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Defining the constructs of a safety climate measurement tool to determine readiness for a behavioral approach to safety management.

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Business Administration

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Abstract

Safety climate provides an indication of the perceptions of employees with regard to safety management in an organisation. Although there have been many studies on safety climate, a common platform to measure safety climate has not yet been agreed upon. This makes it difficult to compare climate performance across industries and organisations. This study endeavors to identify the common thread that flows through all safety climate studies through extensive literature review and develop safety climate measurement tool in the form a 65 question survey. The survey was validated using confirmatory factor analysis and expert review. The study further looks at the elements of safety climate that affect the behavioral safety management and determines how an organisation performs on those identified elements through descriptive statistic models.100 employees of a large petrochemical organisation based in South Africa participated in the survey. The results required that several of the questions in the survey be reevaluated and therefore the survey will need to be re tested. The results also demonstrated that the sample organisation had considered and implemented the elements of safety climate that are required for a behavioral safety program.

Keywords

Safety Climate; Behavioural safety; Safety; Petrochemical

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Desigan Pather (13423101)

10 November 2014

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1. Introduction

Workplace injuries have resulted in loss of lives, reduction of loss of productivity which at the end equates to a loss of revenue for the organisation involved. Both employers and employees have endeavored to understand the causes of injuries such as inadequate hazard identification processes, equipment failure and human error. Organisations have since made many changes to way workplace injuries are viewed by introducing controls such as safety management systems, risk management systems and human behavior systems in an attempt to reduce the number of workplace injuries. It has been widely considered that most accident have been caused by human error and systems have been implemented to manage the risk of the human element, however these systems do require other elements in the organisation to be in place before it can be successful.

1.1. History of Occupational Safety and workplace injuries

During the early 19th century child labour and fatalities due to injuries at the workplace were widespread. In the midst of the industrial revolution, employers were only concerned with productivity and had no concern for employee wellbeing. Employees were sustaining significant injuries at the workplace and were not being compensated for their losses (Lewis, B 2009). In 1883, the UK government introduced one of the first forms of governance in the labour space, which was the factory inspectorate. The initial key roles of the factories inspectorate were to prevent workplace injuries and overworking of child labour in factories. The UK government was deemed to be the pioneers of occupational safety (Health and Safety Executive 2014).

In the United States where mining, manufacturing and construction were booming, the average fatality rate of workers were approximately 300 fatal injuries for every 1000 employees employed. The United States market demanded mechanised labour which caused employers to have more disregard for employee well-being (Aldrich, M 2014). When employees were injured, it was difficult to claim compensation, as the law at the time provided that the employee had to prove negligence on the side of the employer or else they were deemed to have accepted the risk. This lead to workplace accidents being relatively “cheap” (Aldrich, M 2014)

During the early 1900’s there were many elements that initiated a drive for a safer working environment. These included refusal of employees to accept high risk work, increase in the cost of insurance and public pressure which lead to substantial increase in the cost of employment. Between 1906 and 1910 laws such as, the commissioning of the Mining bureau and enactment of the compensation laws lead to employers becoming more concerned about employee safety. Items

such as machine guarding and safe design principles became a principle of good business. With the introduction of both preventative and corrective measures, incident rates began to fall significantly (Aldrich, M 2014).

1.2. Impact of workplace injuries on organisation

In their article: Corporate cost of occupational accidents: an activity-based analysis, Rikhardsson and Impgaard, (2004) indicate that the cost of workplace injuries can be broken into direct and indirect costs. Direct costs include:

- Medical costs- in the case where a person needs to be hospitalised or treated.
- Cost of repair to equipment- lost equipment
- Lost hours- cost to replace injured employee as well as paying and employee that are not able to deliver productively.
- Loss of revenue if operations needs to be stopped

Indirect costs include:

- Increase in insurance premiums due to the claim
- Possible customer dissatisfaction- if delivery schedules are not met
- Decreased employee morale leading decreased productivity
- Costs of systems implemented that have failed to prevent the injury.

According to (Waehrer, Dong, Miller, Haile, & Men, 2007) a single fatal injury can cost up to $ 864 000 of direct costs and up to $ 4 million of indirect costs. The direct costs for organisations are very high, and even higher are the indirect costs of workplace injuries. A significant portion of the indirect costs is the implementation of preventative and corrective measures to prevent or mitigate the injuries such as behavior based safety programs (Waehrer, Dong, Miller, Haile, & Men, 2007).

Taking into consideration, the costs associated with have a workplace injuries and associated costs of having the systems that were supposed to prevent the injury it is imperative that organisations ensure that these systems are implemented correctly.

1.3. Mitigation of injuries

Considering the facts presented above, there will always be a business case for the reduction of occupational injuries. Organisations strive continuously to remove hazards and prevent workplace injuries. In their endeavor to minimize the number of injuries, there have been many interventions

implemented before the behavioral approach is taken to achieve zero harm. It must also be noted that these interventions are considered as antecedents to a behavioral approach and are necessary for the optimal functioning of the behavioral system. The following section explains some of those interventions through the Du Pont Bradley curve. Although the Bradley curve was designed with far more than just mitigation of injuries in mind, this study used this model to identify where each safety intervention fits into the safety maturity model as a pre requisite to behavioral safety and safety climate.

1.3.1. Du Pont Bradley Curve

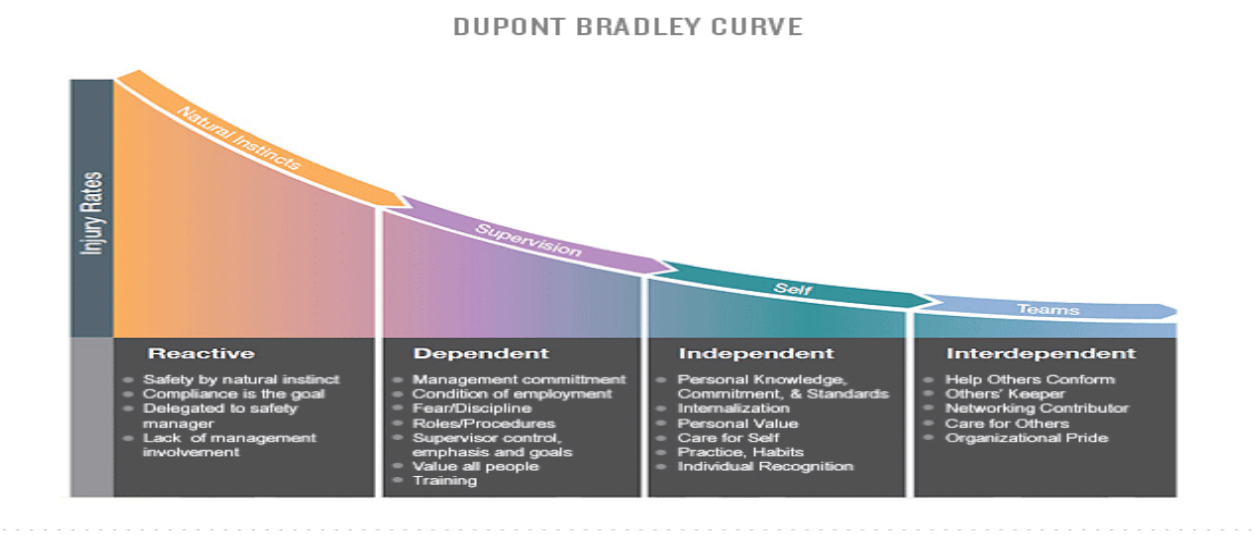

Figure 1 Du Pont Bradley Curve

The Bradley curve demonstrates the progressive maturity of an organisations safety culture from reactive to interdependent. The Bradley curve presents a model of safety interventions that are conducted by organisations in their endeavor to reduce workplace incidents (du Pont, 2009)

Reactive Stage

At the first stage of the curve is where safety is not particularly managed. All the organisation strives to achieve is compliance to legislation and management is not committed to managing risk at the workplace. Safety management is left up to the instincts of the employees (du Pont, 2009)

Dependent Stage

In the dependent stage the organisation has implemented policies and procedure to control hazards in the workplace. In this stage of the curve elements such as safety management systems which include elements such as policy and procedures, hazard identification and risk assessment, and indicators of performance (du Pont, 2009)

- Policy and procedures

Policies are management commitment to providing the required support and resources to enable the required safety performance. The procedures in turn provide guidance to all employees with the aim of achieving the objectives set out in the policy (Kale, Gujrathi, & Kale, 2013)

- Hazard identification and Risk Assessment

It is important to understand that the basis of any safety system is its risk management model. Without having this system in place it would very difficult to ensure that any other system would function effectively (Manuele, 2005).

The hierarchy of control is used to establish the control measures that are most effective at reducing risks in the workplace. This framework considers the following steps to minimizing workplace incidents (Manuele, 2005). :

1. Elimination- Remove the hazard by designing it out- this is the most effective level of mitigating injuries as the hazard no longer exists(Manuele, 2005)..
2. Reduce Risk- by substituting less hazard materials- At this level the hazard still exists, however the consequences of exposure is limited(Manuele, 2005).
3. Engineering- Incorporate safety devices into design- at this level there are safety devices inherent to the design that will prevent the hazard from materializing (Manuele, 2005).
4. Administrative- Communication, Awareness and training- this level is target the human element of the hierarchy. It alludes to a tolerable risk and provides that the user will be aware and competent to manage the hazard (Manuele, 2005).
5. Protect- Personal protective equipment- this is the reactive stage of the hierarchy, as the personal protective equipment will protect the user from consequences of exposure to the hazard (Manuele, 2005).

The steps are ranks in the order of effectiveness in the control of workplace incidents and counter ranked in the order of supervision required (Manuele, 2005).

- Safety Performance Indicators (Incident Rates)

In order to make decision on whether the intervention that has been employed is effective in reducing incidents, an organisation has to measure its performance. This is usually done by using the following typical rates. These rates are seen as key indicator as to whether the decision to implement a Behavioral safety program is required or if the existing program is effective.

The Bureau of Labor Statistics (2013) explains that organisation should use incidence rates as an indicator of the performance of the safety system. These rates can help problem areas as well as

preventing workplace injuries. Incidence rates add value to an organisation when used in comparison to other similar organisations; you can then determine your safety performance.
Incidence rates are calculated using the number of fatal and/or non-fatal injuries that occurred in the process of carrying out acts of employment during dedicated working hours. The number of injuries are multiplied by a factor of 200 000(40 normal hours per week x 50 work weeks in the year x 100 employees) and divided by the number employees in the area of employment. (BLS, 2013). It must be noted that these calculation can differ in countries as well as in industries.

Table 1- Incidence Rates Calculation

Number of injuries X 200000(factor)/ number of employees

In this stage the organisation is heavily reliant of the first line supervisor to ensure that all safety measure and enforced (du Pont, 2009)

Independence Stage

Independence is where everyone takes responsibility for their own safety. Everyone internalizes their roles and responsibilities with regard to safety. Employees understand that their actions could lead to injury and damages. This acknowledgement help reduce incidents.

Interdependence Stage

This is the utopia of safety where everyone understands they could impact on everyone. In this stage no system would be required; the hierarchy of controls will entrenched in every business decision and organisational incidents are managed by the behaviour and action of all employees. This phase of the curve alludes to a positive safety climate that is driven by leadership and committed to by all employees (du Pont, 2009) parenthesis

- Safety Climate

(Zohar 1980) defines the safety climate as a summary of perceptions that employees share about their work environment at that given moment that is a subset of the organisational climate. In his study thirty years later, Zohar (2010) confirms that through more studies there is a strong correlation between safety climate and safety performance indicators in that if there is a decline in perception of employees of certain aspects of safety climate, then there is direct decline in the indicators of performance. This suggests that safety climate is an antecedent to all systems that manage safety including a behavioral approach to safety.

Although there has been no real challenge to the concept that safety climate and safety indicators of performance are related, there has been no real consensus on what are the elements of safety climate and how these elements should fit together to form an effective tool for measurement of safety climate (Tharaldsen & Haukelid, 2009). Generally the use of a questionnaire is best suited tool for the understanding of safety climate in an organisation. The questionnaire should be composed of a series of questions which are divided into themes (Guldenmund, 2007).
Guldenmund (2007) explained that there are two avenues that can be pursued when developing a safety climate questionnaire (1) a normative and theoretical approach or (2) a more pragmatic approach is to use results of previous research. This study aims to identify the common threads of safety climate through a comprehensive literature review in order to develop a tool in the form of a quantitative survey to measure an organisations safety climate. The study will also highlight the correlation between a behavioral safety programs and establish what key elements need to be in place before implementing a behavioral safety program.

This is also the stage that is supported by Behavioral safety systems which helps mold the safety culture and climate with the organisational culture and climate (du Pont, 2009).

- Behavioural Safety

Behavioural approach to safety is explained as analytical, objective and data driven approach that focusses on behaviour that could affect safety and is conducted by first line personnel with of goal of changing risky behaviour into safer behaviour thus driving a culture of acceptable behaviour (Tharaldsen & Haukelid, 2009).

In the book Values-Based Safety Process: Improving Your Safety Culture With Behaviour-Based Safety, it was determined in a study of more than 100 organisations over ten years that up to 96% of injuries occurring were caused by some form of human error. He defines unsafe work behaviour as a function of the physical and social environment as well as how people interact within these environments. He further states that Du Pont has been significantly successful in reduce workplace injuries by focusing on the behavioural aspect of safety as well other initiatives (McSween, Terry E 2003).

Studies have shown that behavioral safety programs usually fail due to many reasons. Some of those reasons include commitment (all employees), trust (between employees and supervision) and involvement (Tharaldsen & Haukelid, 2009).These elements are considered constructs of a safety climate (Bergh, 2011)

1.4. .Significant Incidents in recent history

- On April 23, 2004, an explosion and fire at the Formosa Plastics Corporation, Iliopoulos, Illinois, (Formosa-IL) polyvinyl chloride (PVC) manufacturing facility killed five and severely injured three workers. The explosion and resulting fire which was caused by ignition of highly flammable product destroyed most of the reactor facility, warehouse and lead to ignition of resin storage facility as well. Smoke emitted from the flames drifted across the factory and into the local community which resulted in a full evacuation as a precautionary measure. After detailed investigation, the United States Chemical Safety Board (CSB) determined that a few of the many causes was human error such as:
    - Operator inadvertently transferred contents of an operating reactor, resulting in product release to atmosphere
    - Even though operators were not authorised, they still used uncontrolled access to bypass the interlock system.
    - The organisation did not adequately address the potential for human error (Merrit & Bresland, 2007).
- Epoxy based paint ignited leading to flash fire in a confined space at an Xcel Energy hydroelectric plant 72 kilometers outside of Denver, Colorado on October 2, 2007. The incident resulted in 5 fatal injuries and 3 sever injuries to employees. The cause of the ignition was identified as static spark. After detailed investigation, the Chemical Safety Board identified some of the causes as human error related such as:
    - Detailed hazard evaluation of the planned activity was not conducted which could have identified the associated risks.
    - The area where the work was conducted should have categorized as a confined space, however there was an oversight operators, shift supervisors as well as the contractor.

From the theory is evident that human behaviour elements are a significant part of the root cause of the above incidents. Considering the magnitude of the few incidents mentioned above in terms of economic, social and ethical values, it is clear that these incidents or those similar in nature should be prevented.

Many organisations have implemented a behavioral safety program to minimize such incidents .Behavioural safety programs play an important role in mitigating the role that humans play in such incidents, however when implementing such programs, it is important to ensure that they are implemented correctly, that is within the correct safety climate.

1.5. Research Objectives

1.5.1. It is important that organisations minimize the number of workplace incidents. Together understanding safety climate and behavioral safety are effective mechanisms to use in the managing this challenge. In order to understand, the safety climate it is important to be able to measure it and as indicted briefly in the introduction, that there is not a not a standard approach to measuring safety climate in organisations, the objective of this research is to determine the constructs of an effective safety climate with the objective developing a safety climate measurement tool in the form of a detailed questionnaire.

1.5.2. Measure employee's perception of safety elements using the safety climate tool to determine:

1.5.2.1. Validity of the safety climate tool through factor analysis

1.5.2.2. Determine whether organisations have the required elements in place for the implementation or running a behavioral safety system.

1.5.3. Determine areas of strengths and weaknesses in an organisations safety climate and how they would affect the performance of behavioral safety system.

2. Literature Review

2.1. Introduction

In this chapter the study will strive to understand the intricacies of safety climate by comparing it to safety culture and explaining the value of positive safety climate. The study will also determine the common constructs of a safety climate by reviewing literature and bringing them together using a prescribed model into a new safety climate assessment tool.

The second phase of the literature review is explain the behavioural safety approach, why is it important to organisations and which elements of safety climate are required to support the behavioral approach to safety management.

2.2. Safety Climate vs Safety Culture

Safety culture has been defined many times in the literature and there still isn't clarity on the definition. The term was first coined after the Chernobyl nuclear power plant incident, when failures in the safety systems lead to a catastrophic disaster. In his article, Zohar defines a safety culture as "*A summary of molar perceptions that employees share about their work* environments" (Zohar, 1980).Guldenmund (2000) defines Safety culture as the aspects of organisational culture that will impact on behaviour and could have an impact of decreasing or increasing risk.

Safety Climate in the early days of safety studies was often interchanged with term safety culture. Recent studies have shown that there are significant differences between safety culture and safety climate (Pecquet, 2013) which are further explained in Table 4 below. Safety climate is the employee's reflection of the perceptions of the organisational atmosphere (Guldenmund, 2007). This is further supported by Zohar (2010) which explains safety climate as the perceptions of the employees regarding the features of their safety and organisational environment.
Guldenmund (2000) drew up the table below to indicate the similarities as well as the differences between the definitions of safety climate and safety culture.
In the table below nine of the definitions explain the definitions of a safety climate and all of the nine talks to perception of employees in the six that define safety culture; all six talks about attitude of employees, Guldenmund thus inferred that safety climate is as about perceptions and safety culture is about attitude of employees (Guldenmund 2000).

Table 2- Safety Climate vs Safety Culture

Reference	Definition
Zohar (1980)	A summary of molar perceptions that employees share about their work environments (climate)
Glennon (1982a,b)	Employees' perceptions of the many characteristics of their organisation that have a direct impact upon their behaviour to reduce or eliminate danger (safety climate) and, safety climate is a special kind of organisational climate
Brown and Holmes (1986)	A set of perceptions or beliefs held by an individual and/or group about a particular entity (climate)
Cox and Cox (1991)	Safety cultures reflect the attitudes, beliefs, perceptions, and values that employees share in relation to safety (safety culture)
Dedobbeleer and BeÂland (1991)	Molar perceptions people have of their work settings (safety climate)
International Safety Advisory Group (1991)	Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance (safety culture)
Pidgeon(1991)	The set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimising the exposure of employees, managers, customers and members of the public to conditions considered dangerous or injurious (safety culture)
Ostrom(1993)	The concept that the organisation's beliefs and attitudes, manifested in actions, policies, and procedures, affect its safety performance (safety culture)
Cooper and Philips (1994)	Safety climate is concerned with the shared perceptions and beliefs that workers hold regarding safety in

	their work place (safety climate)
Geller (1994)	In a total safety culture (TSC), everyone feels responsible for safety and pursues it on a daily basis (safety culture)
Niskanen (1994)	Safety climate refers to a set of attributes that can be perceived about particular work organisations and which may be induced by the policies and practices that those organisations impose upon their workers and supervisors (safety climate)
Coyle(1995	The objective measurement of attitudes and perceptions toward occupational health and safety issues (safety climate)
Berends (1996)	The collective mental programming towards safety of a group of organisation members (safety culture)
Lee (1996	The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, and organisation's health and safety
Cabrera(1997)	The shared perceptions of organisational members about their work environment and, more precisely, about their organisational safety policies (safety climate)
Williamson(1997)	Safety climate is a summary concept describing the safety ethic in an organisation or workplace which is reflected in employees 'beliefs about safety (safety climate)

2.3. Importance of Safety Climate

Safety climate comprises on perceptions of employees, thus it will inform the behaviour of employees thus an expected outcome would be that a supportive safety climate where safe behaviour is promoted and reinforced, one would expect this climate to be associated with fewer injuries. On the other side of the coin, in an unsupportive climate, where safe behaviour is not supported or when unsafe behaviour is condoned, one would expect the number of injuries to be higher (Beus, Payne, Bergman, & Arthur Jr, 2010).

Safety climate is also conceptualized as a predictor to workplace injuries, conversely workplace injuries are seen to be predictors of safety climate by looking at the type of injuries and the associated causes which will provide insight to the perception of the employees with regard to occupational safety (Beus, Payne, Bergman, & Arthur Jr, 2010).

The figure below shows a basic design of safety climate as a leading indicator.

