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LEADING KEY PERFORMANCE INDICATOR DEVELOPMENT REQUIREMENT FOR A STEEL MANUFACTURING ORGANISATION

BY

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A MINI DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

MAGISTER INGENERIA

IN

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IN THE

FACULTY OF ENGINEERING

AT THE

UNIVERSITY OF JOHANNESBURG

NOVEMBER 2015

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Student number __ 201049076 __________________________

Qualification __ Master of Philosophae in Engineering Management ____________________

Faculty __ Engineering __________________________

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I further declare that the work presented in the __ LEADING KEY PERFORMANCE INDICATOR
DEVELOPMENT REQUIREMENT FOR A STEEL MANUFACTURING ORGANISATION____
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in such instances full reference to the source is acknowledged and I do not pretend to receive any
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Signature __________________________ Print name __________________________

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February 2001 as amended.
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Student number, 201049076, Faculty: Engineering.

I hereby declare that the thesis/dissertation/minor dissertation submitted for the _ Master of Philosopiae in Engineering Management ______ degree to the University of Johannesburg, apart from the help recognized, is my own work and has not previously been submitted to another university or institution of higher education for a degree.

Signed at __Pietermaritzburg______on this ___3rd______day of _December______ 2014___.
Signature__________________________________ Print name__Zipho Khumalo________
ABSTRACT

The steel industry is considered a very harsh working environment that has been seen to be a major contributor to the occupational health and safety incidents occurring in the manufacturing sector. Due to the nature of the steel making process, the steel industry remains dangerous to employees. Leading key performance indicators of safety are a control mechanism that can be used in contributing to the improvement of safety performance. The aim of the research conducted was to determine if leading key performance indicators of safety are being utilised in organisations in the steel industry, to determine the KPI in use was informative of the root cause of the safety incident and to identify the initial KPI development requirements in a steel manufacturing organisation in South Africa.

A literature review centred on leading key performance indicators of safety was conducted to establish the meaning of KPI and their application in other similar industries. A benchmark for the research was established from the literature review.

The research was influenced by the methods that were applied by Grabowski, Ayalasomayajula, Wang, Merrick, Mc Cafferty, Meador & Kinney, 2007, that were successfully used in the derivation of leading KPI in the shipping industry. The research done by Toellner, 2001 on leading indicators of safety was also influential in conducting this study. The data was obtained through random sampling in a population of production staff, engineering, personnel, specialists and managerial staff, whose experience in the industry ranged from two years to forty years. The questionnaire was randomly distributed to a population consisting of fourteen supervisors, twelve engineering staff, eighty-six production personnel, twenty-one specialists and six management staff. The respondents’ level of experience in the industry varied from two years to forty years and a combined experience level of one-hundred and thirty-five years.

It was found that the key performance indicators of safety that were being utilised have not evolved significantly over the past fifteen years and they do not provide insight to the root cause of the accident. This research provides the strategic requirements needing for developing leading key performance indicators of safety in a steel manufacturing organisation.
## LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMS</td>
<td>Safety Management System</td>
</tr>
<tr>
<td>OH&amp;S</td>
<td>Occupational Health &amp; Safety</td>
</tr>
<tr>
<td>H&amp;S</td>
<td>Health and Safety</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>SHEQS</td>
<td>Safety, Health, Environment, Quality and Security</td>
</tr>
<tr>
<td>SA</td>
<td>South Africa</td>
</tr>
<tr>
<td>IISI</td>
<td>International Iron and Steel Institute</td>
</tr>
<tr>
<td>HSE</td>
<td>Health and Safety Executive</td>
</tr>
<tr>
<td>DART</td>
<td>Days Away from work, job Restrictions and/or Transfers</td>
</tr>
<tr>
<td>EMR</td>
<td>Electromagnetic radiation</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>ABS</td>
<td>American Bureau of Shipping</td>
</tr>
<tr>
<td>HIRA</td>
<td>Hazards Identification and Risk Assessment</td>
</tr>
<tr>
<td>LTIFR</td>
<td>Loss Time Injury Frequency Rate</td>
</tr>
</tbody>
</table>
1. CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Steel is commonly produced in the form of plates, coils, bars, strips, pipes, billets, rods, spikes and sheets. The most common causes of occupational health and safety accidents in the steel manufacturing industry range from incidents of working personnel slipping, tripping and, or falling as a result of the presence of hazardous energy sources, exposure to hazardous gases, to inadequate accident prevention and inspection measures (The International Labour Organization, 2005).

