extra level of objectivity.

Conclusion

Evidence collected over the six month project period found the Mindsense Safety Program improved the safety culture, improved leadership/ workforce alignment, improved safety leadership and lessened the impact of the unstable restructuring workplace environment on the incident frequency rate.

The program did not negate all injury causing factors but did introduce a level of safety resilience within the project group compared the control group. The program also functioned to minimise cultural impact during a highly challenging business period.

The Global Safety Index cultural measuring program used to monitor cultural and leadership trends worked well to track cultural data in real time and provide evidence of the program impacts.

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Appendix

- A. Safety Culture Review (November, 2015)
- B. GSI Survey Report: SCI Project Group (November 2015)
- C. GSI Survey Report: SCI Control Group (November 2015)
- D. GSI Survey Report: SLI Project Group (November 2015)
- E. GSI Survey Report: SLI Control Group (November 2015)
- F. GSI Pulse Report: SCI Project Group (March 2016)
- G. GSI Pulse Report: SCI Control Group (March 2016)
- H. GSI Survey Report: SCI Project Group (June 2016)
- I. GSI Survey Report: SCI Control Group (June 2016)
- J. GSI Survey Report: SLI Project Group (June 2016)
- K. GSI Survey Report: SLI Control Group (June 2016)