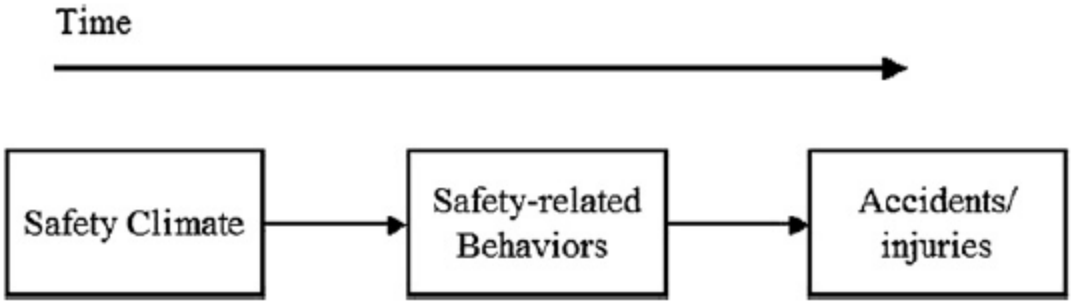

Figure 2 adapted from Payne, Bergman, Beus, Rodríguez, & Henning (2009)

In addition to the reduction and being a pre cursor to occupational injuries, a supportive safety climate directly or indirectly leads to the following benefits:

- Reduction of costs- in an environment with supportive safety climate, there will have fewer workplace injuries, which lead to reduced downtime on the production line, reduced labour costs to replace injured worker and reduced costs to repair/replace damaged equipment. Reductions of costs are also associated with costs of insurance and compensation to the injured employee/s. This in turn would lead an increase in the profit and profit margins.
- Employee Morale- Employees will further perceive that the organisation values their services and this will lead to more productive workforce. A productive efficient workforce will have knock on effect of efficiency and thus providing a competitive edge.
- Improved Customer relations- Many customers in large western markets are seeking a supplier with a good safety record, as this demonstrates. In a supportive safety climate, the number of workplace injuries are reduced, thus downtime is reduce, thus perfect order fulfilment is improved(Bergh, 2011).

As the Safety climate has been proven to be a leading indicator to workplace injuries, thus providing much value to any organisation, there always been a need to measure the safety climate of an organisation. Operationally safety climate is measured using surveys that are issued to all employees as the definition implies the perception of employees, however there has not been a clear definition of the elements of the safety climate survey (Payne, Bergman, Beus, Rodríguez, & Henning, 2009).The most frequently used method to determine the safety climate of an organisation is by factor analysis, however there is no agreement on which constructs a safety climate should consists of(Tharaldsen, Olsen, & Rundmo, 2008).

Although there have been many studies on safety climate, and the general definition of safety climate has been concurred, the dimensionality of the construct of the safety climate questionnaire is still being argued (Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2012). There has been some concurrence that safety climate is multi-dimensional, but the number of factors that should be incorporate in the questionnaire has not been agreed upon.one. It has been demonstrated that although the structure is important to the questionnaire, it could also be unique to each situation (Kines 2011).

2.4. Constructs of safety climate measurement tools

From the Table below, it can be seen that a large number of climate surveys conducted across various industry sectors have been assessed. The elements of measurement can viewed as the perceptions of the employees with regard to safety in their workplace.

Table 3- Review of safety climate surveys

Research	Tool	Elements of Measurement
Safety climate in industrial organizations: theoretical and applied implications (Zohar, 1980).	Questionnaire	Managements concern of safety issues Management participation and commitment Perception of risks
The use of a factor-analytic procedure for assessing the validity of an employee safety climate model (Brown & Holmes, 1986).	Questionnaire	Managements concern of safety issues Management participation and commitment Perception of risks
The structure of employee attitudes to safety: a European example(Cox & Cox, 1991)	Questionnaire	Personal Sceptism Locus of Control(responsibility) Environment at Work Safety Rules

Risk perception and safety on offshore petroleum platforms—Part I: Perception of risk(Rundmo, 1992)	I	Associated Risks Work Stress Conditions at workplace Safety rules Propaganda
Assessing safety culture(Ostrom, Wilhelmsen, & Kaplan, 1993)	Questionnaire	Safety Awareness and communication Management Commitment Team Accountability Safety Rules and Systems
The development and evaluation of a safety climate measure as a diagnostic tool in safety management(Budworth, 1997)	Questionnaire	Management Commitment Line manager Support Safe systems of work Attitudes towards Safety Safety representatives
Assessment of safety culture at a nuclear reprocessing	Focus Group	Safety Procedures,

plant(Lee, 1998)		Risk management, Permit to Work, Job satisfaction, Safety Rules, Employee Knowledge and competence, Employee Participation, Safety Systems, Organisational Design
Confirmatory cross-cultural research: Testing the viability of a corporation-wide safety policy (Janssens, Brett, & Smith, 1995)	Questionnaire	Commitment of management Production vs Safety Safety Level
The development of a measure of safety climate: The role of safety perceptions and attitudes (Williamson, Feyer, Cairns, & Biancotti, 1997)	Questionnaire	Employee motivation Safety Practices in place Justification of the risk
Is risk perception one of the dimensions of safety climate (Dedobbeleer & Béland, 1998)	Interview	Policies on Safety Team attitude on safety

		Strategies to prevent safety incidents Productivity vs Safety
Safety climate factors and its relationship with accidents and personal attributes in the chemical industry (Glendon & Litherland, 2001)	Questionnaire	Work pressures Incident investigations Adequacy of procedures Training and development Relationships Personal protective equipment Availability of Spares Safety Rules
Safety climate, safety management practice and safety performance in offshore environments (Mearns, Whitaker, & Flin, 2003)	Questionnaire	Safety Activities Safety Involvement Safety Communications Safety Knowledge and competence Management /Supervisor commitment
Safety climate and self-reported injury: Assessing the mediating role of employee safety control (Huang, Ho,	Questionnaire	Injury Incidence

Smith, & Chen, 2006)		Management Commitment Return to Work Policies Post injury administration Safety control Safety training
Safety climate factors and its relationship with accidents and personal attributes in the chemical industry (Vinodkumar & Bhasi, 2009)	Questionnaire	Management commitment Knowledge and exposure Employees attitude(fairness) Safeness of environment Employee involvement Production vs safety

2.5. .Extracting the Elements of Safety climate measurement tool

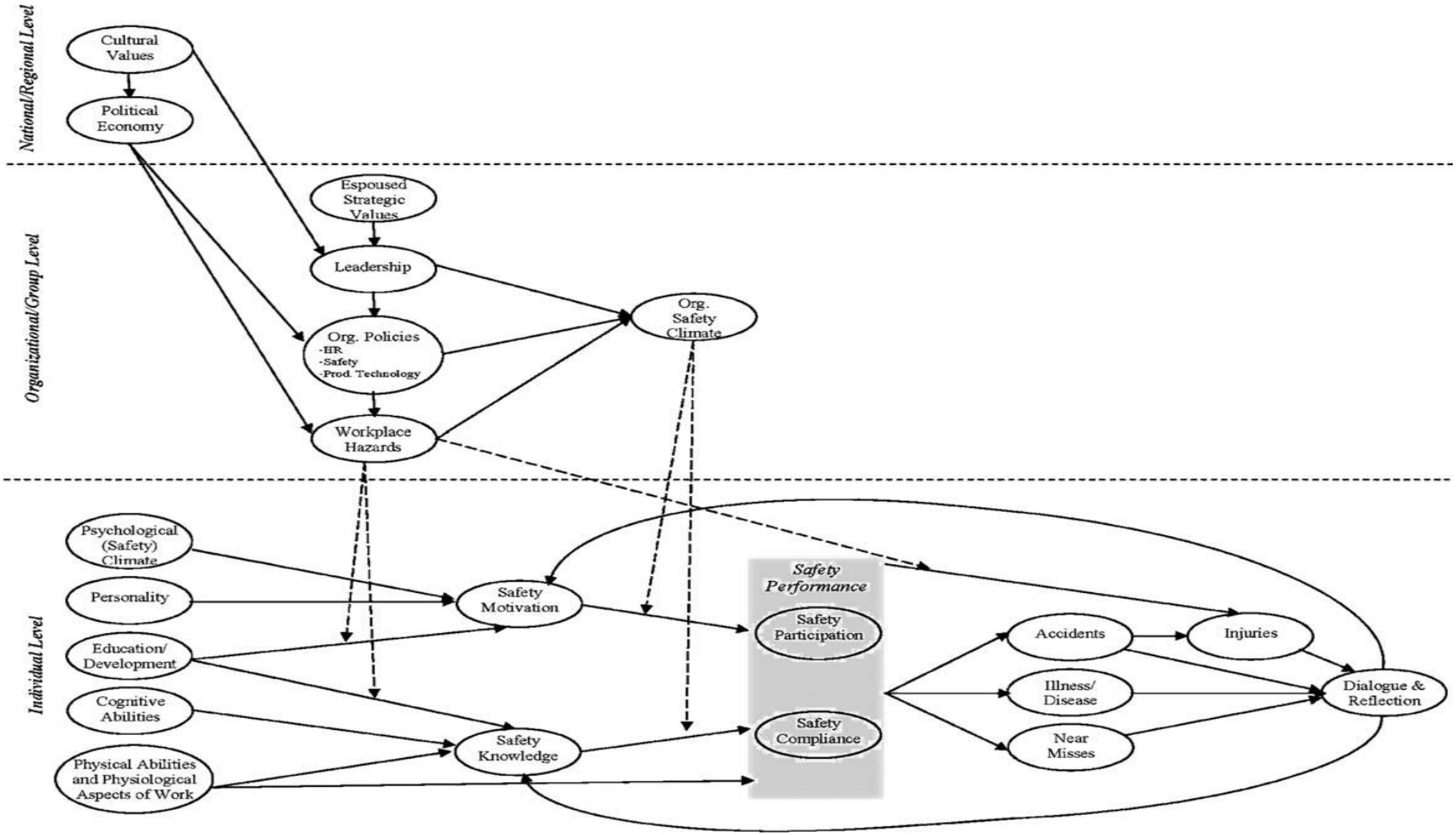

Figure 3- Explaining the multilayer interdisciplinary perspective of workplace safety (Burke & Signal, 2010)

In the article Workplace Safety: A Multilevel, Interdisciplinary Perspective(Burke & Signal, 2010) discuss the influencers from a national regional and individual level that result in safety related work behaviour:

At a national level our cultural values influences our political economy such as the legal, political and economic systems of a country. Our cultural values also influence our political economy, however it is not the sole influencer, as other factors such as natural resource availability and international agreement can play a significant role in guiding the political economy.

At an organisational level, the values that are established by an organisation are interpreted by leadership team who in turn develop organisational policies and practices. Leadership is underpinned by cultural values. Leadership refers to both senior management (SLC) and first line management (LMC). Development and implementation are directly linked to senior leadership and line management commitment respectively although these policies and practices are influenced by political economy as well. Workplace hazards refer to ability of all employees to view both perceived and objective risks in the workplace. All the elements at the organisational level mediate the influences of cultural and organisational values on safety climate.

The safety climate element in Figure 4 above relate to element of trust in the organisation between leadership and employees. If leadership create a perception that production is more important that safety matter, then it is very easy to lose the trust of the employee (PVS).

At the individual layer which is the broadest layer (Burke & Signal, 2010) split the safety related actions into two content categories (1)Safety Compliance and (2) Safety participation(EP).The article focuses on participation rather than compliance.

Psychological Safety climate- this talks the perceptions of safety in the workplace, the perception of control that employees have with regard to safety learnings, participation (EP) and compliance (LOC).The psychological safety climate has a direct relationship with employee motivation pertaining to safety matters (EM).

Personality discusses that it is important to understand the type of person that you employ in the organisation, as his/her traits could have a direct impact on the organisation safety performance. Traits that need to be considered could emotional stability, anxiety, impulsiveness etc. these traits should be evaluated during the hiring stage and continuously during the employment stage (HR). Personality has an influence on safety motivation for employees.

Education and development experiences whether formal or informal together with a person's cognitive abilities are important to ensure compliance to safety issues (EKC). The ability of an organisation to communicate (SC) policy, practices and risks have a direct influence on safety knowledge with has an influence on performance. The study also suggests that's attention and cognitive failures are meaningful predictors of safety performance (LI)

Physical abilities and psychological aspects of work are the effects of fatigue, ergonomics (WC) on the safety performance of an organisation (compliance + participation)

Dialogue and reflection is the ability of an organisation to continuously learn from their peers, their stakeholder's as well as themselves in order to improve safety performance (LC).
At this level in the organisation have many individuals, therefor the ability for all the individuals to function effectively and safely is essential to the safety performance of the organisation. The individual must be able to depend on his colleagues (the next individual) to act safely to prevent harm to the group (TA).
Using the model above, the following constructs of a safety climate have been identified: Senior Leadership Commitment (SLC), Line Management Commitment (LMC), Employee Participation (EP), Employee Motivation (EM), Locus of Control (LOC),Learning Culture (LC), Production vs. Safety (PVS), Safety Communication (SC), Employee Knowledge and Compliance (EKC), Team Accountability (TA), Work Conditions (WC), Leading Indicators (LI), Human Resources and Organisational Design (HR) (Burke & Signal, 2010)

2.6. Defining the constructs of a safety climate measurement tool

In order to understand what each construct comprises of, the study defines each of the constructs. These definitions will support the questions that are used to measure each construct as part of the safety climate survey.

2.6.1. Management Commitment (SLC) - management's commitment to safety in the workplace remains a critical element of any safety management system (Zohar, 1980). (Heinrich, 1941) explains that management commitment is more than developing and laying the policies and process for safety management. Psychology of Safety Handbook explains that management commitment is about providing the necessary support and resources to ensure that end goal is achieved. This support and resources can come in the form of leadership's ability to choose safety of employees over running of operations, or participating in safety initiatives or creating the perception that safety is an important element of running the business (Geller, 2001).

2.6.2. Supervisor Commitment (LMC) - Line management or first line supervisors are essentially the people that are responsible for the correct implementation of the policies and procedures set by top management. They are the people that allow for the success of any system by ensuring that there is a proactive approach to managing risks, by communicating hazards and risks and ensuring that the controls are in place to prevent injuries. (Agrilla, 1999)

2.6.3. Employee Participation (EP) - It has made sufficiently clear through many studies that employee involvement is equally important as management and supervisor commitment. If employees are not involved in decisions that impact their safety, then

the chances of that decision failing during the implementation process is significantly higher. Employee involvement includes participation in risk identification processes, reporting of incidents and development and implementing procedures. (Niskanen, 1994).

2.6.4. Employee Motivation (EM) - In order for employees to participate in safety activities and decisions, they need to be motivated. They need to believe that what they are participating in will add value and make a difference to them personally. Employees need to believe in the organisations values and understand their roles in achieving the organisational safety goals. Demotivated employees could lead to non-participation or false participation in safety activities which could lead to an unrealistic outcome (Burke & Signal, 2010).

2.6.5. Locus of Control (LOC) - Work locus of control represents the way an employee understands who or what controls his/her environment. Work locus of control involves the way that employees explain how things happen to them, and whether or not they have control over their choices or if they are controlled by their environment (Rotter, 1971; Spector, 1998) Safety control is a person's perception of the ability or opportunity to manage work situations to avoid injuries and accidents (5). Results also suggest that employee safety locus of control plays a critical role in the mediation between safety climate and self-reported injury (Huang, Ho, Smith, & Chen, 2006)

2.6.6. Production vs Safety (PVS) - In an economy of ever increasing competitiveness, constant cost reduction, the pressure (work pressure) is constantly on all employees in an organisation to deliver on stretched targets. This leads to the perception of choice between production and safety (Fahlbruch & Wilpert). This construct ties back to the construct of leadership commitment, line management commitment as well as the construct of communication.

2.6.7. Communication (SC) - Communication to employees regarding the issues is important, regardless if the communication mechanism is formal or informal (Baxendale & Jones, 2000). Openness and communication is essential for the functioning of any safety management system, as it allows for the flow of information from top down and from bottom to the top. Relevant communication through applicable mechanisms will allow every employee to know what is developing in safety field.(Sawacha, Naoum, & Fong, 1999)

2.6.8. Employee Knowledge and Compliance (EKC)-The workforce's perception of whether each person has the required skills, knowledge and experience to carry out the task required by his/her job description. It is the ability of the employee to understand processes and procedures and follow them correctly.(Flin, Mearns, O'Connor, & Bryden, 2000)

2.6.9. Team Accountability (TA) - (Burke & Signal, 2010) discusses a stakeholder approach to safety concerns, that is how is the actions of one person going to affect the safety wellbeing of the people that they are working with. This would include discusses unsafe situations, and confronting unsafe acts.

2.6.10. Leading Indicators (LI) – This construct is closely linked to the construct of learning culture, however the focus of this construct is on the organisations ability identify those measurements that can actually prevent the significant injury. These measurements include near misses reporting, audits and housekeeping (Burke & Signal, 2010).

2.6.11. Human Resource and Organisational Design (HR) - (Burke & Signal, 2010) discuss that organisational design policies which dictate how many resources should be allocated to a specific job has a direct impact of safety climate. Ensuring that an employee has sufficient time to deliver their workload, with proper supervision and sufficient breaks is essential to a safe workplace.

2.6.12. Learning Culture (LC) - Learning culture is defined as an organisations ability to learn from its mistakes that is learning from incidents, injuries and near misses. It is the ability of the organisation to see benefit in reporting and creating an environment where crucial mistakes are hidden (Burke & Signal, 2010).

2.6.13. Work Conditions - Poor work organization are part of the contributing risk factors to occupational safety and health problems. A number of situations within the workplace are conjectured to contribute to the increasing magnitude of workplace injuries (Niu, 2010). Zohar (2010) indicates that occupational injuries are a combination of unsafe work conditions, which include incorrect/inadequate tools, safety gear and unsafe acts.

2.7. Aligning constructs with elements of other safety climate studies

Now that the constructs have been defined, the study will aim to align the constructs identified through past studies to those identified in this study. The table below matches the constructs identified through the (Burke & Signal, 2010) model and the elements of other safety climate measurement tools (Table 5). Through the definitions listed above the table fits each of the elements into each one of the constructs. The number in the brackets indicate how many times that element has been discussed in the studies mentioned earlier in this research.

Following on from the identified constructs below, the study is now going to identify the elements of a positive safety climate that are required to support a behavioral approach to safety management.

Table 4- Constructs vs elements of safety climate studies

Constructs Identified(Burke & Signal, 2010)	**Elements identified through Literature(Table 5)**
Senior Leadership Commitment (SLC)	Managements concern of safety issues(2), Management participation and commitment(5)
Line Management Commitment (LMC)	Safety Rules and Systems(4),Line manager support; Safe systems of work, Safety Procedures, Permit to Work
Employee Participation (EP)	Employee Participation
Employee Motivation (EM)	Employee motivation, Personal Sceptism
Locus of Control (LOC)	Locus of Control(responsibility)
Learning Culture (LC)	Risk management, Associated Risks
Production vs. Safety (PVS)	Conditions at workplace, Work Stress, Production vs Safety(2)
Safety Communication (SC)	Perception of risks(2), Safety Awareness and communication, Propaganda
Employee Knowledge and Compliance (EKC)	Employee Knowledge and competence, Safety Awareness and communication
Team Accountability (TA)	Team Accountability, Attitudes towards Safety, Justification of the risk
Work Conditions (WC)	Work Stress, Environment at Work, Conditions at workplace
Leading Indicators (LI)	Safety Practices in place, Risk management
Human Resources and Organisational Design (HR)	Job satisfaction, Organisational Design

2.8. Behavioral Approach to managing Safety incidents

2.8.1. Background

(Heinrich, 1941) created the concept that the human factor played a significant role in occupational incidents. In his research, he coined the term unsafe acts and developed a set of rules and principles to guide the way that people interacted with their surroundings and the machinery to prevent the “unsafe act” from occurring.

There are three basic phases to all behavioral safety programs:

1. Identifying specific safety behaviour that offers opportunities for improving safety and safety records on the basis of historical data collected via the safety management system. The data will include incidents and accidents that have been reported as well potential incidents that were reported.
2. Establishing a baseline measure of the existing safety behaviours by conducting work sampling where operational descriptions of target safety behaviours are developed and employees performance are observed against the target items.
3. Feedback to employees regarding their safety performance is essential. The feedback should be relative to the target performance areas and should be used to encourage employees to improve their compliance to safety procedures and policies (Ray, Purswell, & Bowen, 1993).

Figure 4 Safety Pyramid adapted from (Vaughen, Lock, & Floyd, 2010)

As can be seen in safety pyramid (Figure 4) above there are different levels of injuries beginning at the foundation layer with at risk behaviours(unsafe acts), which are representative of the largest number of incidents in the workplace. At the top of the pyramid is the most significant level which is

the loss of human life. The pyramid alludes that if you manage your foundation layers i.e. the “At risk behaviours” and “near misses”, then should be able to prevent or predict the causes of your significant incidents. A behavioural safety program aims to attack the base of this pyramid (Vaughen, Lock, & Floyd, 2010).