Safety performance has traditionally been measured using metrics such as recordable injury rates, days away from work, restricted work, experienced modification on workers’ compensation and OH&S administration. However these statistics do not reveal the contributing factors to the improvement or deterioration in safety performance (Hinze, Thurman & Wehle, 2012). These measures are associated with the outcomes of an accident and are dependent on numerous variables such as people deciding to report or not to report an accident (Toellner, 2001). This can lead to inaccuracies, especially in cases where such indicators are linked to employee evaluations, remuneration and bonuses.

Leading performance indicators of health and safety can be described as conditions, events or measures that come before an incident and have foretelling significance in respect of an accident, incident or unsafe condition (Grabowski, AyalaSomayajula, Wang, Merrick, McCafferty, Meador & Kinney, 2007). Leading indicators are measurements linked to preventative accomplishments; they focus on optimising safety performance through reporting, measuring and managing positive safe behaviour (Toellner, 2001).

This research was conducted with the aim to achieve the following: determine if leading key performance indicators of safety are being commonly utilised to improve safety performance in steel manufacturing organisations, to determine if the KPI’s being used reveal any information about the causes of accidents, and to identify the KPI development requirements that may be used to produce leading KPI of safety in a steel manufacturing organisation in South Africa.

1.2 PROBLEM STATEMENT

Throughout history the steel industry has continuously featured operational factors that are hazardous to its employees (Jovanovic’ & Arand-elovic, 2004). Steel industry workers are a high risk of incurring injuries and diseases due to the nature of the steel production processes and the handling of materials (Jovanovic’ & Arand-elovic, 2004). Workers have been found to be exposed to
avoidable hazards in the workplace, such as excessive noise, dusts, unguarded machinery, piercing material and sparking metal (Kifle, Rai Sharma, Amsalu & Feleke, 2012). An international parts manufacturing company organisation called GrafTech, which services primarily the steel industry conducted an occupational health and safety study on the steel industry. The organisation recorded injury and illness ratios per one hundred full time employees within the steel manufacturing sector. The analysis that was done by GrafTech included other industries and provides a good comparison of the steel industry safety performance relative to the manufacturing sector as whole (Graphtech International, 2012). The data used in performing the analysis was calculated using the annual surveys of occupational injuries and illnesses that were completed by the Bureau of Labour Statistics, U.S Department of Labour. Figure 1.1 shows a decrease in injury rates throughout the manufacturing sector, however the steel industry injury rate remains the dominant contributor to the statistic, thus indicating that there is room for further improvement with regards to the occupational health and safety of workers (Graphtech International, 2012).

![Industrial Recordable Injury/ Illness Rate Comparison](image)

**Figure 1.1 Results of the GraphTech analysis (GraphTech International, 2012, 1)**

The custom safety performance measurement metrics utilised in industry such as OH&S Act recordable injury rates, Days Away from work, job Restrictions and/or Transfers (DART) rate and Experience Modification Rate (EMR) are measurements that are collected after losses have been sustained and cost evaluations have been completed (Grabowski et al. 2007). These indicators are typically received with a degree of disgruntlement especially by the personnel responsible for operations in the area where the incident occurred. Managers are usually not enthusiastic to communicate negative news up the management hierarchy, which leaves the question of how many injuries or illnesses go unreported (Toellner, 2001).
1.3 THE REQUIREMENT FOR LEADING KPI
An increasing number of safety professionals are interrogating the value of lagging safety indicators and disputing that these indicators do not offer insight to commendably avoid future accident occurrences (Grabowski et al. 2007). This outlook is shared by Fred A. Manuele, 2009; who states that “it is commonly stated in the literature that lagging indicators provide rear-view mirror data, have a low-level of confidence in predicting performance, and are inadequate as measures of the effectiveness of safety management processes”. On the contrary leading safety KPI’s determine the construction of the safety culture of an organisation. When a leading KPI measure advocates that an aspect of the safety processes is frail or deteriorating then interventions may be implemented to recover or develop that safety process therefore creating a positive impact on the process afore the occurrence of a health and safety incident (Hinze, Thurman & Wehle, 2012).

1.4 RESEARCH OBJECTIVES
The research objectives were to:

- Determine if leading key performance indicators of safety are being commonly utilised to improve safety performance in steel manufacturing organisations.
- To determine if the KPI’s being used reveal any information about the causes of accidents.
- To identify the initial KPI development requirements that may be used to produce leading KPI of safety in a steel manufacturing organisation in South Africa.

1.5 RESEARCH QUESTIONS
1. Is the use of leading KPI being adopted in steel manufacturing organisations to assure good health and safety performance?

2. Do the KPI being utilised inform on the causes of accidents?

3. What are the strategic ingredients needed to develop leading KPI in a steel manufacturing organisation?

1.6 RESEARCH PROCESS
The research methodology design that was utilised in this study; illustrated in figure 1.2; was adopted from Leedy & Ormrod, 2010.
A predominantly qualitative research approach was applied in answering the research question and solving the research problem. Quantitative methods such as questionnaires were also utilised. Table 1.1 is a sample from literature and provides a brief explanation of the qualitative research methods that were used (Leedy & Ormrod, 2010).
Table 1.1: A general description of qualitative research approach (Leedy & Ormrod, 2010).

<table>
<thead>
<tr>
<th>Qualitative Research Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
</tr>
<tr>
<td><strong>Nature of research process</strong></td>
</tr>
<tr>
<td><strong>Data Collection</strong></td>
</tr>
<tr>
<td><strong>Data Analysis</strong></td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
</tr>
</tbody>
</table>

1.7 LIMITATIONS OF THE STUDY

Most of the literature on leading indicators of health and safety does not comprise of mathematically or scientifically reinforced evidence that shows a quantitative affiliation between leading indicators and the prevention of accidents. It is very challenging for health and safety professionals to institute a cause and effect relationship directly linked to leading KPI (Haight, & Thomas, 2003; Manuele, 2009). This challenge was observed as the shortfall experienced in conducting the study for the purposes of this document. This limitation was overcome by identifying case studies where the use of leading KPI was employed.

1.8 FORMULATION OF RESEARCH PROBLEM

Field research is the systematic study, principally done through interactions and observations of daily life (Bailey, 1996). Prior to conducting the research, the researcher had been an active resource in the steel manufacturing industry in south Africa from 2005 until 2012. “Research originates with a question or problem and Research requires a clear articulation of a goal” (Leedy & Ormrod, 2010).

The observation of the steel industry hazards and high incident rates as seen in figure 1.1 and in steel industry organisation annual reports, initiated a motive to explore best safety improvement practices that have been researched and identified.
1.9 COLLETION OF DATA

Data collection was an essential step in conducting the research. A good research design alone, without the required data is insufficient to conclude the research. Data collection can be described as the planning for and obtaining useful information on key quality characteristics produced by a process (Cayce, 2008).

Literature related to this research topic was gathered from the following sources:

- Books
- Journals
- Legal documentation
- Conference reports
- Internet publications

These sources were the primary instruments utilised in conducting the literature study for this document. Questionnaires were utilized to collect field data for the research.