2.8.2. Why the behavioural approach

Cooper (1998) demonstrated that over the years a behavioural approach to safety has always improved areas of safety performance regardless of the industry. These areas include:

- General increase in safety performance by reducing accident and incident rates
- Reduction in costs
- Improvement in cooperation, involvement and communication between management and workforce teams
- Improved safety climate
- Improved ownership of safety and accountability and responsibility for safety
- Improved understanding between safe behaviours and accidents.

It is widely supported by many safety professionals that a key element of any good safety management program is in the systems efforts to modify both employee and management behaviour to encourage safe behaviour (Ismail, Ahmad, Janipha, & Ismail, 2012).

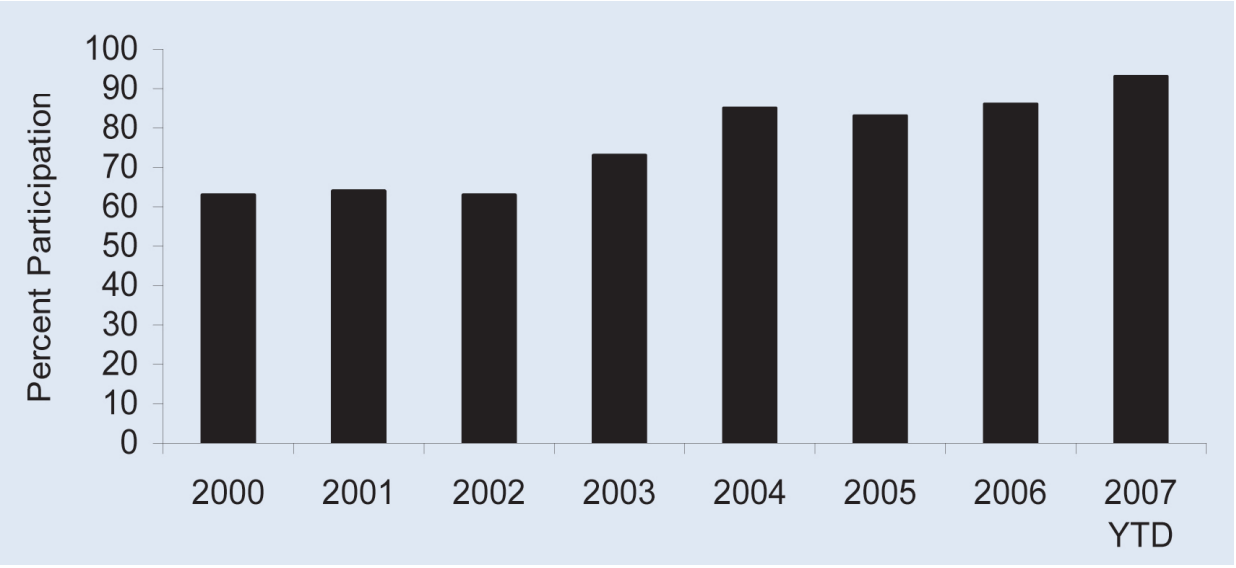

Figure 5- Participation percentage at Lake Charles Refinery 2000 – 2008.

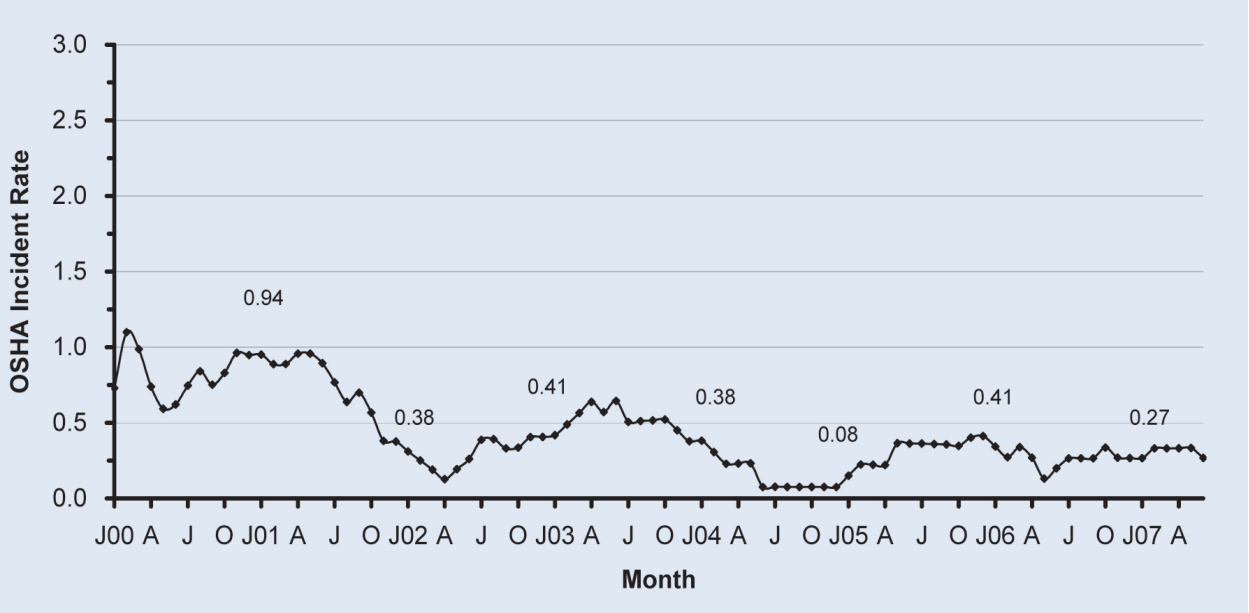

Figure 6- Incident Rate from 2000- 2007 in Lake Charles refinery since implementation of Behavioral safety program

Figures 5 and 6 are the results of a study done a refinery that implemented a behavioral safety program. There is a direct correlation between increase in percentage of participation of the behavioural safety program and the decrease in the lagging indicator (Medina, McSween, Rost, & Alvero, 2009).

2.8.3. Requirements for effective Behavioural Safety programs

There are many requirements for an effective implementation of behavioral safety program. These elements are closely linked to the elements of an effective safety climate. Key elements include management commitment (Ismail, Ahmad, Janipha, & Ismail, 2012). In a study in the THAI construction industry, it was revealed that management commitment was the most influential factor in the development and implementation of a behavioral safety program (Aksorn & Hadikusumo, 2008). (Ismail, Ahmad, Janipha, & Ismail, 2012) explain management commitment as participation (EP), visibility and support.

Participation- management is required to actively engage colleagues and subordinates on safety through the behavioural safety program. Employees also need to be actively and voluntarily engaged in the process to ensure all unsafe behaviours are reported (Ismail, Ahmad, Janipha, & Ismail, 2012).

Visibility- The management team has to be seen to participate in the process. Behavioural change is usually driven by learning by seeing (Ismail, Ahmad, Janipha, & Ismail, 2012).

Support- The resources in terms of finance and human resources need to be made available for both the implementation and the maintenance of the process (Ismail, Ahmad, Janipha, & Ismail, 2012).

Attitude- Management needs to demonstrate a positive attitude to the program (Ismail, Ahmad, Janipha, & Ismail, 2012). Four important safety leadership behaviours that are identified are (1) development of open, honest and trusting relationships with the employees, (2) making yourself visible in the name of workplace safety, (3) Involving the workforce in planning and decision making, therefore empowering the workforce, (4) taking a proactive approach to safety.(Lu & Yang, 2010).

There are several investigations underway on the impact of employee motivation (EM) on the behavioural approach to safety. Studies have shown that motivated employees are more prone to complying with internal and external requirements, hence fewer injuries (Anderson, 2005). (Griffin and Neal, 2000). Vroom (1964) has also proposed that motivated individuals (EM) behaved in a certain way if they (1) have a strong desire to achieve safe behaviour; (2) have a reasonable expectation that they will achieve that outcome; and (3) expect that the achievement of the task outcome will result in a reward, for instance increased safety performance, and reduced accident rates.

(Anderson 2005) discusses the requirements for successful implementation of behavioral interventions such as engineering, technical and system aspects. These aspects include:

Hazard and operability studies or similar studies to ensure safe working place (WC), which would include hierarchy of controls to minimize the extent of incident.

The organisation should have accurate and relevant procedure which provide for direction for operating and working safely as well ensuring that the all employees have the required competencies to carry out their tasks (EKC). The training should include knowledge of their job, the process that they work in, normal and abnormal conditions (Anderson 2005).

There should be an effective process to log, communicate, investigate and learn from incidents that have occurred in the organisation (LC & EC). Learning from incidents will prevent repeat incidents or at least reduce the exposure if it occurs again (Anderson 2005).

Anderson (2005) goes on to establish that succession planning and human resource process are essential to support an effective behavioral safety intervention (HR).

The Health and Safety Executive (HSE 2010) supports Anderson's argument and specifies that behavioural programs will only be successful if engineering, technical and system aspects are in place and adequately managed in the organisation. HSE suggests that before an organisation embarks on a behavioural safety program, it should ensure that the following condition should be considered:

- A fully developed hazard identification and risk assessment process is implemented and utilised. The hierarchy of control should be applied to prevent identified hazards or minimize the consequences if they occur.
- Issues related to human performance must be identified and managed i.e. (roles and responsibilities in relation to safety etc.)

- There is sufficient knowledge, experience and staffing levels that is required to carry out engineering, operating and maintenance activities.
- Training of all employees should include normal, abnormal and emergency conditions. It should include in depth knowledge of plant operation as well as trouble shooting
- Processes in place to ensure that incident are communicated actively and lessons learnt are shared and implemented where applicable
- Adequate HR processes to ensure proper succession planning to allow for effective knowledge transfer.
- A detailed review process that ensures that the risk profile, critical controls and corrective and preventative measures of an organisation is up to date and relevant (HSE, 2010).

Based on the evidence above, it is clear that an organisation should have the following process effectively implemented before embarking on a behavioral approach to safety management. To summarize the aspects are: (1) Management commitment(both from senior management and line management) (2) Employee Motivation and Participation(EM &EP) (3) workplace conditions need be conducive to safe work(WC), (4) Training, knowledge and competence is essential (EKC), (5) the necessary HR processes need to be implemented to support safe systems of work(HR), (6) the organisation needs to be able to learn from mistakes(LC) and (7) relevant communication mechanisms must be in place to promote and support a safe workplace.

2.8.4. Challenges to Behavioral Safety Program

At a fundamental level all behavioral programs are based on the premise that most of occupational injuries are caused by human error (Heinrich, 1941) however(Smith, 1999), 1999) argues that Heinrich did not take the workplace hazards into account in his study, thus the BBS process is aimed at the employee which is not entirely correct. The study goes on to state that organisation should predominantly focus on the management team and their control of hazards instead of asking employees to change their (Smith, 1999)

Following on the abovementioned argument (Agnew & Ashworth, 2012) argue that behavioral safety programs ignore the hierarchy of control which is a proven fundamental of any good safety management system. The study suggests that Behavioral safety removes the focus from the most effective controls (elimination and engineering) to less effective (administration and PPE).

There has long been a debate that a behavioural safety intervention focusses on employee behaviour rather than attitude. The argument is that it would very difficult to change behaviours if you do not change the employee's attitude (Cox & Jones, 2006). (Cox, Jones, & Rycraft, 2004) argues that both attitude and behaviour needs focus in order to achieve long term sustainability of a behavior based safety intervention.

Employees are also concerned about the employers using the data gathered in a typical behavioural safety program against the employees which could lead to lack of participation and reduced employee motivation (Cox & Jones, 2006).

The ability to act on deviations reported as well as provides proper feedback to those that have provided observations is important to ensure that observers remain engaged and participate (Cox & Jones, 2006). It is argued that a behavioral approach to safety focusses on the human error, but leadership only view frontline supervisors as the human that can make the error (Cox & Jones, 2006)

2.9. Conclusion

In this chapter the study looked at literature on safety climate measurement tools to identify common constructs with the aim to develop a valid safety climate measurement tool. It further explored the elements that are required to support an effective behavioral approach to safety management. In the next chapter the study will identify the hypothesis that it wishes to test. .

3. Research Hypothesis

Thus far the study has explained basic safety principles, the importance of managing safety in the workplace and how safety climate and behavioral safety will assist in the management of safety incident. The second chapter defined the constructs of safety climate as well as those constructs that are critical to the implementation and maintenance of a behavioral safety program. It has been shown that understanding both safety climate and behavioral safety plays an important role in reducing safety incident as they both act as an antecedent to incidents, therefore it is equally important to measure safety climate and understand what the requirements for successful behavioral safety program implementation are.

In this chapter the study defines the possible outcomes of the study in the way of null and alternative hypothesis. Below are the hypotheses for this study

3.1. Hypothesis 1

H_0-A validated safety climate measurement tool in the form a survey questionnaire cannot be developed using literature studies of safety climate surveys.

H_A- A validated safety climate measurement tool in the form a survey questionnaire can be developed using literature studies of safety climate surveys

3.2. Hypothesis 2

H_0- Organisations implement behavioural safety programs without considering elements of safety climate that support a behavioral approach to safety

H_A- Organisations have considered elements of a safety climate before implementing a behavioral based safety system

4. Research Methodology

4.1. Introduction

The previous chapter provided detailed background on the study and clarified the theoretical aspects of the study from literature. The constructs of a safety climate measurement tool such as Senior Leadership Commitment (SLC), Line Management Commitment (LMC), Employee Participation (EP), Employee Motivation (EM), Locus of Control (LOC),Learning Culture (LC), Production vs. Safety (PVS), Safety Communication (SC), Employee Knowledge and Compliance (EKC), Team Accountability (TA), Work Conditions (WC), Leading Indicators (LI), Human Resources and Organisational Design (HR were extracted from the literature and relationship to the important elements of behavioral safety were explained Using the constructs identified, a detailed survey questionnaire was developed and the survey was run at the sample organisation. The results were used to establish the validity of the questionnaire and to identify whether the organisation sampled had the correct safety climate for a behavioral safety program implementation.

Using the established theoretical framework, this chapter will present the research design. Mouton (1996) refers to research design as the guidelines and rules to determine the validity of a measurement tool. This chapter will explain the research methodology in the terms of the approach, population and sample, design of research, collection of data and analysis techniques

4.2. Research Approach

The initial phase of this research was to identify the independent variables or constructs that will be used to evaluate/measure safety climate. These constructs were identified by identifying the common threads that run through previous safety climate measurement tools and used to develop a measurement tool in the form of a survey questionnaire. Guldenmund (2007) explained that the most pragmatic approach to measure safety climate is by using a quantitative survey and an effective approach to developing the survey is to conduct a comparative study of previous literature to identify common constructs.

The second phase of the theoretical study was to establish the factors of safety climate that impact the implementation of a behavioral safety program through literature study. Using literature on behavioral safety programs to identify key elements that align to that of safety climate although it could be argued that there are other elements that affect a behavioral safety program, the scope of this study was within the elements of safety climate identified through literature review.

The initial phase of the quantitative research is to collect data through the questionnaire developed in the theoretical phase and use the quantitative data to determine the validity and reliability of the survey.

Using further quantitative analysis the study aims to demonstrate correlations between results and literature with regard to behavioral safety.

4.3. Research design

(Lewis & Saunders, 2012) distinguishes among the three key research methods, as follows:

- Exploratory studies – When a topic is not understood properly and has uncertainties, research into the new phenomenon is required to have some insight.
- A descriptive study –This type of research is important to describe the phenomena and accurately describes persons, events or situations involved, the 'what' questions are answered.
- Explanatory studies- a further from a descriptive study, looking for an explanation and reason behind a phenomenon, can be qualitative or quantitative, tends to answer the 'Why' question.

4.3.1. Exploratory

This research will focus on exploring the literature to determine the constructs that are most consistent to organisations and when is an organisation ready for the implementation of a Behavioral safety system.

In his article Guldenmund (2000) says that the determination of the components of a safety climate has been pursued by many, however there are only very few that are considered discernable as well as replicating factor structures from previous studies have proven to be difficult.

(Saunders & Lewis, 2011) suggests that it is perfectly possible to combine research strategies within the same study. In this research the study will take place within two phases, first in the exploratory and second in the explanatory phase.

4.3.2. Data Collection

Data for this project will be collected by two stages:

The first approach is through literature review of previous safety climate surveys to determine the common thread of safety climate surveys. This study incorporated data from peer reviewed articles published in reputable journals from 1980 to 2010. The data collected has been expanded into a sixty five questions survey with thirteen subscales defined in the research design. The subscales of the survey include:

- Senior leadership commitment - is senior leadership visibly committed to safety and do they interact with employees on safety related matters?
- Line management commitment - do line managers' day to day behaviour suggest that they are accountable with regard to safety?
- Employee participation - are employees consulted and involved in safety related matters?
- Employee motivation - do employees feel that they want to participate in safety related activities or do they only do it because they have to?
- Employee locus of control - do employees believe that they have an influence on safety or do they feel helpless in this regard?
- Learning culture - is there a just culture perception, leading to incidents being reported and a culture where the real root causes of incident are identified and corrected?
- Productivity versus Safety - which do employees perceive as being most important?
- Work conditions - is the work environment conducive to working safely, e.g. availability of tools and PPE?
- Safety communication - considers aspects such as information overload, sharing of lessons learnt and loop closure following incidents.
- Knowledge and compliance - do employees have the knowledge to do their work safely?
- Team accountability - do team members hold one another accountable to work safely or is each for his own?
- Leading indicators - does a mind-set exist where leading indicators are used to prevent incidents or is it mostly a reactive approach that is taken to safety?
- Human resources and organisational design - are there issues such as span of control, turnover, work load, etc. that have an impact on safety performance?

The table below demonstrates the variables per scale for the safety climate survey. Each subscale has 5 items per scale.

Table 5 - Items on survey that match to the subscales

Subscale	Questions
Senior Leadership Commitment (SLC)	1, 7, 8, 18, 65
Line Management Commitment (LMC)	4, 5, 9, 10, 15
Employee Participation (EP)	3, 6, 12, 13, 53
Employee Motivation (EM)	14, 21, 25, 29, 35
Locus of Control (LOC)	11, 17, 20, 37, 40
Learning Culture (LC)	16, 22, 31, 33, 50
Production vs. Safety (PVS)	27, 43, 44, 47, 49
Safety Communication (SC)	28, 34, 41, 52, 55
Employee Knowledge and Compliance (EKC)	26, 45, 46, 51, 57
Team Accountability (TA)	19, 38, 39, 48, 54
Work Conditions (WC)	2, 36, 56, 61, 62
Leading Indicators (LI)	32, 42, 59, 63, 64
Human Resources and Organisational Design (HR)	23, 24, 30, 58, 60

The second approach was quantitative and nature made use of the questionnaire with responses on a Likert scale to establish the level of safety climate in an organisation. The survey was conducted during face to face meeting with member of the sample. The team that conducted the surveys was members of the Safety, Health and Environmental (SHE) team which consisted of safety professionals. Before the survey was handed out to the sample population, the SHE team discussed the details of the purpose and proposed outcomes of the survey with each participant. The surveys were handed out as a hard copy document and required to be completed in pen whilst the research team assisted with any questions and concerns. Due to this process there was an expectation of 100% participation. Annexure A shows the layout and content of the safety climate survey that was used for the collection of data.

4.4. Population and Sampling

4.4.1. Population

The population for this research is any organisation that has employees that are exposed to hazards in the course of their employment. This would mean that these employers would need to take steps to minimize the exposure to these hazards.

4.4.2. Sample Unit

The sample for this study will be employees in a multinational petrochemical organisation based in South Africa as this organisation is representative of the greater population i.e. all organisations that have employees that are exposed to hazards in the course of their employment e.g. manufacturing, chemicals, logistics etc. This organisation has a risk profile the spans from high risk mining to low risk office work. Furthermore it provides both complexities and simplicities that are representative of most organisations that would want to measure safety climate and implement a behavioral safety system i.e. simple tasks such as sitting at desk to complex activities such as commissioning and decommissioning of interwoven chemical process units. This organisation has well developed safety management systems, as well as ongoing behavior based safety system, which it uses as a vital mechanism to reduce workplace injuries. The credibility and validity of the SHE management systems are verified annually by both internal and external audits which ensure compliance to international SHE standards (ISO 14001 and OHSAS 18001). Another reason for choosing this organisation as a sample is convenience i.e. access to participants is easy and readily available and the researcher is employed in a management role in the Safety Health and Environmental (SHE) department.

4.4.3. Sampling method and size

In the study, a sample size of 100 employees was drawn using probability sampling. The top safety risks of this organisation exist in two spaces, (1) onsite at fuel storage depots and (2) offsite while delivering the product to customers which is considered an of site risk. The sample was broken down into 3 categories:

- Employees exposed to high risk hazards on site- this is a typical plant operator
- Employees exposed to high risk hazards off site- this is a typical fuel distribution officer
- Employees exposed to low risk on site- this is the typical administrative employee

And spread across the country:

- Mpumalanga
- Gauteng
- Cape Province

- Free State

Using these categories and regions ensures that the study gets an even spread of the risk profile of the organisation.