1.10 ANALYSIS METHODS

The research conducted was predominantly of a content analysis form. “A content analysis is a detailed and systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes or biases” (Leedy & Ormrod, 2010). One fundamental step in content analysis is to tabulate the occurrence of each characteristic discovered in the material being studied. The analysis was therefore both qualitative and quantitative (Leedy & Ormrod, 2010). A suitable statistical analysis was implemented on the frequencies and percentages acquired from the research data, to determine the significant differences relative to the research question. The tabulations and statistical analysis were compiled and presented in the form of graphs which were used to interpret the data relative to the research problem.

1.11 STRUCTURE OF DESITATION DISSERTATION

The chapters in this document is structured in the following manner:

Chapter 1: Provides an introduction to the problem and the purpose of the study including the research question.
Chapter 2: This section is the literature review of the material concerning the research objectives. It provides a description and account of leading KPI according to literature, and previous research that was done on the topic.

Chapter 3: Describes the research design and justification for the adaptation of the method in answering the research question.

Chapter 4: The research findings are discussed.

Chapter 5: Conclusions to the research are presented.

1.13 CONCLUSION

Steel industry workers remain at risk in terms of their health and safety because of the practical requirements of processes involved in the production of steel. The traditional safety performance measuring metrics such as recordable injury rates, days away from work, restricted work, modification on workers’ compensation and OH&S administration, do not provide insight as to how an accident could have been prevented from happening. Leading KPI of safety can be utilised as a pro-active tool in the optimisation of safety performance through reporting, measuring, managing and rewarding positive health and safety behaviour.

Based on the research plan that was discussed in this chapter the author was able to conduct the literature review that is discussed in Chapter 2 that follows.
2. CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION
This chapter aims to present the literature review that was conducted, of the material that has been published prior to the compilation of this document. The study was conducted with the intention to find answers to the following questions:

- What are leading KPI?
- Which KPI’s are typically utilised in Industry?
- Where are leading indicators of safety found?
- What are the factors to consider in selecting leading?
- How is the accuracy in selection leading KPI determined?
- What challenges have been experienced with leading KPI?
- What technique has been used to evaluate leading KPI?

2.2 WHAT IS A LEADING KPI
The significance of leading KPI’s is in providing an accession of barriers when it comes to health and safety. In some instances they are referred to as Risk Control Systems. Leading KPI’s are in most occurrences dependent on inspections, tests and maintenance to verify the functionality of the barriers. Nevertheless, operational alterations bring in new requirements and creeping modifications result in the weakened operation of safety barriers (Ian Herbert, 2009). Leading performance indicators of health and safety can be described as conditions, events or measures that come before an incident and have foretelling significance in respect of an accident, incident or unsafe condition (Grabowski et al. 2007). Leading indicators are metrics related to measurable systems or specific behaviours associated with accident prevention. These indicators are designed to focus on optimising the safety output by determining, reporting and dealing with positive safety conduct (Toellner, 2001). From an economic point of view a leading indicators can be described as “a measurable economic factor that changes before the economy starts to follow a particular pattern or trend” (Manuele, 2009).

2.3 OCCUPATIONAL HEALTH AND SAFETY STANDARDS
The objectives of the Occupational Health and safety Act are to designed to ensure the health and safety of people in a workplace. This includes the health and safety of people in respect of the use of
machinery and plant. The Act further aims to provide for the protection of people other than those who are at work against hazards to their health and safety ascending out of or in connection with the activities of people in the workplace. The Act generally commits employers to minimise the threats to the health and safety of people in the place of work. It grants the regulation and monitoring of workplace environments in order to preserve the health and safety of workers, and other people in the place of work, in the utilisation of plant and machinery (The Occupational Health and Safety Act of the Republic of South Africa, Act no. 85 of 1993). Through the Act, the employer is obliged to maintain a workplace that is free of hazardous substances that may cause disease, injury or physical damage to any person. The South African version of the Act requires that “every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.” In cases where avoidance of hazards is not possible, it is the employer’s responsibility to inform the workers of the dangers, ways in which to avoid the dangers, methods to work safely and to supply protective equipment. The health and safety of the workplace is not placed entirely on the employer. The act also stipulates that employees themselves are to take reasonable care for their own health and safety, and that of people who could be affected by the workers actions or omissions of appropriate action, in the workplace. The core principle of OH&S Act places the responsibility on both the employer and the employee to identify hazards and dangers, and to generate and apply control measures to create a safe working environment (The Occupational Health and Safety Act of the Republic of South Africa, Act no. 85 of 1993).