This technique is justified since it ensures that the results are representative, although they may not be inferred to the entire population. These participants were sourced from the sample frame (multinational petrochemical company based in South Africa) which employs more than 30 000 employees.

Probability sampling (Saunders, Mark 2012) requires that an entire list of a population with gives the ability to select randomly. Types of probability sampling include simple random, systematic random and stratified random sampling (Saunders & Lewis, 2011)

4.5. .Data analysis

4.5.1. Reliability

In this study reliability of the data collection methodology was tested using the Cronbach's alpha which is a coefficient of internal consistency (Cronbach, 1951). A coefficient value above 0.7 is considered as acceptable, however the closer the study can get to 1, the more reliable the document is considered (Saunders & Lewis, 2011)defines reliability as the extent to which the data collection method and analysis procedure will produce consistent findings. Newman (2000) explains that consistency exists in a situation where test scores do not decrease or increase in a test- re- test situation, therefore reliability is obtained whereby the information provided by the indicators of the measurements does not differ from the result of the instrument, indicator and device. (Davis & Smith, 1991) suggested that retest models are not always the most effective, rather the use of internal consistency coefficients to estimate reliability. These coefficients measure how consistently individuals respond to the items on a scale by creating groups of items that measure the same concept with in the survey questionnaire. In this study reliability of the data collection methodology will be tested using the Cronbach's alpha which is a coefficient of internal consistency (Cronbach, 1951). A coefficient value above 0.7 is considered as acceptable, however the closer the study can get to 1, the more reliable the document is considered

4.5.1.1. Descriptive Statistics.

Cooper and Schindler (2001) explain descriptive statistics as tools used to provide a description of the features of a set of observations as well as provide a summary of collected data. This is done via studies such as kurtosis, skewness, variance, mean, standard deviations and standard error.

Skewness measures deviation from symmetry where if symmetrical the mead, mode and median are in the same location.

4.5.2. Validity

(Lewis & Saunders, 2012) defines validity as the ability of the questionnaire to actually collect the data about what it is meant to measure. Construct validity is explained as the extent to which a test measure the construct that it is supposed to measure and is considered to be the fit between the construct and its indicators. This study is aimed at identifying the validity of the safety climate survey and whether is serve to measure the constructs that it claims to measure (de Vos, Strydom, Fouche and Delport, 2004).

4.5.3. Research Techniques

4.5.3.1. Factor Analysis

Confirmatory factor analysis was carried out to assess the construct validity of all the measuring instruments employed in this study Factor Analysis, which is a statistical technique, can be used to derive relatively small number of factors which in turn can be used to represent relationships amongst sets of any interrelated variables Theoretically, factor analysis comprises of a series of methods for determining groups of related variables and reducing a large number of variables into an easily workable and comprehendible number(Brown, 2012).

The factor or component loadings in Factor Analysis are described at the correlation coefficients between rows and columns of the results (Brown, 2012). Although a loading of 0.7 may be considered significant by some, most times real life data may not meet these criteria. Some researchers have been known to loadings much lower; closer to 0.4. Factor loading should be considered in the light of theory and generalized cut of values (Kline, 2014).

The data collected was analysed using SPSS programme which provides descriptive statistics as well as inferential (multivariate) statistics. Descriptive statistics includes trends, percentages, correlations, standard deviations, kurtosis, skewness and means The SPSS programme (SPSS, 2005) was used to carry out statistical analysis regarding reliability and validity of the measuring instruments, descriptive statistics, correlation coefficients and MANOVA. .

4.6. Limitations

1. Although the sample organisation is diverse and representative of many organisations that have safety climate challenges, the study would be enhanced if it were to be conducted across a range of organisations that spread across; due to Burkes rational that national culture plays an important role in determining safety climate

2. Due to the time constraints of the qualification that this study was conducted for, it was not possible to expand on the relationship, whether causal or non-causal between behavioural safety programs and safety climate.
3. It was not possible to conduct a cross validation study of the safety climate measurement tool
4. It was not possible to run a pilot test of the safety climate measurement tool before it was distributed to the participants. Had this been done, it would have increased the validity of the content of the survey.
5. There are other elements outside of safety climate that can affect the performance and implementation of a behavioral safety system. These were not considered in this study
6. This study was conducted in a large well developed organisation in South Africa with a global footprint. This may not be representative of a startup organisation or organisations that do not require global customers. The petrochemicals industry is fairly well regulated and therefor may not be representative of a less regulated industry.

4.7. Conclusion

In this chapter the design, survey, reliability and validity estimates; statistical procedures that were employed during the study as well as the possible limitations to the study. The procedures identified were deemed adequate to meet the requirements of the study. The next chapter shows the results of the statistical analysis.

5. Results

The objective of this research is to determine the constructs of an effective safety climate through review of previous safety climate studies with the objective developing a questionnaire. The final sample size of this study was one hundred employees of large petrochemical company based in South Africa. The survey was conducted under the supervision of six safety professional that ensured that all surveys were completed accurately which leads to zero invalid surveys. The safety risk profile of the organisation was defined as (1) onsite high risk, (2) off site high risk and (3) on site low to medium risk. The sample incorporated employees from all three categories of risk in the organisation.

This chapter outlines the results of this study. Data was analysed in the Statistical Package for Social Scientists (SPSS) where descriptive statistics and multivariate analysis were run. Likert scale responses were thematically grouped into 13 subscales where reliability was also tested. The results of this study are very reliable as reflected by the high Cronbach alpha (0.875), which enhances interpretability. The following section provides the results according to the 13 thematic areas.

5.1. Descriptive Statistics

Senior Leadership Commitment

Safety climate is a summary of perceptions that employees share about their work environment at that given moment that is a subset of the organisational climate (Zohar, 1980). One of the dimensions the respondents shared their perception on was the issue of senior leadership commitment in ensuring safety climate. The following table provides the results.

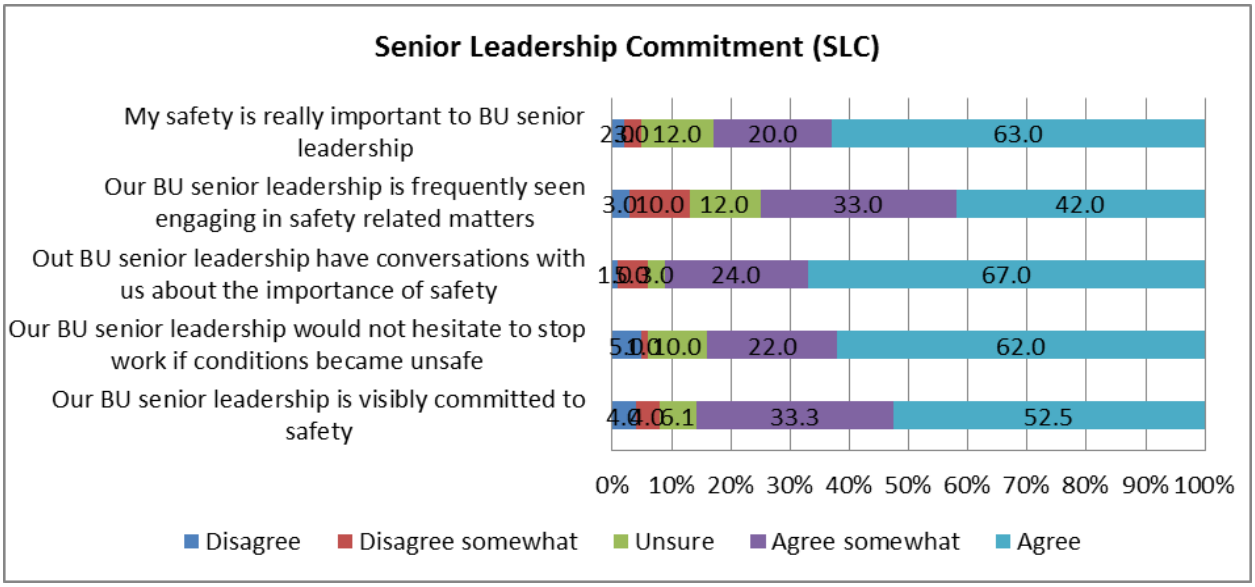

Figure 7- Senior leadership commitment(SLC)

The results indicate that over 60% of the respondents agreed in three dimensions, namely: conversation on importance of safety (67%), respondents' safety to senior leadership (63%), unsafe working conditions (62%), followed by commitment to safety (52.5%). The overall results pertaining senior leadership suggest that respondents generally somewhat agree except for the fact that senior leadership have conversations with about the importance of safety. Such results imply that there is generally good senior leadership commitment within the organisation.

Line Management Commitment (LMC)

Management's commitment to safety in the workplace remains a critical element of any safety management system (Zohar, 1980). Management commitment is about providing the necessary support and resources to ensure that end goal is achieved. The survey sought to know a number of issues pertaining to line management commitment, and the following are the results.

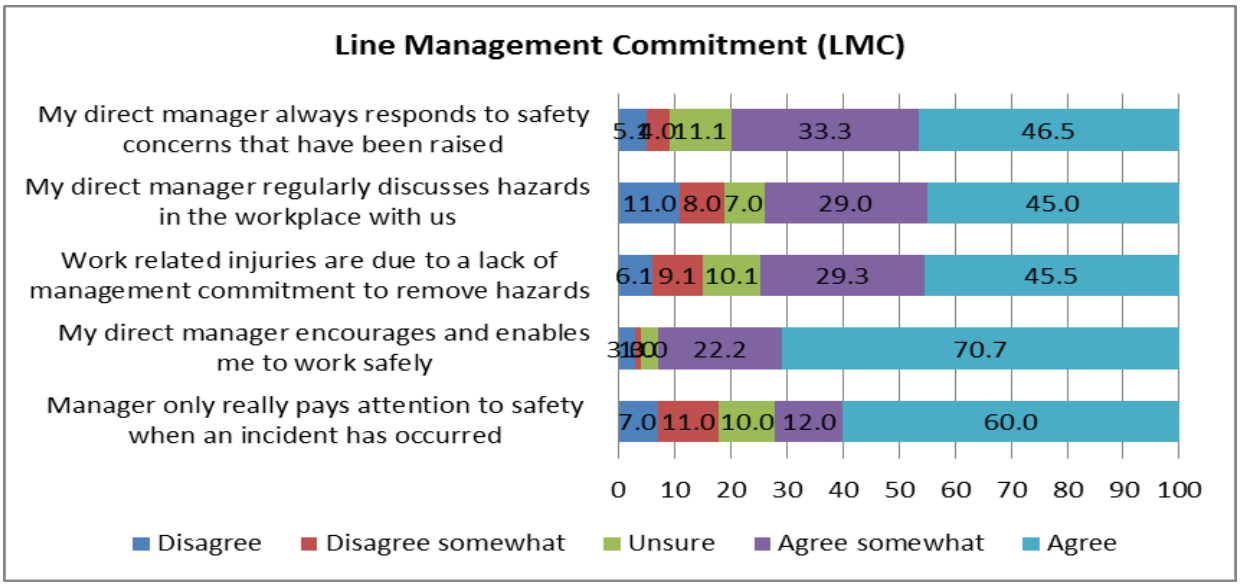

Figure 8- Line Management Commitment

The results indicate a tendency towards agreement towards encouragement by manager as an enabler for working hard (70.7%). Further results indicate that 45% of the respondents agree that managers discuss on hazards in the workplace, and that direct managers direct manager always responds to safety concerns that have been raised and that managers regularly discuss hazards in the workplace with employees. Interestingly, less than 10% generally do not agree that managers really pay attention to safety in case of an accident (7%), and that work related injuries are due to lack of management commitment to remove hazards (6.1%).The overall results indicate that most respondents generally agree towards three of the five dimensions (encouragement discussion on hazards, and response to safety concerns.

Employee Participation

If employees are not involved in decisions that impact their safety, then the chances of that decision failing during the implementation process is significantly higher. The following table presents results on various aspects of employee participation.

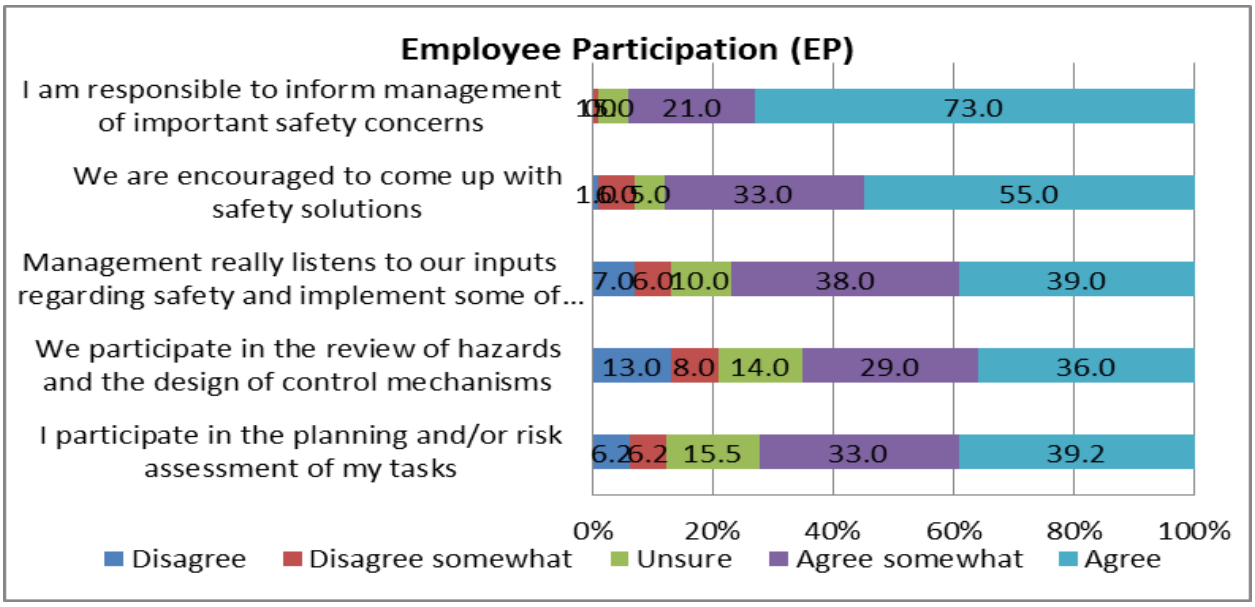

Figure 9- Employee Participation(EP)

Employee participation is an important aspect with regards to their safety concerns. The above results indicate that respondents generally more on their responsibility to inform management of important safety concerns followed by the fact that they are responsible to inform management of important safety concerns. This agreement is from over two thirds (>66%) of the respondents for all dimensions of employee participation. Employee participation is directly linked to their motivation; the more incentivised they are, the more motivated they are. The following section provides results on motivation.

Employee Motivation

In order for employees to participate in safety activities and decisions, they need to be motivated. They need to believe that what they are participating in will add value and make a difference to them personally. De-motivated employees could lead to non-participation or false participation in safety activities which could lead to an unrealistic outcome. The following table provides results on various aspects pertaining to motivation.

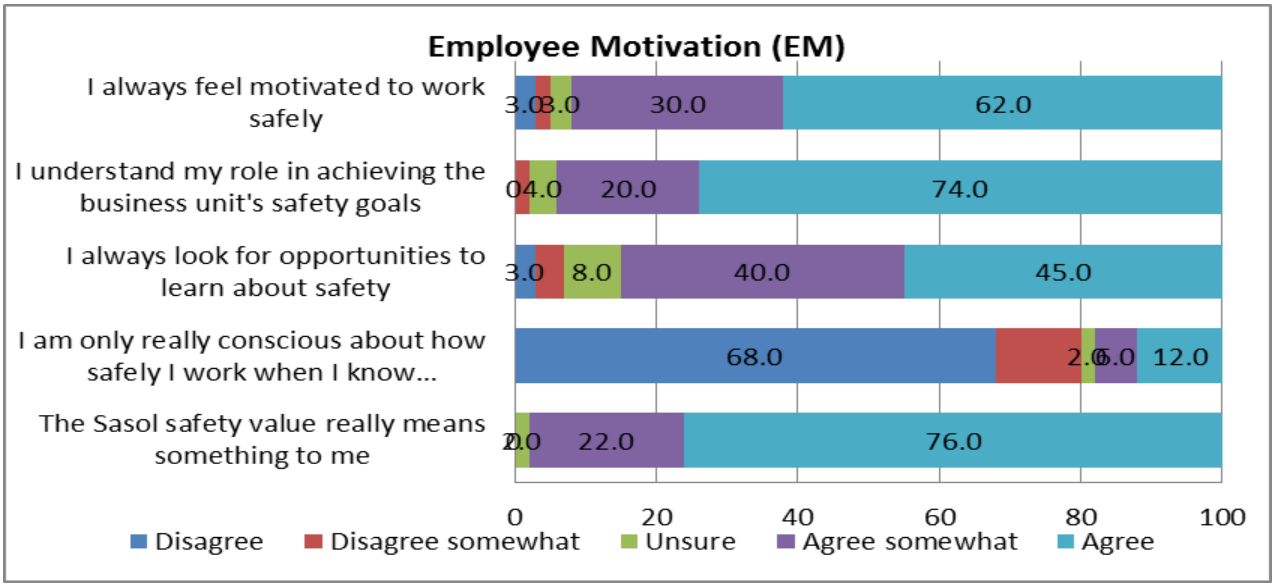

Figure 10- Employee motivation(EM)

Figure 10 indicates a higher tendency towards agreement in the following dimensions of employee motivation: value of the organisations safety role in achieving the business unit's safety goals motivating to work safely opportunities to learn about safety. The only dimension that indicates disagreement among respondents is conscious about how safely they work when they know somebody is watching them.

Locus of control

Employee safety control plays a critical role in the mediation between safety climate and self-reported injury (Huang, Ho, Smith, & Chen, 2006). Safety control is a person's perception of the ability or opportunity to manage work situations to avoid injuries and accidents (Anderson, 2005. The following section outlines the results pertaining to safety control.

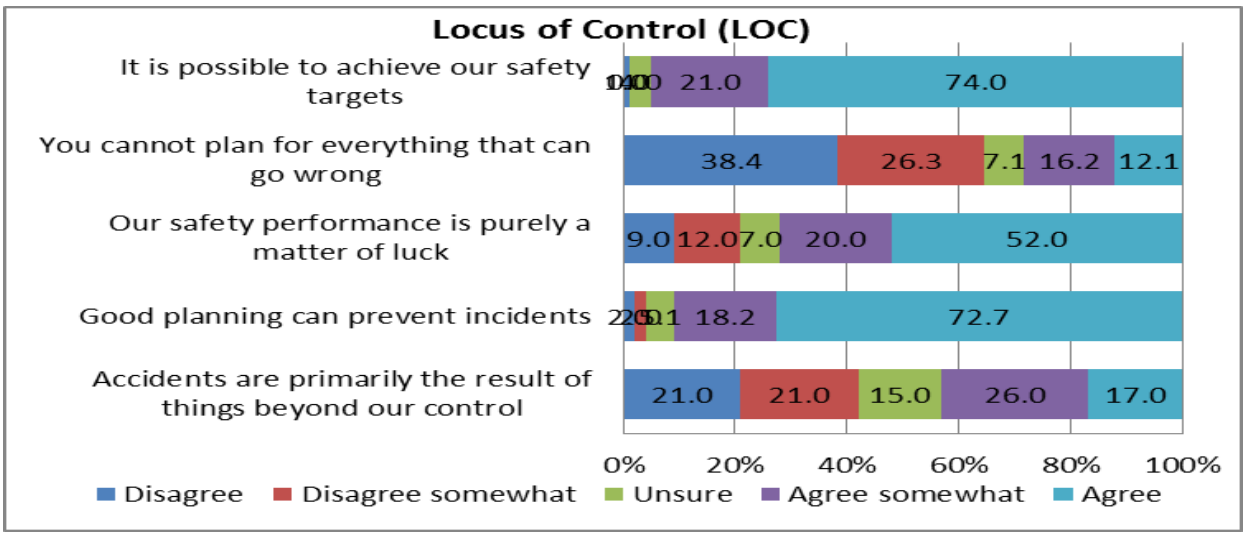

Figure 11- Locus of Control(LOC)

Figure 11 indicates that there is general agreement among respondents with regards to possibility to achieve safety targets; prevention of accidents through good planning; and, that safety performance is a matter of luck). Three dimensions were not popular among the respondents: accidents as being a result of things beyond their control and planning for everything that can go wrong. Overall, the results suggest that locus of control is important, as indicated by higher percentage (65.7%) of the respondents who were in agreement, while the rest (26.4%) were in disagreement and very few unsure (8.1%).

Learning culture

Learning culture is important to have this culture for your safety system to function as it will allow for active reporting without fear of intimidation and prejudice. The following table provides results on learning culture within the organisation, in the context of safety climate.

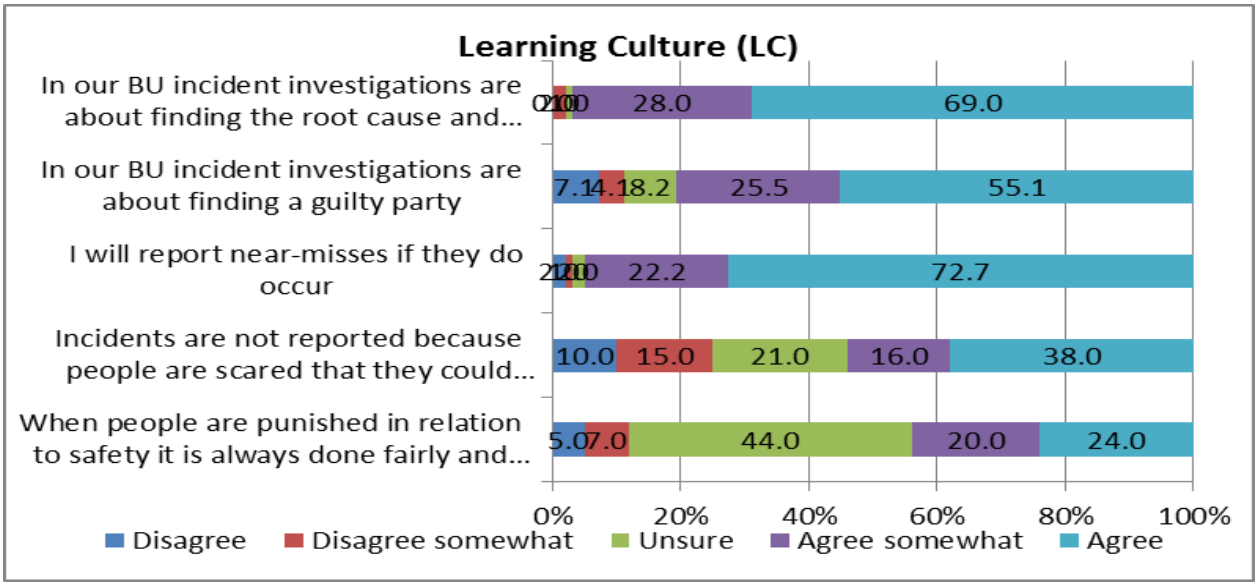

Figure 12- Learning culture(LC)

Figure 12 suggests strong agreement that incident investigations are about finding the root cause and preventing the incident from occurring again and that they can report near-misses if they do occur .The results also suggest that there is moderate agreement that when people are punished in relation to safety it is always done fairly and consistently and that Incidents are not reported because people are scared that they could get dismissed. They did not agree that BU incident investigations are about finding a guilty party. Overall, learning culture seems to be an important element of safety climate as reflected by the degree of agreement (mean score=66.6%)

Production vs Safety

In an economy of ever increasing competitiveness, constant cost reduction, the pressure (work pressure) is constantly on all employees in an organisation to deliver on stretched targets. This leads to the perception of choice between production and safety (Fahlbruch & Wilpert). The following table provides results for the various components pertaining to production from a safety angle.

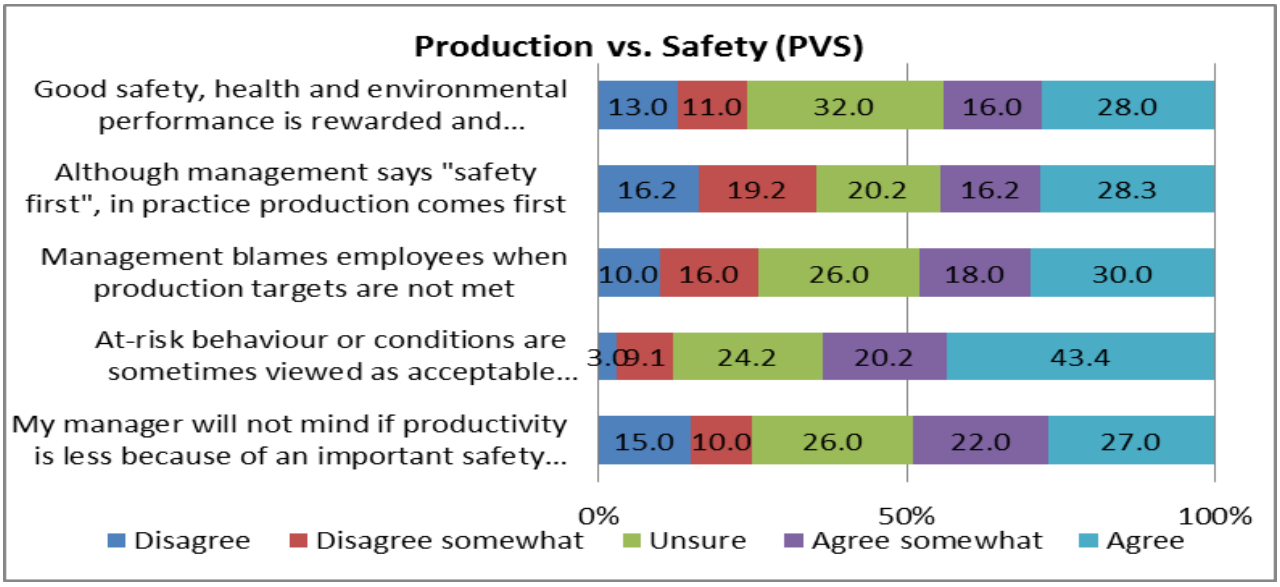

Figure 13- Production vs Safety(PVS)

Figure 13 indicates that there is a high degree of agreement that at-risk behaviour or conditions are sometimes viewed as acceptable because of "special" circumstances. Further results indicate low degree of agreement and a significant percentage of uncertainty in the following four dimensions: that managers will not mind if productivity is less because of an important safety related matter; that management blames employees when production targets are not met, that in practice production comes first than; and lastly that Good safety, health and environmental performance is rewarded and considered in promotion reviews. Overall, the results suggest that safety is more important than production as indicated by the low degree of disagreement and uncertainty in four dimensions.

Safety Communication

Openness and communication is essential for the functioning of any safety management system, as it allows for the flow of information from top down and from bottom to the top. Through proper communication mechanisms every employee will know what is developing in safety field. (Sawacha, Naoum & Fong, 1999). The following table provides results.

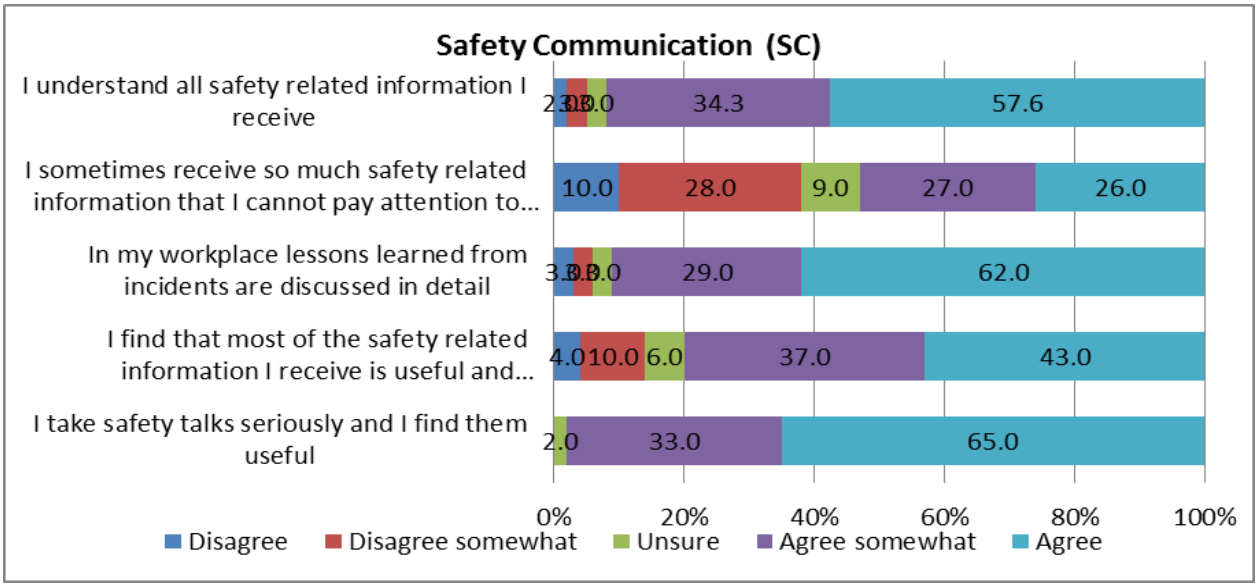

Figure 14 SafetyCommunication (SC)

Figure 14 suggests a very high degree of agreement in taking safety talks seriously and finds them useful and workplace lessons learned from incidents are discussed in detail; understanding all safety related information they receive and most of the safety related information I receive is useful and applicable to me. Safety information overload, featured lowest in terms of importance. Overall safety communication seems to be of high great importance as indicated by the very high degree of agreement in four of the five dimensions.

Employee Knowledge and Competence

The workforce's perception of the general level of workers' qualifications, skills and knowledge is the essence of this competence factor, with associated aspects relating to selection, training, competence standards and their assessment (Flin, Mearns, O'Connor, & Bryden, 2000).

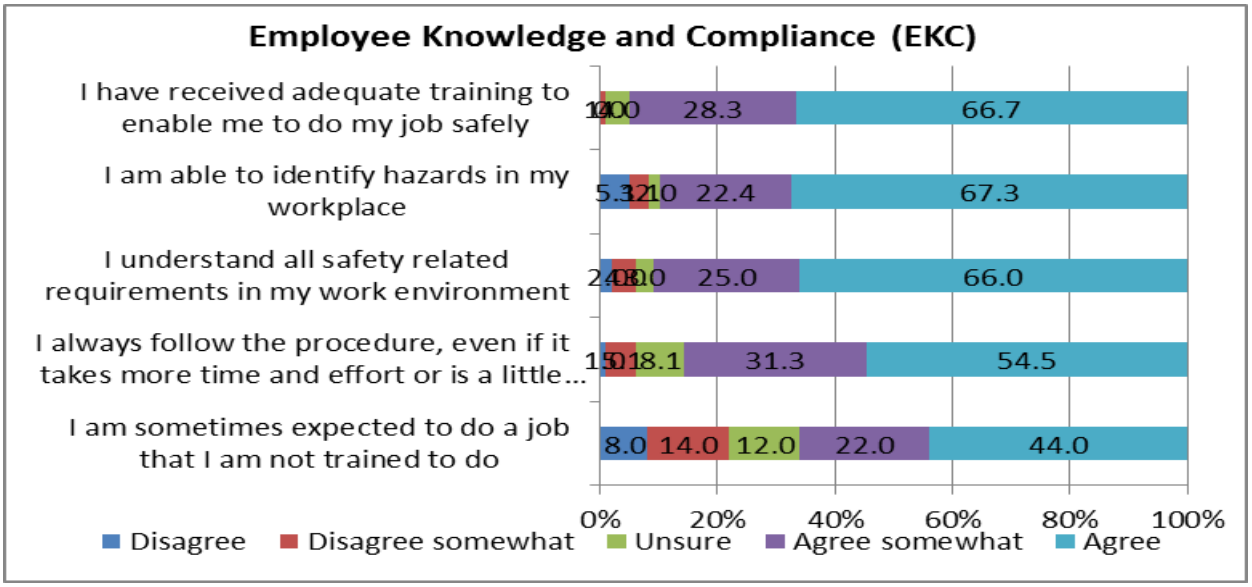

Figure 15- Employee Knowledge and Compliance

Figure 15 indicates that the respondents were not in agreement with the fact that they were sometimes expected to do a job that I am not trained to do. This means that they are expected to perform in jobs that they are not trained to perform. Four dimensions indicate high degree of agreement and these are: always following procedures, even if it takes more time and effort; understanding of all safety related requirements; ability to identify hazards in the workplace and adequate training received. Overall, these results indicate that employee knowledge and compliance are crucial, as indicated by the high degree of agreement on positive aspects of employee knowledge and compliance among the five dimensions

Team Accountability

The ability to trust that your colleagues and employers will not do anything that will cause harm to him/her or you is important to reducing the number of incidents in the workplace. The following table depicts ideas on how the respondents viewed issues of accountability.

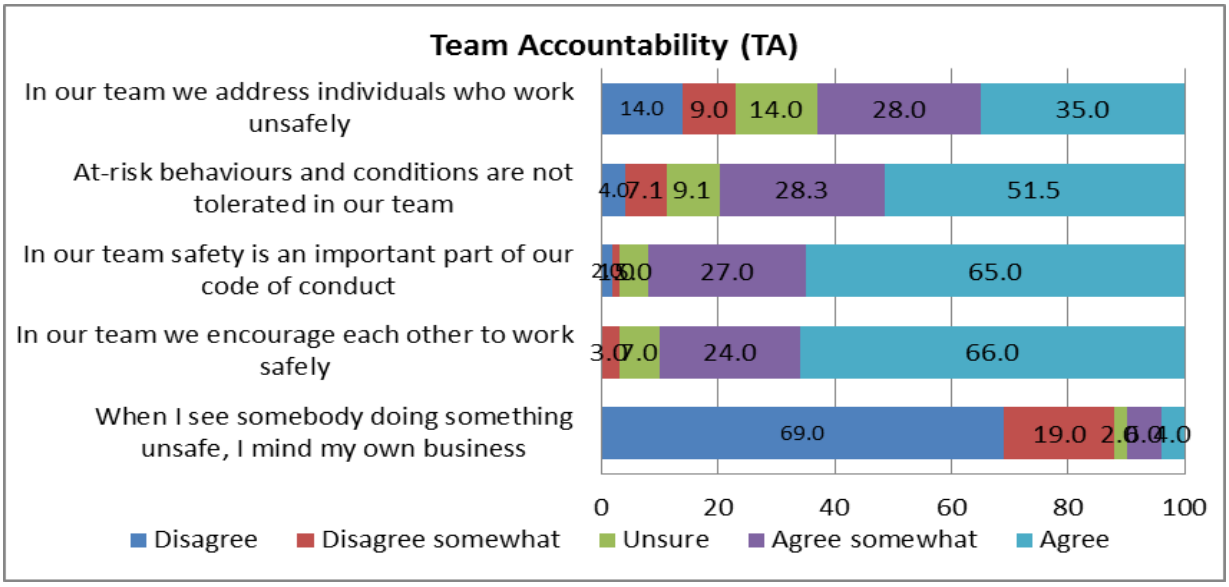

Figure 16 Team Accountability(TA)

Figure 16 indicates that four of the five dimensions of team accountability are crucial in ensuring safety climate. This is depicted by the high degree of agreement in the following dimensions: encouraging each other to work safely, safety as an important part of our code of conduct, non-tolerance in at risk behaviours and conditions, and addressing individuals who are vulnerable to unsafe situations. Only one dimension was not popular among respondents; that they mind their own business even if they see somebody exposing themselves to unsafe conditions, implying that there is a tendency to mind for others in such situations. Overall, the results show that team accountability issues are crucial in safety climate as depicted by the high degree of results in all five aspects of this sub scale

Work Conditions

If employees' work conditions are not conducive to incentive them to be productive then it means the organisation has to improve on their motivation. The results from the following table indicate the importance of safe working conditions.

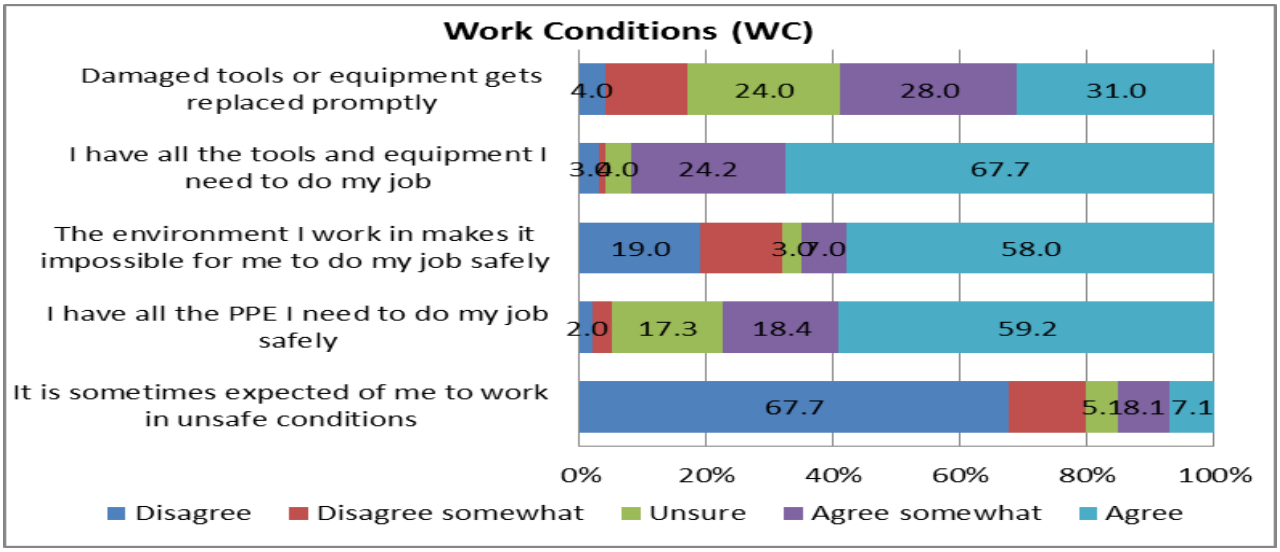

Figure 17- Work Conditions(WC)

Figure 17 indicates that work conditions issues are crucial in as depicted by the fact that respondents agreed to all dimensions of this subscale. These results show that it a concern that they are at times expected to work in unsafe conditions and the fact that the work environment makes it impossible to perform their jobs safely. On a positive side, they have all the PPE they need to do their jobs safely they have all the tools and equipment they to perform their jobs; and damaged tools get replaced promptly.

Leading Indicators

Over three decades of research have led to general consensus on the importance of safety climate as a 'leading indicator' of organisational safety (Zohar, 2010). Many organisations still measure safety performance with lagging indicators such as incidence rates. The ability to predict occupational incidents and injuries is an important factor in driving the correct safety climate in an organisation. The results of this survey suggest the importance of leading indicators.

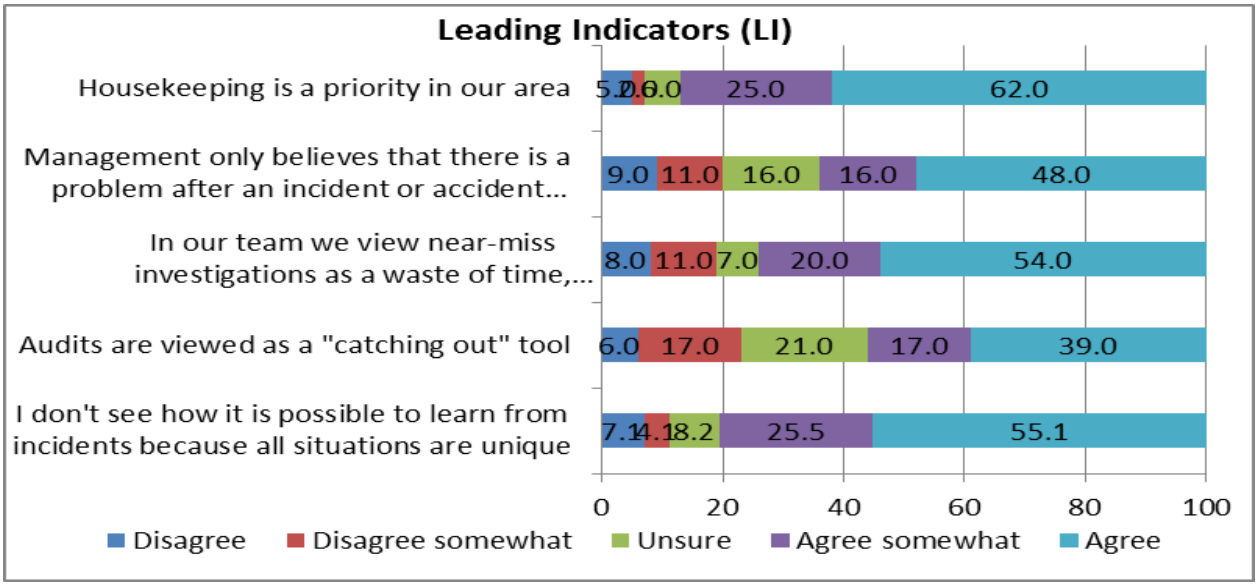

Figure 18 Leading Indicators(LI)

Figure 18 indicates that it is important to have leading indicators in safety climate. On a positive note, housekeeping is viewed as a priority area in leadership that all situations are simple, near miss investigations as a waste of time and adults are viewed as catching out tools. It is only one dimension of this subscale that was ranked lowest and viewed as not crucial: management only believes that there is a problem after an incident or accident has occurred. Overall results indicate that the results are reliable and the inference is that four of the five dimensions are crucial in safety climate as depicted by the high degree of agreement (72.3%)

Human Resources and Organisational Design (HR)

Workload brought on by understaffing and poorly resourced teams have a significant impact of the safety performance of an organisation. Increased workloads lead to a short cut which inevitably leads to workplace incidents. The following table provides results on workload with respect to adequacy of employees, overtime, resting time between shifts, and the physical ability to perform the tasks.