2.4 KPI's IN INDUSTRY

A work group was set up consisting of safety specialists and line managers from companies who are members of the IISI. The findings by the work group were commissioned by the IISI board of directors and were accepted by the IISI Committee on Human Resources. The workgroup conducted a survey of statistical health and safety data that are utilised by participating organisations (Paul-Dauphin, 1998). The survey results are summarised in table 2.1

Table 2.1: IISI Workgoup survey results (Paul-Dauphin, 1998).

<table>
<thead>
<tr>
<th>Statistic Type</th>
<th>Member Organisation Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal Accidents</td>
<td>All members collect</td>
</tr>
<tr>
<td>Major Injuries</td>
<td>Concept is used by the majority of organisations</td>
</tr>
<tr>
<td>Lost Time Injuries</td>
<td>Practically all organisations collect</td>
</tr>
</tbody>
</table>
Frequency Rates

Practically all organisations collect

Table 2.2: Table 2-1 continued (Paul-Dauphin, 1998).

<table>
<thead>
<tr>
<th>Statistic Type</th>
<th>Member Organisation Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Misses</td>
<td>Near miss inquiries and reporting systems were present in some organisations</td>
</tr>
<tr>
<td>Severity Rate</td>
<td>A noteworthy minority did not use this concept</td>
</tr>
<tr>
<td>Accident Cost</td>
<td>Generally regarded as being important but a general reluctance to get involved was expressed.</td>
</tr>
<tr>
<td>Contractor Accidents</td>
<td>Majority of contractor accident are separated from statistics.</td>
</tr>
<tr>
<td>Miscellaneous Issues</td>
<td>Other KPI’s exist that unique to organisations or to a department within the organisation.</td>
</tr>
</tbody>
</table>

The primary safety KPI are advantageous to utilise in industry can be summarised as follows (International Council on Mining and Metal, 2009).

Equation 2.1: Total Recordable Injuries

\[
TRI = \text{Number of (Fatalities + Lost Time Injuries + Restricted Work Injuries + Medical Treatment Injuries)}
\]

Where \( TRI = \text{Total Recordable Injuries} \)

Equation 2.2: Injury Frequency Rate

\[
IFR = \text{Number of injuries} \times \frac{1,000,000}{\text{hours worked}}
\]

Where \( IFR = \text{Injury frequency rate} \).

Equation 2.3: Fatality Frequency Rate

\[
FFR = \text{Fatalities} \times \frac{1,000,000}{\text{hours worked}}
\]

Where \( FFR = \text{Fatality Frequency Rate} \)

Equation 2.4: Lost Time Injury Frequency

12
\[ LTIFR = \frac{LTIs \times 1,000,000}{\text{hours worked}} \]

*Where* \( LTIFR \) = *Lost Time Injury Frequency Rate*

**Equation 2.5: Total Recordable Injury Frequency Rate**

\[ TRIFR = \frac{(\text{Fatalities} + LTis + RWIs + MTIs) \times 1,000,000}{\text{hours worked}} \]

*Where* \( TRIFR \) = *Total Recordable Injury Frequency Rate*

The problem with these statistical indicators is that they do not reveal the contributing factors to the improvement or deterioration in performance (Hinze, Thurman & Wehle, 2012). These measures are associated with the outcomes of an accident and are dependent on numerous variables such as people deciding to report or not report an accident. This can be problematic, especially in cases where the results are linked to financials (Toellner, 2001).

### 2.5 TYPES OF LEADING KPI’s

“Leading indicators are safety metrics that correlate with safety performance for a given organization; they can be objective or subjective measures” (American Bureau of Shipping, 2012). Thus elementary leading indicators can be described as being subjective or objective. Objective leading indicators are straightforward and make use of data that is compiled by the organisation. This includes methods such as physical measures, frequency of events and general numerical methods. The time frame for the data requirements is dependent on the business level at which the analysis is used. Subjective KPI’s refer to mind-set, opinions and values placed on safety performance within an organisation. These indicators can be identified independently from any previous data that was collected in the past. Subjective indicators are challenging to quantify and require a safety culture evaluation (ABS, 2012).

Leading performance indicators of safety can be classified as being passive or active. Passive leading indicators provide a suggestion of the safety performance to be achieved within an organisation or on a project. Although predictive these are less effective for short term basis use. These indicators are generally used in processes that cannot be changed in a short period of time. The most dependable data that passive leading indicators provide when thoroughly analysed and applied, is a qualitative quantity of knowledge or skill base of staff which can be utilised in implementing a wide range of safety management systems. Active leading indicators of safety are those that are subject to alteration over a short period of time for example, the percentage safety compliance on site safety audits (Hinze, Thurman & Wehle, 2012).
2.6 SAFETY MANAGEMENT SYSTEMS

The key step in accident prevention is the identification and understanding of the elements that are present in the occurrence of an accident. Workplace accidents may be categorized as an Unsafe Act, Unsafe Condition or an Act of Providence. The most common and essential elements in the occurrence of an accident can be described as follows (Marx, 2003):

- “Energy sources out of control
- Management system failure
- Training Deficiency
- Latent design defects
- Inappropriate maintenance
- Imperfect procedures
- Unsuitable task directives
- Sub-standard physical conditions
- Unsafe acts
- Barrier failures”

In essence a single element alone is not enough to result in an accident. Generally most of the elements must have a defect. An unsafe act alone cannot cause any accident but is part of the problem. This gives explanation to the presence of an unsafe condition for a long time before an accident occurs (Marx, 2003).

Effective safety management systems are well organized and include safety assessments that periodically seek out flaws in the changes to organizational procedures or machinery; thus allowing these weaknesses to be mitigated at an early stage. There are several key activities that are present in successful safety management systems. OH&S Act section 24 compels industries in South Africa to report all accidents that have occurred in or as a result of the activities in the workplace. Suitable SMS systems include formal written procedures for reporting safety events and unsafe conditions that are understandable, and can be utilized by the persons in the workplace. Important activities in a good SMS include the following (Stranks, 2005):

- “Safety Organization
- Hazard identification Scheme
- Investigation and Analysis
- Safety Performance Monitoring
- Safety Promotion
• **Safety Oversight**

**Safety Organization**: The key components as specified in numerous safety literature is the vision of the organisation’s management, the OHS value of the management and its commitment towards creating a culture of good OHS practice.

**Hazard identification Scheme**: These must use both proactive and reactive methodologies in identifying hazards within an organisation.

**Investigation and Analysis**: The root cause of the accident or unsafe condition must be investigated examined in order to develop preventative measures for the future.

**Safety Performance Monitoring**: Closed loop safety management systems are a good practice. This allows for feedback and continuous improvement on the safety processes. Performance monitoring can be achieved using methods such as trend monitoring and through OH&S audits.

**Safety Promotion**: The lessons learnt from safety analysis and results are shared internally, some cases externally to the organization.

**Safety Oversight**: The performance of safety systems should be continuously monitored and reviewed. In South Africa, OH&S Act Section 17 and Section 18 enforce organizations to include an internal safety overseer (Stranks, 2005).