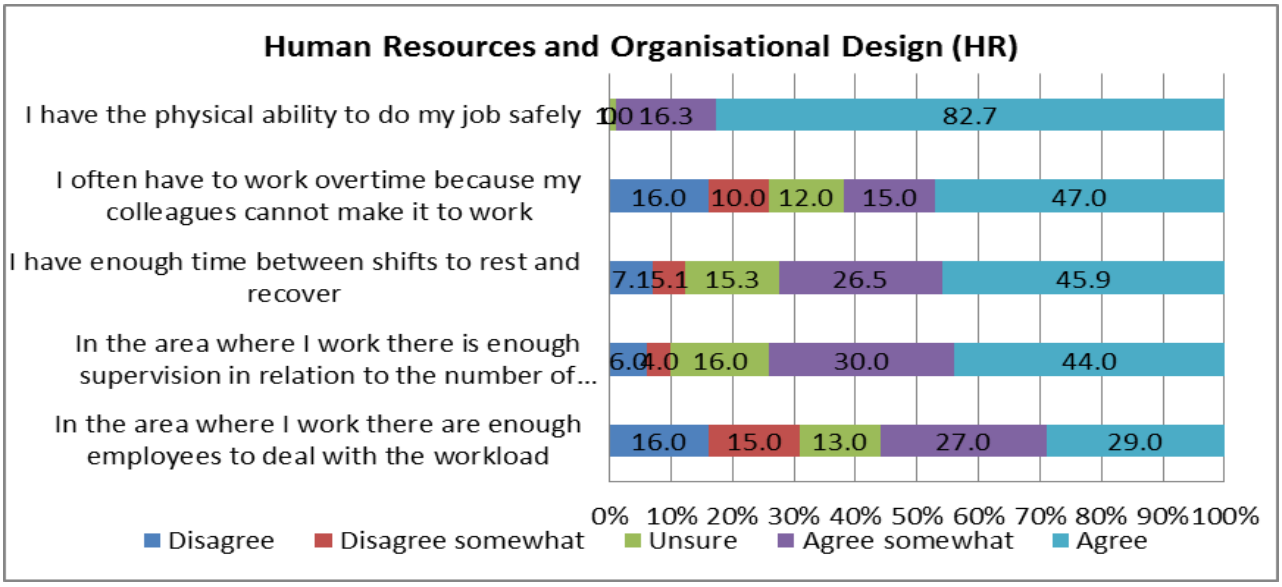

Figure 19- Human Resources and Organisational D

Figure 19 indicates only one of the five dimensions of human resources and organisational design is not crucial; having to work overtime to cover colleague's absence. This means that they do not have to work overtime, although contradicting results indicate that the respondents were indifferent to the fact that there are adequate employees to deal with the existing workload. Further results indicate that four dimensions are crucial in this subscale: physical ability to perform duties, adequate supervision in relation to employees' number, and adequate time between shifts. Overall results indicate that the results of this subscale point to the fact that Human Resources and Organisational Design is important in safety climate.

Summary

Cronbach's alpha was calculated for each of the elements, and showed lower results than the recommended 0.7; however alpha for the entire questionnaire was calculated at 0.875 which suggests that the questionnaire used is reliable to measure safety climate.

5.2. Factor Analysis

The following section applies confirmatory factor analysis to determine the validity of the questions posed in each subscale. Confirmatory factor analysis is conducted to determine validity of each of the factors. It determines whether all the factors of the global construct at hand (safety climate) is measuring the same subscale element. If there is more than one factor loading per subscale, it means that that a specific question/s is perceived as measuring something different to the other questions. Factors that have an eigenvalue higher than one, determine how many components each factor will load onto. .

As can be seen in Figure 20, the thirteen subscales of the questionnaire loaded on one factor, which can be labelled as safety climate.

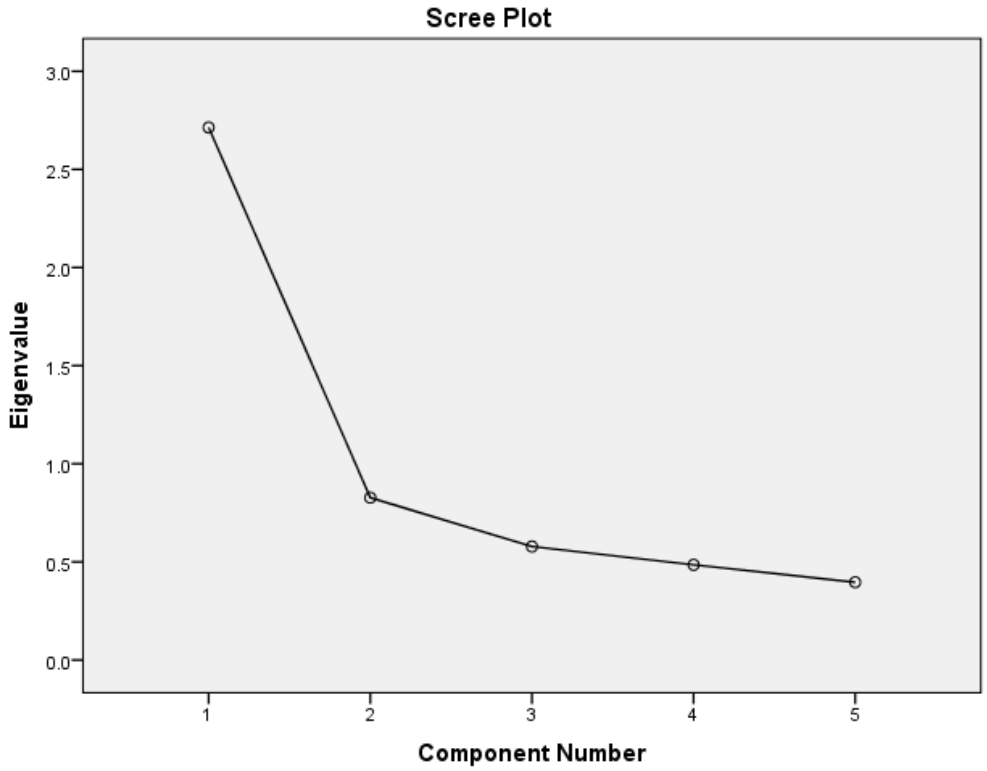

Figure 20 Scree Plot for 13 subscales of safety climate

The following section applies confirmatory factor analysis to determine the validity of the questions posed in each subscale. The senior leadership commitment (SLC) subscale presented with only one factor. Table 7 demonstrates that all the factors of the subscale loaded with sufficient significance on one component.

Table 6 SLC Component Matrix

Component Matrix	
	Component
	1
Senior leadership is visibly committed to safety	.718
Senior leadership would not hesitate to stop work if conditions became unsafe	.720
Senior leadership have conversations with us about the importance of safety	.644
Senior leadership is frequently seen engaging in safety related matters	.765
My safety is really important to senior leadership	.821

The line manager commitment (LMC) subscale also presented as one factor. Table 8 demonstrates that all the items of the subscale loaded with sufficient significance on one component. The two items, which point toward poor line management commitment loaded negatively.

Table 7 LMC Component Matrix

Component Matrix	
	Component
	1
My direct manager encourages and enables me to work safely	.489
My direct manager only really pays attention to safety when an incident has occurred or when an audit or a management walkabout is due to take place	-.718
Work related injuries are due to a lack of management commitment to remove hazards	-.615
My direct manager regularly discusses hazards in the workplace with us	.657
My direct manager always responds to safety concerns that have been raised	.517

The subscale employee participation (EP) presented with two factors. Table 9 illustrates that four of the five items loaded onto Component 1, which can be coined employee participation and the second factor related to the question 'I am responsible to inform management of important safety concerns.

Table 8 EP Component Matrix

Component Matrix		
	Component	
	1	2
I participate in the planning and/or risk assessment of my tasks	.755	.134
We participate in the review of hazards and the design of control mechanisms	.673	-.377
Management really listens to our inputs regarding safety and implement some of the ideas	.559	-.351
We are encouraged to come up with safety solutions	.722	.164
I am responsible to inform management of important safety concerns	.268	.859

The employee motivation (EM) subscale presented with two factors. Table 10 illustrates that four of the five items loaded onto Component 1, which can be named employee motivation and the question ‘I am only really conscious about how safely I work when I know somebody is watching me” loaded on the second component.

Table 9 EM Component Matrix

Component Matrix		
	Component	
	1	2
The Safety value really means something to me	.704	.199
I am only really conscious about how safely I work when I know somebody is watching me	.026	.922
I always look for opportunities to learn about safety	.590	-.363
I understand my role in achieving the safety goals	.722	-.175
I always feel motivated to work safely	.633	.279

The locus of control (LOC) subscale presented with two factors with an eigenvalue value greater than 1. Table 11 illustrates that two factors, one being external locus of control and the other being internal locus of control were formed, which corresponds with the theoretical principle of locus of control being a continuum ranging from external to internal locus of control.

Table 10 LOC Component Matrix

Component Matrix		
	Component	
	1	2
Accidents are primarily the result of things beyond our control	080	.742
Good planning can prevent incidents	.821	-.035
Our safety performance is purely a matter of luck	.596	.455
You cannot plan for everything that can go wrong	-.272	.715
It is possible to achieve our safety targets	.759	.217

The learning culture (LC) subscale presented with two factors with an eigenvalue value greater than 1. Table 12 illustrates that four of the five items loaded onto Component 1 (learning culture) and the question ‘When people are punished in relation to safety it is always done fairly and consistently” loaded on the second component. The difference between the values of two loadings are however quite small, and the loading of this question on the Component 1 is deemed sufficient.

Table 11 LC Component Matrix

Component Matrix		
	Component	
	1	2
When people are punished in relation to safety it is always done fairly and consistently	.523	.632
Incidents are not reported because people are scared that they could get dismissed	-.622	.309
I will report near-misses if they do occur	.560	-.554
In our incident investigations are about finding a guilty party	.744	.152
Incident investigations are about finding the root cause and preventing the incident from occurring again	.663	.429

The production vs safety (PVS) subscale presented as two factors with an eigenvalue value greater than 1. Table 13 illustrates that three of the five factors loaded onto Component 1 whereas the questions “Good safety, health and environmental performance is rewarded and considered in promotion reviews” and “My manager will not mind if productivity is less because of an important safety related matter” loaded on the second component. Two factors therefore emerged, one being productivity and the other being safety, suggesting that productivity and safety run on a continuum, similar to the locus of control construct.

Table 12 PVS Component Matrix

Component Matrix		
	Component	
	1	2
My manager will not mind if productivity is less because of an important safety related matter	-051	.783
At-risk behaviour or conditions are sometimes viewed as acceptable because of "special" circumstances	.650	.227
Management blames employees when production targets are not met	.681	-014
Although management says "safety first", in practice production comes first	.668	.074
Good safety, health and environmental performance is rewarded and considered in promotion reviews	.346	.712

The safety communication (SC) subscale presented with two factors with an eigenvalue value greater than 1. Table 14 illustrates that four of the five items loaded onto Component 1 and the question “I sometimes receive so much safety related information that I cannot pay attention to it all” loaded on the second component.

Table 13 SC Component Matrix

Component Matrix		
	Component	
	1	2
I take safety talks seriously and I find them useful	.796	-011
I find that most of the safety related information I receive is useful and applicable to me	.561	.322
In my workplace lessons learned from incidents are discussed in detail	.729	-283
I sometimes receive so much safety related information that I cannot pay attention to it all	-208	.881
I understand all safety related information I receive	.731	.298

The employee knowledge and compliance (EKC) subscale showed two factors with an eigenvalue value greater than 1. Table 15 illustrates that four of the five items loaded onto Component 1 (employee knowledge and compliance) and the question "I am sometimes expected to do a job that I am not trained to do" loaded on the second component.

Table 14 EKC Component Matrix

Component Matrix		
	Component	
	1	2
I am sometimes expected to do a job that I am not trained to do	-191	.865
I always follow the procedure, even if it takes more time and effort or is a little inconvenient	.617	.199
I understand all safety related requirements in my work environment	.817	-014
I am able to identify hazards in my workplace	.590	.455
I have received adequate training to enable me to do my job safely	.719	-299

The team accountability (TA) subscale presented with one factor with an eigenvalue value greater than 1. Table 16 illustrates that all five factors loaded sufficiently onto Component 1.

Table 15

Component Matrix	
	Component
	1
When I see somebody doing something unsafe, I mind my own business	-.330
In our team we encourage each other to work safely	.841
In our team safety is an important part of our code of conduct	.796
At-risk behaviours and conditions are not tolerated in our team	.642
In our team we address individuals who work unsafely	.601

The workplace conditions (WC) subscale presented with two factors with an eigenvalue value greater than 1. Table 17 illustrates that three of the five items loaded onto Component 1 and the remaining two on Component 2. Nonetheless the factor loadings on Component 1 were all high enough to disregarding the second component.

Table 16

Component Matrix		
	Component	
	1	2
It is sometimes expected of me to work in unsafe conditions	-.663	.073
I have all the PPE I need to do my job safely	.549	.421
The environment I work in makes it impossible for me to do my job safely	-.560	.647
I have all the tools and equipment I need to do my job	.608	-.196
Damaged tools or equipment gets replaced promptly	.461	.647

The leading indicators (LI) subscale formed two factors with an eigenvalue value greater than 1. Table 18 illustrates that four of the five items loaded onto Component 1 and the question “Housekeeping is a priority in our area” loaded on the second component.

Table 17

Component Matrix		
	Component	
	1	2
I don't see how it is possible to learn from incidents because all situations are unique	.651	.517
Audits are viewed as a "catching out" tool	.652	.496
In our team we view near-miss investigations as a waste of time, because nothing serious happened	.586	-.512
Management only believes that there is a problem after an incident or accident has occurred	.773	-.133
Housekeeping is a priority in our area	-.489	.526

The human resources (HR) subscale presented with two factors with an eigenvalue value greater than 1. Table 19 illustrates that four of the five questions loaded onto Component 1 and the question “I often have to work overtime because my colleagues cannot make it to work” loaded on the second component.

Table 18

Component Matrix		
	Component	
	1	2
In the area where I work there are enough employees to deal with the workload	.720	.154
In the area where I work there is enough supervision in relation to the number of employees	.734	-.041
I have enough time between shifts to rest and recover	.413	-.325
I often have to work overtime because my colleagues cannot make it to work	-.196	.889
I have the physical ability to do my job safely	.660	.346

Conclusion

In this chapter the study shows the results from the survey conducted. The chapter included results from descriptive statistics for the 13 subscales, as well as results from the factor analyses. In the next chapter the study will delve into the details of the results and link the results back to the theory identified in Chapter 3.

6. Discussion of Results

In this chapter the study will discuss the results from Chapter Five, in conjunction with the information discussed in Chapter Three in order to accept or reject the hypothesis as stated in Chapter Four. This chapter will explore each hypothesis in conjunction with the results. Industry experts and literature will be consulted to provide sufficient explanation for results. Explanations provided will enable recommendations and conclusions, which follows in the next chapter.

Hypothesis One

H_0-A validated safety climate measurement tool in the form a survey questionnaire cannot be developed using literature studies of safety climate surveys.

H_A- A validated safety climate measurement tool in the form a survey questionnaire can be developed using literature studies of safety climate surveys

To work with this hypothesis the study used literature review to determine the constructs of a safety climate measurement tool. Via the literature study, thirteen constructs were extracted. The thirteen constructs were Senior Leadership Commitment (SLC), Line Management Commitment (LMC), Employee Participation (EP), Employee Motivation (EM), Locus of Control (LOC), Learning Culture (LC), Production vs. Safety (PVS), Safety Communication (SC), Employee Knowledge and Compliance (EKC), Team Accountability (TA), Work Conditions (WC), Leading Indicators (LI), Human Resources and Organisational Design (HR). Five questions which were derived from the definition of each of the constructs were allocated to each construct to form the safety climate questionnaire (Appendix A).

The validity of these constructs was measured using Cronbach's alpha coefficient, inter-item correlation coefficient, and factor analyses. The next section will go into the details of the results of the factor analysis.

An established factor analyses demonstrated that all the subscales of the safety climate questionnaire loaded on one component. This factor was labelled safety climate.

Senior Leadership Commitment (SLC) is explained by researcher as the ability of leadership of an organisation to demonstrate that the safety and he wellbeing of the employees is important to the organisation (Geller, 2001). The questions asked were formulated around this definition. In the results all the factors of this subscale loaded onto one component demonstrating that questions were perceived to be measuring senior leadership commitment. Zohar (2010) argues that communication, participation, visibility and support are essential components of senior leadership commitment. As all factors loaded onto one component with loading values higher than 0.64, it is

indicative that these questions adequately measure senior leadership commitment as a subscale of safety climate.

Line Management Commitment (LMC) is explained as the next step in management commitment. These are the people that implement the policies, disseminate communications and enforce rules (Agrilla, 1999). These roles are important as the ambassadors of the safety values of the organisation (Zohar, 2010). In the results for this subscale, all the factors loaded onto one component demonstrating that the questions were perceived to measure line management commitment. The negative factor loading in this subscale is indicative of a question phrased in reverse. This factor however maintains a loading of 0.615, which is considered significant. The factor loading in this subscale is indicative that the questions asked are measuring line management commitment as a subscale of safety climate.

Employee Participation (EP) is explained as the involvement of employees in safety decision, risk management processes, incident reporting initiatives and development of policies and procedures that affect their safety in the workplace (Niskanen, 1994). The results of the factor analysis for this subscale loaded onto two components (eigenvalues greater than 1). These results further indicate that the four of the five items loaded onto the first component with factor values greater than 0.559 indicating that these four factors do measure the subscale of employee participation in safety climate. The factor" I am responsible to inform management of important safety concerns" loaded onto the second component After discussion with industry experts, this factor was deemed to be more related to the subscale of work locus of control which focuses on the way the employees view their influence and the results thereof in the work environment, rather than line management commitment. This question focused on the employee's perceived responsibility to report safety concerns, and not the employer's tendency to encourage employee participation. It was decided that this question would have to be amended to reflect employee participation. Table 20 below explains the change:

Table 19 Employee participation 2nd component changes

Original question that formed a 2nd factor	Potential reason	Proposed question
I am responsible to inform management of important safety concerns	The other questions relate to what the manager does to encourage employee participation, not the employee's perception of his/her responsibilities."	Line management supports and enables the reporting of incidents.

Employee Motivation (EM) was explained as an essential requirement to ensure that employees participate is safety related initiatives. For this motivation to be realized, employees need to perceive that the work they are doing is adding value to the organisation and in turn the activities that are conducted in the organisation are adding value to them as individuals. This value process will enable employees to participate proactively. (Burke & Signal, 2010). The results loaded onto two components (eigenvalue greater than 1). Four of the five items loaded on component 1 with factor loadings greater than 0.59 indicating that these four questions are perceived to measure employee participation as an element of safety climate. The factor "I am only really conscious about how safely I work when I know somebody is watching me" loaded significantly on the second component with 0.922. After consulting with industry experts and literature, it was identified that this question when compared with the other questions in the subscale relates to something outside of the employees intent. Employee motivation is about an employee beliefs and perception; that is it is an internal aspect (Burke & Signal, 2010) whereas this question is more about an external aspect. Table 21 below explains further:

Table 20 Employee Motivation 2nd component changes

Original question that formed a 2nd factor	Potential reason	Proposed question
I am only really conscious about how safely I work when I know somebody is watching	The other questions in this subscale relate to the individual's intentions, but this one introduces the concept of "being watched"	I make a conscious effort to work safely every day

Locus of control was explained the employees understanding of the amount of control or influence he/she has on safe/unsafe activities that occur within the organisation. This can be further explained as the ability of the employee to accept that sometimes he may be responsible for safety deviation (Huang, Ho, Smith, & Chen, 2006). The results loaded onto two components (eigenvalues greater than 1). This division of the factor loadings can be explained within the definition of locus of control which has two elements: (1) internal locus of control which the ability of a person to understand that the decisions that he/she make can/could be the reason for the activity taking place that is it is an inward looking approach and (2) external locus of control is the ability for the person to perceive that everything that occurs is outside of his control(Huang, Ho, Smith, & Chen, 2006). The questions in this subscale were posed to both elements of locus of control. After consultation from industry experts, it was decided not to amend these questions at is a fair representation of continuum of locus of control, which is also consistent with the theory and research regarding locus of control.