### 2.7 SOURCES OF LEADING KPI’s

A research study to identify and evaluate leading KPI was conducted on large international energy transportation company from the USA. Seventy seven shipboard and twenty-two shoreside employees participated in the project. This included engineers, captains, chief engineers, mates and crew men from various departments, working on vessels (ABS, 2006 & Grabowski et al. 2007). A six step methodology was followed in identifying, deriving and evaluating the leading KPI of safety. The method consisted of the following steps:

1. Identify the safety decisions in the organization,
2. Identify the fundamental objectives for achieving safety in the organization,
3. Identify safety factors to achieve the fundamental objectives
4. Measure the organization’s safety performance
5. Measure the safety factors, and
6. Determine the candidate leading indicators.
A total of seven categories of leading KPI were identified and associated with the safety performance in the organization. Only one organisation was subjected to the research conducted for the above mentioned study. (Grabowski et al. 2007).

Primarily the core of identifying KPI is to recognize the hazards associated with the manufacturing environment. Directly linked to the hazards is the events that occur as a result of the presence of those hazards and the related consequences. When identifying KPI's the following line of enquiries must be investigated (Groot, 2010):

- “What are the hazards?
- How can the event develop?
- What are potential outcomes?
- What happens when control of those hazards is lost?
- What happens when the hazard is released?
- What causes the release of those hazards?
- How can control be lost?
- How do we prevent the release of the hazard?
- How do we maintain control?
- How do we minimize severity of an accident?
- How might control fail?
- How could the effectiveness of the control measures be undermined?”

To screen leading indicators of safety there are three strides to be taken, namely (Toellner, 2001):

- Understanding the causes of accidents.
- Identify the essential steps to be taken in preventing those accidents.
- Convert the steps to be taken into quantifiable processes.

### 2.8 COST

The implementation of a leading KPI program has the potential to incur costs related to the following (ABS, 2012):

- “Resources to retrieve the safety metrics and safety performance data.
- Employee time
- Knowledge of analysis tools
- Experience of using statistics packages or spread sheets
- Purchase of statistics package, if necessary”
As with any business endeavour there are associated costs with acquiring the correct set of leading KPI’s and effective implementation thereof. These costs can be in the form of essential resources required to acquire the safety metrics and safety performance information. The time consumed by employees in compiling and analysing KPI data. Employees could require training on the interpretation of the statistical data. More training is required for the use of statistical packages and spread sheets. Alternatively the skills could be out sourced which involve additional costs as well. Statistical software packages are in general very costly; although there are exceptions, it could be necessary to purchase the applicable packages (ABS, 2012).

2.9 SELECTING KPI’s

The development of significant safety KPI’s requires an understanding of the safety risks of the operations within an organisation, an assessment of the existing safety systems and comprehension of the organisation’s business plan, culture and policy. If the organisation has a reactive culture than a strong focus on short term goals is preferable. It is advantageous that the best KPI’s for a particular organization are dependent on the following factors (Baldauf, 2010):

- The organisation’s present performance in terms of health and safety.
- The standard that the organisation hopes to achieve in terms of health and safety in the near future.
- Who does the KPI data go to and what gets done with the data
- The manner in which the KPI’s and associated conclusions are communicated to people.

The steps to follow when selecting leading KPI’s in the chemical and major hazards industries are as follows (European Health and Safety Executive, 2006):

1. “Step 1: Establish the organisational arrangements to implement the indicators” – This involves appointing a custodian and creating an execution team. It is advantageous to involve senior management.

2. “Step 2: Decide on the scope of the measurement system. Decide what can go wrong and where.” - Recognize the degree of the measurement method; investigate possible incident circumstances; identify any possible hazards; assess performance and non-conformances.

3. “Step 3: Identify the risk control systems in place to prevent major accidents”– Identify the risk control systems currently in place and determine the outcomes.
4. “Step 4: Identify the critical elements of each risk control system and set the leading indicators” – Look into the imperatives of the risk control system. Specify tolerances and follow up on departures from the tolerances.

5. “Step 5: Establish the data collection and reporting system” – Decide on the collection of information method and the presentation format.