Learning culture was explained as the ability of an organisation to learn from its mistakes or the mistakes from other organisations. In order for learning to happen, there must be a proper reporting mechanism (Burke & Signal, 2010). The results of the factor analysis for this subscale has two factors with an eigenvalue greater than 1 and four of the five items loaded onto component 1.This indicates that these four questions are perceived to measure the element of learning culture. The factor "When people are punished in relation to safety it is always done fairly and consistently" loaded on component 1 with 0.523 and on component 2 with 0.632. After consultation with industry experts, it was decided that there was not a significant difference between the two factor loadings to warrant a change. The questions for his subscale remain the same.

Production vs safety was explained as the perception in an organisation that there are elements of making a profit that are more important than the safety and wellbeing of the employee or the safety initiatives that are required. (Fahlbruch & Wilpert 1999). The results of the factor analysis for this subscale has two factors with an eigenvalue greater than 1 and three of the five factors loaded onto component 1, whereas the other two loading onto component 2. Upon closer inspection, it could be seen that two scales were formed, one measuring productivity focus and the other measuring safety focus, i.e. similarly to the locus of control findings. Productivity vs safety therefore runs along a continuum ranging from pure productivity focus to pure safety focus.

Safety communication was explained as the organisation's ability to communicate the required policies, procedures, training and awareness adequately to its employees. The organisation should ensure that appropriate quality and quantity of communications are conducted by an adequate delivery system (Sawacha, Naoum, & Fong, 1999). The results of the factor analysis loaded on two components (eigenvalue greater than 1) with four of the five items loaded onto component 1. The item "I sometimes receive so much safety related information that I cannot pay attention to it all" loaded onto the second component. After consultation, it was identified that this question, brings in the element of locus of control and ability to pay attention. Table 22 explains further:

Table 21

Original question that formed a 2nd factor	Potential reason	Proposed question
I sometimes receive so much safety related information that I cannot pay attention to it all	Other questions relate to usefulness of safety communication, whereas this question introduces the concept of being able to pay attention to everything	I am able to apply learnings in my work environment

Employee knowledge and compliance (EKC) is explained as the perception that every employee is equipped mentally to conduct their tasks safely (Flin, Mearns, O'Connor, & Bryden, 2000). The results of the factor analysis loaded on two components (eigenvalue greater than 1) with four of the five items loaded onto component 1. The item "I am sometimes expected to do a job that I am not trained to do" loaded onto the second component. After consultation, it was identified that this question, does not refer to the element of safety, and may be perceived as general competence to conduct work. Table 23 explains further:

Table 22

Original question that formed a 2nd factor	Potential reason	Proposed question
I am sometimes expected to do a job that I am not trained to do	Other questions relate to knowledge & compliance regarding safe working & following procedure, but this one doesn't refer to safety specifically. Additionally, it is more of a LM commitment indicator.	I know how to execute my work in a safe way

Team Accountability (TA) brings in a certain element of trust in order to work safely. Every employee should be vigilant not top cause harm to another employee (Burke & Signal, 2010). In the results of the factor analysis, all the items loaded onto one component demonstrating that the questions were perceived to measure team accountability. The negative factor loading in this subscale is indicative of a question phrased in reverse.

Work Conditions (WC) is explained as the environment that work is conducted is an important element in determining whether an incident will take place or not (Niu, 2010). The results of the factor analysis loaded on two components (eigenvalue greater than 1) and four of the five items loaded onto component 1. The item "The environment I work in makes it impossible for me to do my job safely" loaded onto the second factor, however the factor loading were very similar to each other, therefore after consultation with industry experts, it was decided not to amend this question.

Leading Indicators (LI) is the organisations ability to develop measure that will prevent the workplace incident from occurring (Burke & Signal, 2010). The results of the factor analysis loaded on two components (eigenvalue greater than 1) with three of the five items loaded onto component 1. . The items "I don't see how it is possible to learn from incidents because all situations are unique" and "Audits are viewed as a "catching out" tool" loaded onto the second component. Table 24 below explains further:

Table 23

Original question that formed a 2nd factor	Potential reason	Proposed question
I don't see how it is possible to learn from incidents because all situations are unique	This question differs from the others in that it asks for a personal opinion as opposed to a group practice/view	In our team we believe all situations are unique, therefore it is not really possible to learn from incidents
Audits are viewed as a "catching out" tool	This question differs from the others in that it asks for a personal opinion as opposed to a group practice/view	In our team we view audits as a mechanism to catch us out.

Human Resource and Organisational Design (HR) is the ability of the organisation to provide adequate resource and human resource processes to enable employee to conduct their work safely (Burke & Signal, 2010). The results of the factor analysis loaded on two components (eigenvalue greater than 1) with four of the five items loading onto component 1. The item “I often have to work overtime because my colleagues cannot make it to work” loaded onto the second component. Table 25 explains further:

Table 24

Original question that formed a 2nd factor	Potential reason	Proposed question
I often have to work overtime because my colleagues cannot make it to work	The original intent was to measure absenteeism management, there is a question relating to rest between shifts	Some of my colleagues are absent from work very often

Summary of factor analysis

All 13 subscales with all 65 questions were subjected to factor analyses. An analysis of the results of the factor analyses indicates that only 7 questions needed re- evaluation, although it must be noted that there were several other questions that were not reevaluated to due to the factor loading being insignificantly different between the two components. This analysis of the factors has thus proved the alternative hypothesis, that the tool developed through study of previous safety climate

studies is valid. The next section will explain the descriptive statistical results that deal with the 2nd hypothesis.

Hypothesis Two

H_0- Organisations implement behavioural safety programs without considering elements of safety climate that support a behavioral approach to safety

H_A- Organisations have considered and implemented the necessary elements of a positive safety climate before implementing a behavioural approach to safety

In this section the study will analyse the results of the descriptive statistics for the elements identified in Chapter 2, in other words those that are required for an effective behavioral safety program. This analysis will be conducted in relation to literature review and with the input industry experts to achieve an objective view.

Senior Leadership Commitment SLC

The results showed that 57.3%% of the sample perceived senior leadership as being committed to safety and 26.5% were somewhat sure of senior leadership commitment in their organisation. 8.3%, 3.6% and 3% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. Numerous studies have shown that workforce perceptions of a high level of management commitment to safety are correlated to low accident rates. Furthermore there is a lot of empirical evidence indicating that workforce perception of management attitude to safety is a prerequisite of successful safety initiatives (Zohar 2010).

Line Management Commitment (LMC)

The results showed that 53.5%% of the sample perceived line management as being committed to safety and 25.2% were somewhat sure of line management commitment in their organisation. 8.3%, 3.6% and 3% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. This dimensions refers to the support that employees' immediate supervisor provides in carrying out their work. Supervisors are directly and indirectly instrumental in shaping and reinforcing an organisational climate for safety. However, if the supervisory practices of an organisation or group are deficient in terms of establishing a positive safety climate (e.g. in terms of supervisory support, work pressure and reward practices), the result will be a weak safety climate Guldenmund (2000).

Employee Participation (EP)

The results showed that 48.4%% of the sample participated in safety activities and 30.8% were somewhat sure of their participation in safety initiatives in their organisation. 9.9%, 5.4% and 5.4% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. Research shows that employees that are involved in safety initiatives are generally less prone to having incidents. Employee participation results in greater ownerships of safety initiatives and will also promote the effectiveness of a behavior based safety system (Ismail, Ahmad, Janipha, & Ismail, 2012).

Employee Motivation (EM)

The results showed that 53.8%% of the sample motivated positively towards safety and 23.6% were somewhat motivated in their organisation. 3.8% and 4% however felt unsure or disagreed slightly 14.8% disagreed completely, however this number must considered in conjunction with the factor analysis which suggested that the question be re phrased. For employees to participate, they need to be motivated. These results indicate a fairly well motivated workforce, which could be a result of the line management and leadership commitment to safety (Seo, Torabi, Blair, & Ellis, 2004).

Workplace conditions (WC)

The results showed that 56.7%% of the sample were sure that workplace conditions were conducive ti safety and 17.9% were somewhat sure of their workplace conditions in their organisation. 10.7 %, 7.6% and 7% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. It is essential to provide a safe working environment to employees to (1) keep employees motivated, (2) enable them to participate and (3) prevent injuries. These results are indicative of leadership commitment as well as a motivated workforce that participates in SHE initiatives (Seo, Torabi, Blair, & Ellis, 2004).

Employee Knowledge and Compliance (EKC)

The results showed that 59.7%% of the sample perceived that they had the required training and knowledge to conduct the work safely and 25.8% were somewhat sure of this requirement in their organisation. 5.8 %, 5.4 % and 3.2% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. Employees need to be geared with the correct training to work safely. These results indicate a workforce that receives adequate training and awareness. Research has shown that in an organisation that has a high prevalence of leadership commitment, and then employees are generally well equipped to conduct their work safely (Seo, Torabi, Blair, & Ellis, 2004).

Human Resource (HR)

The results showed that 49.7%% of the sample perceived that there were sufficient HR structures and resources to conduct work safely and 23% were somewhat sure of this requirement in their organisation. 11.5 %, 6.8 % and 9% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. The 72.7% that were sure and somewhat sure was an indication of organisation that has the correct structures in place to support a safe environment (Seo, Torabi, Blair, & Ellis, 2004). The 27.3% that were not sure was a result of the question based on overtime. This was a question that required re phrasing on the factor analysis.

Learning Culture (LC)

The results showed that 51.8%% of the sample perceived that the organisation learned from errors and 22.3% were somewhat sure of this fact in their organisation. 15.2%, 5.8% and 4.8% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. Both research and case studies have shown that organisations tend to struggle to learn from mistakes(Anderson 2005), this is indicative in the 25.8 % of the sample indicating that there is still room for learning and sharing.

Safety Communications (SC)

The results showed that 47.5%% of the sample perceived that was sufficient relevant safety information provided in the organisation and 25.2% were somewhat sure. 4.6%, 10.8% and 8.8% however felt unsure, disagreed slightly or disagreed completely, suggesting room for improvement. There is some indication in the results that there might be too much safety information, however there is good indication that there is value in the safety communication that is received. Research has shown that an increase in two way communication will reduce workplace incidents. Organisations that have the required structures in place to support safety initiatives will reduce the number of incidents (Baxendale & Jones, 2000).

Summary of Descriptive Statistics

The results of this study have shown that the sample organisation has largely implemented or acted proactively on the nine elements that this study deems necessary for the implementation of a behavioral safety program. Although the results show that there are elements that require more work and adjustment, the results have largely proven the alternate hypothesis that this organisation has consider factors of safety climate when implementing a behavioral based safety system, rather than solely relying on a behavioural based safety program to reduce incidents without a supportive safety climate.

7. Conclusion

Provision of an effective measure of safety climate can prove to have enormous benefits to safety fraternity as well as industry at large. If an organisation can understand the performance of its safety climate, it will be able to be more proactive in its approach to managing workplace incidents (Zohar, 2010). Understanding safety climate will enable to organisations to focus its efforts in the correct area's thereby improving efficiencies and reducing costs by reducing incidents at the workplace. In addition, the use of a common platform to measure performance of safety climate will allow cross organisational comparison as efficient sharing of best practices (Seo, Torabi, Blair, & Ellis, 2004).

In response to the argument that there is not a common platform to measure safety climate, an extensive literature review was conducted to develop a 65 question, 13 subscale safety climate survey questionnaire, which covers all the constructs (common threads) of previous safety climate studies. The survey questionnaire was developed by identifying constructs that were common across previous safety climate studies and pulling them together using the Burke & Signal, (2010). The questions were derived from definitions of the constructs in literature.

The Safety Climate Survey was undertaken to assess the perceptions of employees in a multinational organisation. The results of the survey were used to determine the validity of the safety climate measurement tool.

The age of the sample group range from 24 to 59 years with largest age group being between the ages of 31 and 39(38%) The sample consisted of 55% male and 45% female. Only 4% of the employees in the sample have a secondary education, with the rest of the population having some form of tertiary education.

The results of the factor analysis indicated that the safety climate survey that was developed was accurate in measuring safety climate. It also indicated that the constructs identified in the literature review loaded onto one component, which is safety climate. There were however, questions that were perceived not to measure certain constructs of safety climate. After consultation with experts and literature these questions were reevaluated and amended.

The results of the descriptive statistics showed that the employees perceived that the organisation had considerable leadership commitment, the required human resource policies and processes, effective safety communications processes in place. The results also showed that employees perceived that their work environment was conducive to safety and that the organisation learnt from previous errors. These results thus proved that the organisation had considered constructs of safety climate when embarking on behavioural safety program.

This study can only be considered taking the limitations mentioned in Chapter 4 into account.

Despite the limitations, this study contributes to the literature by defining a common scale of measurement of safety climate and requirements of safety climate that support the implementation of a behavioural safety system.

Recommendations and Future Research

The factor analysis indicated that changes were required from certain questions. These amendments were made accordingly as shown in Appendix D. To determine whether these questions have been addressed effectively in this study, the survey needs to be tested on another sample and the factor analyses conducted.

The purpose of this study was to establish a common mechanism to measure safety climate. Considering that requirement, this model should be tested across different industries to ensure that it is compatible in other industries outside of the petrochemical sector.

To increase the validity of this study, a possible cross validation of the safety climate tool should be conducted.

There is much literature that discusses the relationship between safety climate and behavior based safety. To determine how that relationship function, further research using the tool developed in this study should be conducted.

THE END

8. References

Agrilla, J. A. (1999). Construction safety management formula for success. In *Proceedings of the 2nd International Conference of the International Council for Research and Innovation in Building and Construction (CIB) Working Commission W* (Vol. 99, pp. 33–6).

Aksorn, T., & Hadikusumo, B. H. W. (2008). Critical success factors influencing safety program performance in Thai construction projects. *Safety Science*, *46*(4), 709–727.

Aldrich, M. (2014). History of Workplace Safety in the United States, 1880-1970. Retrieved November 4, 2014, from http://eh.net/encyclopedia/history-of-workplace-safety-in-the-united-states-1880-1970/

Anderson, M. (2005). Behavioural Safety and Major Accident Hazards: Magic Bullet or Shot in the Dark? *Hazards XVIII*, *83*(2), 109–116. doi:10.1205/psep.04230

Baxendale, T., & Jones, O. (2000). Construction design and management safety regulations in practice—progress on implementation. *International Journal of Project Management*, *18*(1), 33–40.

Bergh, M. (2011). Safety Climate-An evaluation of the safety climate at AkzoNobel Site Stenungsund.

Beus, J. M., Payne, S. C., Bergman, M. E., & Arthur Jr, W. (2010). Safety climate and injuries: an examination of theoretical and empirical relationships. *Journal of Applied Psychology*, *95*(4), 713.

Brown, R. L., & Holmes, H. (1986). The use of a factor-analytic procedure for assessing the validity of an employee safety climate model. *Accident Analysis & Prevention*, *18*(6), 455–470.

Brown, T. A. (2012). *Confirmatory factor analysis for applied research*. Guilford Press.

Budworth, N. (1997). The development and evaluation of a safety climate measure as a diagnostic tool in safety management. *Iosh Journal*, *1*, 19–29.

Bureau of Labor Statistics. (2013). How To Compute Your Firm's Incidence Rate for Safety Management. Retrieved August 11, 2014, from http://www.bls.gov/iif/osheval.htm

Burke, M. J., & Signal, S. M. (2010). Workplace Safety: A Multilevel, Interdisciplinary Perspective. *Research in Personnel and Human Resources Management*, *29*, 1–47.

Cooper, D. (1998). *Improving safety culture: A practical guide*. Wiley England.

Cooper, D. &*Schindler (2001), Business Research Methods*. McGraw-Hill International.

Cooper M. D. (2000). Towards a model of safety culture. *Safety Science*, *36*(2), 111–136.

Cox, S., & Cox, T. (1991). The structure of employee attitudes to safety: a European example. *Work & Stress*, *5*(2), 93–106.

Cox, S., & Jones, B. (2006). Behavioural Safety and Accident Prevention: Short-Term "Fad" or Sustainable "Fix"? *Human Factors and Management*, *84*(3), 164–170. doi:10.1205/psep.05186

Cox, S., Jones, B., & Rycraft, H. (2004). Behavioural approaches to safety management within UK reactor plants. *Safety Science*, *42*(9), 825–839. doi:10.1016/j.ssci.2004.03.002

Coyle, I. R., Sleeman, S. D., & Adams, N. (1995). Safety climate. *Journal of Safety Research*, *26*(4), 247–254. doi:10.1016/0022-4375(95)00020-Q

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334.

Davis, J. A., & Smith, T. W. (1991). *General social surveys, 1972-1991: Cumulative codebook*. National Opinion Research Center (NORC).

Dedobbeleer, N., & Béland, F. (1998). Is risk perception one of the dimensions of safety climate? *Occupational Injury: Risk Prevention and Intervention*, 73–81.

DeJoy, D. M. (2005). Behavior change versus culture change: Divergent approaches to managing workplace safety. *Safety Science*, *43*(2), 105–129. doi:10.1016/j.ssci.2005.02.001

DeJoy, D. M., Schaffer, B. S., Wilson, M. G., Vandenberg, R. J., & Butts, M. M. (2004). Creating safer workplaces: assessing the determinants and role of safety climate. *Journal of Safety Research*, *35*(1), 81–90. doi:10.1016/j.jsr.2003.09.018

De Vos, A. S., Strydom, H., Fouche, C. B., & Delport, C. S. L. (2004). Research at grass roots 2nd ed. *Pretoria: Van Schaik Publishers*.

Dov, Z. (2008). Safety climate and beyond: A multi-level multi-climate framework. *Regulatory Issues, Safety Climate, Culture and Management Papers Selected from the Third International Conference Working on Safety (WOS2006), September 12-15th, 2006, Zeewolde, The Netherland*, *46*(3), 376–387. doi:10.1016/j.ssci.2007.03.006

du Pont. (2009). Bradley Curve Safety Consulting Tool | DuPont Bradley Curve. Retrieved November 4, 2014, from http://www.dupont.com/products-and-services/consulting-services-process-technologies/brands/sustainable-solutions/sub-brands/operational-risk-management/uses-and-applications/bradley-curve.html

Fahlbruch, B., & Wilpert, B. (1999). System safety—An emerging field for I/O psychology.

Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2009). Relation between occupational safety management and firm performance. *Safety Science*, *47*(7), 980–991. doi:10.1016/j.ssci.2008.10.022

Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2012). Safety climate in OHSAS 18001-certified organisations: Antecedents and consequences of safety behaviour. *Accident Analysis & Prevention*, *45*(0), 745–758. doi:10.1016/j.aap.2011.10.002

Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (2000). Measuring safety climate: identifying the common features. *Safety Science*, *34*(1–3), 177–192. doi:10.1016/S0925-7535(00)00012-6

Gadd, S., & Collins, A. M. (2003). *Safety Culture: A review of the literature* (No. HSL/2002/25). Health and Safety Laboratory. Retrieved from http://www.hse.gov.uk/search/search-results.htm?q=safety%20culture#gsc.tab=0&gsc.q=safety%20culture&gsc.ref=more%3Aresearch&gsc.page=1

Geller, E. S. (2001). *The psychology of safety handbook*. Boca Raton, FL: Lewis Publishers.

Glendon, A. I., & Litherland, D. K. (2001). Safety climate factors, group differences and safety behaviour in road construction. *Safety Science*, *39*(3), 157–188.

Glendon, A. I., & Litherland, D. K. (2001b). Safety Climate in Construction Site Environments: Journal of Construction Engineering and Management: (ASCE). Retrieved July 14, 2014, from http://ascelibrary.org/doi/abs/10.1061/(ASCE)0733-9364(2002)128:5(375)

Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety Science*, *34*(1), 215–257.

Guldenmund, F. W. (2007). The use of questionnaires in safety culture research – an evaluation. *Safety Culture and Behavioral Change at the Workplace: A Selection of Papers from the 23rd NeTWork Workshop, 2004*, *45*(6), 723–743. doi:10.1016/j.ssci.2007.04.006

Hahn, S. E., & Murphy, L. R. (2008). A short scale for measuring safety climate. *Safety Science*, *46*(7), 1047–1066. doi:10.1016/j.ssci.2007.06.002

Heinrich, H. W. (1941). Industrial Accident Prevention. A Scientific Approach. *Industrial Accident Prevention. A Scientific Approach.* (Second Edition).

Heyman, D., & Wines, M. (2014). 2 Killed in West Virginia Mine Where Safety Lapses Were Cited. *The New York Times*. Retrieved from http://www.nytimes.com/2014/05/14/us/west-virginia-mine-accident.html

Hopkins, A. (1999). For whom does safety pay? The case of major accidents. *Safety Science*, *32*(2–3), 143–153. doi:10.1016/S0925-7535(99)00017-X

Health and Safety Executive. (2010). Thinking about behavioural safety - Article. Retrieved September 10, 2014, from http://www.hse.gov.uk/humanfactors/resources/articles/behavioural-safety.htm

Huang, Y.-H., Chen, P. Y., & Grosch, J. W. (2010). Safety climate: New developments in conceptualization, theory, and research. *Safety Climate: New Developments in Conceptualization, Theory, and Research*, *42*(5), 1421–1422. doi:10.1016/j.aap.2009.12.007

Huang, Y.-H., Ho, M., Smith, G. S., & Chen, P. Y. (2006). Safety climate and self-reported injury: Assessing the mediating role of employee safety control. *Accident Analysis & Prevention*, *38*(3), 425–433. doi:10.1016/j.aap.2005.07.002

Inc, S. (2005). *SPSS Base 14.0 user's guide*. Prentice Hall.

Ismail, F., Ahmad, N., Janipha, N. A. I., & Ismail, R. (2012). Assessing the Behavioural Factors' of Safety Culture for the Malaysian Construction Companies. *ASEAN Conference on Environment-Behaviour Studies (AcE-Bs), Savoy Homann Bidakara Hotel, 15-17 June 2011, Bandung, Indonesia*, *36*(0), 573–582. doi:10.1016/j.sbspro.2012.03.063

Ismail, F., Hashim, A. E., Ismail, R., & Majid, M. Z. A. (2009). The operationalisation of safety culture for the Malaysian construction organisations. *International Journal of Business and Management*, *4*(9), p226.

Janssens, M., Brett, J. M., & Smith, F. J. (1995). Confirmatory cross-cultural research: Testing the viability of a corporation-wide safety policy. *Academy of Management Journal*, *38*(2), 364–382.

Johnson, S. E. (2007). The predictive validity of safety climate. *Journal of Safety Research*, *38*(5), 511–521. doi:10.1016/j.jsr.2007.07.001

Kale, S. R., Gujrathi, A. M., & Kale, L. S. (2013). Review Of Occupational Health And Safety Management System (OHSMS) Of Process Industries With A Case Based Study Of A Fiber Industry. In *International Journal of Engineering Research and Technology* (Vol. 2). ESRSA Publications.

Kines, P., Lappalainen, J., Mikkelsen, K. L., Olsen, E., Pousette, A., Tharaldsen, J., … Törner, M. (2011). Nordic Safety Climate Questionnaire (NOSACQ-50): A new tool for diagnosing occupational safety climate. *International Journal of Industrial Ergonomics*, *41*(6), 634–646. doi:10.1016/j.ergon.2011.08.004

Kline, P. (2014). *An easy guide to factor analysis*. Routledge.

Lee, T. (1998). Assessment of safety culture at a nuclear reprocessing plant. *Work & Stress*, *12*(3), 217–237.

Lu, C.-S., & Yang, C.-S. (2010). Safety leadership and safety behavior in container terminal operations. *Safety Science*, *48*(2), 123–134. doi:10.1016/j.ssci.2009.05.003

Manuele, F. A. (2005). Risk assessment and hierarchies of control. *Professional Safety*, *50*(5), 33–39.

Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, *41*(8), 641–680. doi:10.1016/S0925-7535(02)00011-5

Medina, R. E., McSween, T. E., Rost, R., & Alvero, A. M. (2009). Behavioral safety in a refinery. *Professional Saf, August*, 36–40.

Merrit, C. W., & Bresland, J. S. (2007). *Formosa Plastics Vinyl Chloride Explosion*. Chemical Safety Board.

Mouton, J. (1996). *Understanding social research*. Van Schaik Publishers.

Neal, A., & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *Journal of Applied Psychology*, *91*(4), 946.

Newman, M. E. (2000). Models of the small world. *Journal of Statistical Physics*, *101*(3-4), 819–841.

Niskanen, T. (1994). Safety climate in the road administration. *Safety Science*, *17*(4), 237–255.

Niu, S. (2010). Ergonomics and occupational safety and health: An ILO perspective. *Special Section: Selection of Papers from IEA 2009*, *41*(6), 744–753. doi:10.1016/j.apergo.2010.03.004

O'Connor, P., O'Dea, A., Kennedy, Q., & Buttrey, S. E. (2011). Measuring safety climate in aviation: A review and recommendations for the future. *Safety Science*, *49*(2), 128–138. doi:10.1016/j.ssci.2010.10.001

Ostrom, L., Wilhelmsen, C., & Kaplan, B. (1993). Assessing safety culture. *Nuclear Safety*, *34*(2), 163–172.

Payne, S. C., Bergman, M. E., Beus, J. M., Rodríguez, J. M., & Henning, J. B. (2009). Safety climate: Leading or lagging indicator of safety outcomes? *Papers Presented at the 2007 and 2008 International Symposium of the Mary Kay O'Connor Process Safety Center and Papers Presented at the WCOGI 2007*, *22*(6), 735–739. doi:10.1016/j.jlp.2009.07.017

Pecquet, C. F. (2013). *Measuring safety climate as an indicator of effective safety and health programs in the construction industry*. Louisiana State University, Shreveport.

Pousette, A., Larsson, S., & Törner, M. (2008). Safety climate cross-validation, strength and prediction of safety behaviour. *Regulatory Issues, Safety Climate, Culture and Management Papers Selected from the Third International Conference Working on Safety (WOS2006), September 12-15th, 2006, Zeewolde, The Netherland*, *46*(3), 398–404. doi:10.1016/j.ssci.2007.06.016

Ray, P. S., Purswell, J. L., & Bowen, D. (1993). Behavioral safety program: Creating a new corporate culture. *International Journal of Industrial Ergonomics*, *12*(3), 193–198. doi:10.1016/0169-8141(93)90025-9

Reason, J. (1990). *Human error*. Cambridge university press.

Rikhardsson, P. M., & Impgaard, M. (2004). Corporate cost of occupational accidents: an activity-based analysis. *Accident Analysis & Prevention*, *36*(2), 173–182.

Rotter, J. B., & Stein, D. K. (1971). Public attitudes toward the trustworthiness, competence, and altruism of twenty selected occupations. *Journal of Applied Social Psychology*, *1*(4), 334–343.

Rundmo, T. (1992). Risk perception and safety on offshore petroleum platforms—Part I: Perception of risk. *Safety Science*, *15*(1), 39–52.

Saunders, M. N., & Lewis, P. (2011). *Research methods for business students, 5/e*. Pearson Education India.

Sawacha, E., Naoum, S., & Fong, D. (1999). Factors affecting safety performance on construction sites. *International Journal of Project Management*, *17*(5), 309–315. doi:10.1016/S0263-7863(98)00042-8

Seo, D.-C., Torabi, M. R., Blair, E. H., & Ellis, N. T. (2004). A cross-validation of safety climate scale using confirmatory factor analytic approach. *Journal of Safety Research*, *35*(4), 427–445.

Smith, T. A. (1999). What's wrong with behavior-based safety? *Professional Safety*, *44*(9), 37–40.

Spector, P. E. (1998). A control theory of the job stress process. *Theories of Organizational Stress*, 153–169.

Sulzer-Azaroff, B., & Austin, J. (2000). Does BBS work? *Professional Safety*, *45*(7), 19–24.

Tharaldsen, J.-E., & Haukelid, K. (2009). Culture and behavioural perspectives on safety–towards a balanced approach. *Journal of Risk Research*, *12*(3-4), 375–388.

Tharaldsen, J. E., Olsen, E., & Rundmo, T. (2008). A longitudinal study of safety climate on the Norwegian continental shelf. *Regulatory Issues, Safety Climate, Culture and Management Papers*

Selected from the Third International Conference Working on Safety (2006), September 12-15th, 2006, Zeewolde, The Netherland, *46*(3), 427–439. doi:10.1016/j.ssci.2007.05.006

Vaughen, B. K., Lock, K. J., & Floyd, T. K. (2010). Improving operating discipline through the successful implementation of a mandated behavior-based safety program. *Process Safety Progress*, *29*(3), 192–200. doi:10.1002/prs.10376

Vinodkumar, M. N., & Bhasi, M. (2009). Safety climate factors and its relationship with accidents and personal attributes in the chemical industry. *Safety Science*, *47*(5), 659–667. doi:10.1016/j.ssci.2008.09.004

Vredenburgh, A. G. (2002). Organizational safety: Which management practices are most effective in reducing employee injury rates? *Journal of Safety Research*, *33*(2), 259–276. doi:10.1016/S0022-4375(02)00016-6

Vroom, V. H. (1964). Work and motivation.

Waehrer, G. M., Dong, X. S., Miller, T., Haile, E., & Men, Y. (2007). Costs of occupational injuries in construction in the United States. *Accident Analysis & Prevention*, *39*(6), 1258–1266. doi:10.1016/j.aap.2007.03.012

Williamson, A. M., Feyer, A.-M., Cairns, D., & Biancotti, D. (1997). The development of a measure of safety climate: The role of safety perceptions and attitudes. *Occupational Injury*, *25*(1–3), 15–27. doi:10.1016/S0925-7535(97)00020-9

Wu, T.-C., Chen, C.-H., & Li, C.-C. (2008). A correlation among safety leadership, safety climate and safety performance. *Human Factors*, *21*(3), 307–318. doi:10.1016/j.jlp.2007.11.001

Zin, S. M., & Ismail, F. (2012). Employers' Behavioural Safety Compliance Factors toward Occupational, Safety and Health Improvement in the Construction Industry. *ASEAN Conference on Environment-Behaviour Studies (AcE-Bs), Savoy Homann Bidakara Hotel, 15-17 June 2011, Bandung, Indonesia*, *36*(0), 742–751. doi:10.1016/j.sbspro.2012.03.081

Zohar, D. (1980). Safety climate in industrial organizations: theoretical and applied implications. *Journal of Applied Psychology*, *65*(1), 96.

Zohar, D. (2010). Thirty years of safety climate research: Reflections and future directions. *Safety Climate: New Developments in Conceptualization, Theory, and Research*, *42*(5), 1517–1522. doi:10.1016/j.aap.2009.12.019

9. Appendices

Appendix A	Safety Climate Survey Questionnaire
Appendix B	Subscales and Scoring Protocol
Appendix C	Demographics and Consent
Appendix D	Updated Climate survey Questionnaire

APPENDIX A- Safety Climate questions

	STATEMENT	
1	*Our senior leadership is visibly committed to safety*	*SLC*
2	*It is sometimes expected of me to work in unsafe conditions*	*WC*
3	*I participate in the planning and/or risk assessment of my tasks*	*EP*
4	*My direct manager only really pays attention to safety when an incident has occurred or when an audit or a management walkabout is due to take place*	*LMC*
5	*My direct manager encourages and enables me to work safely*	*LMC*
6	*We participate in the review of hazards and the design of control mechanisms*	*EP*
7	*Our senior leadership would not hesitate to stop work if conditions became unsafe*	*SLC*
8	*Out senior leadership have conversations with us about the importance of safety*	*SLC*
9	*Work related injuries are due to a lack of management commitment to remove hazards*	*LMC*
10	*My direct manager regularly discusses hazards in the workplace with us*	*LMC*
11	*Accidents are primarily the result of things beyond our control*	*LOC*
12	*Management really listens to our inputs regarding safety and implement some of the ideas*	*EP*
13	*We are encouraged to come up with safety solutions*	*EP*
14	*The organisation's safety value really means something to me*	*EM*
15	*My direct manager always responds to safety concerns that have been raised*	*LMC*
16	*When people are punished in relation to safety it is always done fairly and consistently*	*LC*
17	*Good planning can prevent incidents*	*LOC*
18	*Our senior leadership is frequently seen engaging in safety related matters*	*SLC*
19	*When I see somebody doing something unsafe, I mind my own business*	*TA*
20	*Our safety performance is purely a matter of luck*	*LOC*
21	*I am only really conscious about how safely I work when I know somebody is watching me*	*EM*
22	*Incidents are not reported because people are scared that they could get dismissed*	*LC*
23	*In the area where I work there are enough employees to deal with the workload*	*HR*
24	*In the area where I work there is enough supervision in relation to the number of employees*	*HR*
25	*I always look for opportunities to learn about safety*	*EM*
26	*I am sometimes expected to do a job that I am not trained to do*	*EKC*
27	*My manager will not mind if productivity is less because of an important safety related matter*	*PVS*

28	*I take safety talks seriously and I find them useful*	*SC*
29	*I understand my role in achieving the safety goals*	*EM*
30	*I have enough time between shifts to rest and recover*	*HR*
31	*I will report near-misses if they do occur*	*LC*
32	*I don't see how it is possible to learn from incidents because all situations are unique*	*LI*
33	*Incident investigations are about finding a guilty party*	*LC*
34	*I find that most of the safety related information I receive is useful and applicable to me*	*SC*
35	*I always feel motivated to work safely*	*EM*
36	*I have all the PPE I need to do my job safely*	*WC*
37	*You cannot plan for everything that can go wrong*	*LOC*
38	*In our team we encourage each other to work safely*	*TA*
39	*In our team safety is an important part of our code of conduct*	*TA*
40	*It is possible to achieve our safety targets*	*LOC*
41	*In my workplace lessons learned from incidents are discussed in detail*	*SC*
42	*Audits are viewed as a "catching out" tool*	*LI*
43	*At-risk behaviour or conditions are sometimes viewed as acceptable because of "special" circumstances*	*PVS*
44	*Management blames employees when production targets are not met*	*PVS*
45	*I always follow the procedure, even if it takes more time and effort or is a little inconvenient*	*EKC*
46	*I understand all safety related requirements in my work environment*	*EKC*
47	*Although management says "safety first", in practice production comes first*	*PVS*
48	*At-risk behaviours and conditions are not tolerated in our team*	*TA*
49	*Good safety, health and environmental performance is rewarded and considered in promotion reviews*	*PVS*
50	*In our incident investigations are about finding the root cause and preventing the incident from occurring again*	*LC*
51	*I am able to identify hazards in my workplace*	*EKC*
52	*I sometimes receive so much safety related information that I cannot pay attention to it all*	*SC*
53	*I am responsible to inform management of important safety concerns*	*EP*
54	*In our team we address individuals who work unsafely*	*TA*
55	*I understand all safety related information I receive*	*SC*
56	*The environment I work in makes it impossible for me to do my job safely*	*WC*
57	*I have received adequate training to enable me to do my job safely*	*EKC*
58	*I often have to work overtime because my colleagues cannot make it to work*	*HR*

59	*In our team we view near-miss investigations as a waste of time, because nothing serious happened*	*LI*
60	*I have the physical ability to do my job safely*	*HR*
61	*I have all the tools and equipment I need to do my job*	*WC*
62	*Damaged tools or equipment gets replaced promptly*	*WC*
63	*Management only believes that there is a problem after an incident or accident has occurred*	*LI*
64	*Housekeeping is a priority in our area*	*LI*
65	*My safety is really important to senior leadership*	*SLC*

APPENDIX B- Subscales and scoring protocol of survey

Subscale	Questions
Senior Leadership Commitment (SLC)	1, 7, 8, 18, 65
Line Management Commitment (LMC)	4, 5, 9, 10, 15
Employee Participation (EP)	3, 6, 12, 13, 53
Employee Motivation (EM)	14, 21, 25, 29, 35
Locus of Control (LOC)	11, 17, 20, 37, 40
Learning Culture (LC)	16, 22, 31, 33, 50
Production vs. Safety (PVS)	27, 43, 44, 47, 49
Safety Communication (SC)	28, 34, 41, 52, 55
Employee Knowledge and Compliance (EKC)	26, 45, 46, 51, 57
Team Accountability (TA)	19, 38, 39, 48, 54
Work Conditions (WC)	2, 36, 56, 61, 62
Leading Indicators (LI)	32, 42, 59, 63, 64
Human Resources and Organisational Design (HR)	23, 24, 30, 58, 60

APPENDIX C- Demographics and Consent

Dear Colleague,

I need to gather a snapshot of the current safety climate within an organisation to enable me to identify focus areas that can be addressed to create an environment where you and your colleagues are enabled to work as safely as possible. I am interested in how you experience safety in your workplace on a day to day basis. This assessment should not take you longer than 20 minutes to complete.

Please be assured that your individual survey results will not be communicated or shared with anybody and will only be entered anonymously into a larger dataset. Below you will see some questions relating to you as individual. This data will be used to examine trends in the larger dataset and not to try to identify individual responses.

Participation in this exercise is completely voluntary and you can withdraw from the exercise at any time.

The confidential treatment of your response is guaranteed, therefore please be honest in your feedback.

Please answer the following biographical questions before commencing the survey

1. Gender? _____
2. Age? _____
3. Highest qualification? _____
4. Years of service in the organisation? _____
5. Years of service in current position? _____
6. Do you manage others? _____
7. Your year of birth? _____
8. Today's date? _____

Participant Signature **Researcher Signature**

APPENDIX D - Adapted Safety Climate Survey

	STATEMENT	
1	Our senior leadership is visibly committed to safety	SLC
2	It is sometimes expected of me to work in unsafe conditions	WC
3	I participate in the planning and/or risk assessment of my tasks	EP
4	My direct manager only really pays attention to safety when an incident has occurred or when an audit or a management walkabout is due to take place	LMC
5	My direct manager encourages and enables me to work safely	LMC
6	We participate in the review of hazards and the design of control mechanisms	EP
7	Our senior leadership would not hesitate to stop work if conditions became unsafe	SLC
8	Out senior leadership have conversations with us about the importance of safety	SLC
9	Work related injuries are due to a lack of management commitment to remove hazards	LMC
10	My direct manager regularly discusses hazards in the workplace with us	LMC
11	Accidents are primarily the result of things beyond our control	LOC
12	Management really listens to our inputs regarding safety and implement some of the ideas	EP
13	We are encouraged to come up with safety solutions	EP
14	The organisation's safety value really means something to me	EM
15	My direct manager always responds to safety concerns that have been raised	LMC
16	When people are punished in relation to safety it is always done fairly and consistently	LC
17	Good planning can prevent incidents	LOC
18	Our senior leadership is frequently seen engaging in safety related matters	SLC
19	When I see somebody doing something unsafe, I mind my own business	TA
20	Our safety performance is purely a matter of luck	LOC
21	I make a conscious effort to work safely every day	EM
22	Incidents are not reported because people are scared that they could get dismissed	LC
23	In the area where I work there are enough employees to deal with the workload	HR
24	In the area where I work there is enough supervision in relation to the number of employees	HR
25	I always look for opportunities to learn about safety	EM
26	I know how to execute my work in a safe way	EKC
27	My manager will not mind if productivity is less because of an important safety related matter	PVS
28	I take safety talks seriously and I find them useful	SC

29	I understand my role in achieving the business unit's safety goals	EM
30	I have enough time between shifts to rest and recover	HR
31	I will report near-misses if they do occur	LC
32	I don't see how it is possible to learn from incidents because all situations are unique	LI
33	In our incident investigations are about finding a guilty party	LC
34	I find that most of the safety related information I receive is useful and applicable to me	SC
35	I always feel motivated to work safely	EM
36	I have all the PPE I need to do my job safely	WC
37	You cannot plan for everything that can go wrong	LOC
38	In our team we encourage each other to work safely	TA
39	In our team safety is an important part of our code of conduct	TA
40	It is possible to achieve our safety targets	LOC
41	In my workplace lessons learned from incidents are discussed in detail	SC
42	Audits are viewed as a "catching out" tool	LI
43	At-risk behaviour or conditions are sometimes viewed as acceptable because of "special" circumstances	PVS
44	Management blames employees when production targets are not met	PVS
45	I always follow the procedure, even if it takes more time and effort or is a little inconvenient	EKC
46	I understand all safety related requirements in my work environment	EKC
47	Although management says "safety first", in practice production comes first	PVS
48	At-risk behaviours and conditions are not tolerated in our team	TA
49	Good safety, health and environmental performance is rewarded and considered in promotion reviews	PVS
50	In our incident investigations are about finding the root cause and preventing the incident from occurring again	LC
51	I am able to identify hazards in my workplace	EKC
52	I am able to apply learnings in my work environment	SC
53	We are encouraged to report any safety concerns we may have	EP
54	In our team we address individuals who work unsafely	TA
55	I understand all safety related information I receive	SC
56	The environment I work in makes it impossible for me to do my job safely	WC
57	I have received adequate training to enable me to do my job safely	EKC
58	Some of my colleagues are absent from work very often	HR
59	In our team we view near-miss investigations as a waste of time, because nothing serious happened	LI

60	I have the physical ability to do my job safely	HR
61	I have all the tools and equipment I need to do my job	WC
62	Damaged tools or equipment gets replaced promptly	WC
63	Management only believes that there is a problem after an incident or accident has occurred	LI
64	Housekeeping is a priority in our area	LI
65	My safety is really important to BU senior leadership	SLC