6. “Step 6: Review” - Re-evaluate the performance of the process management; Re-evaluate the capacity of the indicators; and tolerances.

When selecting KPI’s it is vital to at minimum take into consideration the following aspects (Garret, 2011):

- “Quantity does not equal quality.
- Measure the most important things, not everything.
- Ensure field and line management buy-in.
- Consider piloting metrics before rolling them out company wide.
- Don’t let the cost of measuring exceed the value of the results.”

There are five rules that can be applied in selecting the best indicators for a manufacturing organization (Paitt, 2012). These rules can be summarized as follows:

1. “Focus on the critical few, not the trivial many.
2. Ensure that selected KPI’s drive towards your strategic intent.
3. Ensure that KPI are relatable on all levels of the organization.
4. Ensure the data for the KPI are valid.
5. Ensure controllable KPI are selected.”

Ideally the scope of the KPI’s must be as simple as possible to avoid confusion in terms of what is essential. The KPI’s must be in line with the organization’s strategic goals. It is essential that all employees can understand and are able to relate to the KPI’s for them to be effective (Paitt, 2012).

Another aspect to be interrogated when developing leading KPI is the behavioural safety basis. It must be determined if that safety behavioural basis is measurable and how its development improves safety performance (Toellner, 2001).

2.10 SELECTION ACCURACY

The following questions need to be taken into consideration when selecting leading KPI’s (Marlowe & Skrabak, 2007; Manuele, 2009):
• Is there any meaning to the selected KPI?
• How can you know?

Making predictions about the future is generally difficult. The selection of leading KPI is mostly pejorative and in most cases only time reveals if the selected indicators are the correct ones. Typically the selected indicators relate to opportunities to reduce risk by advancing the safety management processes that require improvement (Manuele, 2009).

It is challenging to regulate factors that cannot be effectually measured therefore it is essential for the leading indicators to be quantifiable on a real-time basis. Non-measurable indicators are challenging to establish against the objectives of a measurable goal and in turn this makes it difficult to communicate developments towards that goal. For example it is paramount to measure safety behaviours on a real time basis over measuring safety attitudes, provided that the measured quantities are kept simple (Toellner, 2001).

2.11 EVALUATING LEADING KPI’s

The assessment of the leading KPI’s should be partitioned into the categories, which are more explained and specific in terms of the aspects being assessed (Bennett, 2007). These categories can be described as follows:

• “Management
  • Health and Safety management and related processes
  • Safe and Healthy Person
  • Safe and healthy place”

The management aspect is further segmented into senior management and line management respectively.

Features such as the active involvement in promoting and consideration of the health and safety policy from senior management, should be included during the evaluation. The objectives of the KPI’s must be clear and communicated effectively across the organisation. It is up to line managers to stretch the health and safety objectives and to ensure that there is progress towards these objectives. Line management has to adapt these objectives to the operational, financial, and to quality objectives of the company. These are the aspects of the KPI’s which must be evaluated from line management level (Bridges, 2012).
Leading KPI’s should involve the workforce in such a manner that they are able to manage their own health and safety, and understand their H&S accountabilities. Guidance in terms of a systematic approach to OH&S should be evident in the KPI’s. A from bottom to top method of review of the leading KPI and safety management systems is in most cases effective because it allows contribution from all interested employees. Essentially the KPI’s must be accompanied by a good audit program and must be in line with mandatory legal requirements. The leading indicators can be calculated using equation 2.6 to equation 2.7 (Bridges, 2012):

**Equation 2.6 : Recommended Leading Indicator**

\[
\text{Leading OH&S indicator} = \frac{\sum \text{near misses}}{\text{number of accidents}}
\]

A value of Leading OH&S indicator that is less than five can be viewed as poor and suggests that the organisation is learning from the occurrence of accidents. Generally values from twenty and above are considered good. Another leading indicator formula that has been suggested by the Process Improvement Institute is formula 2.

**Equation 2.7 : Recommended Leading Indicator of Safety**

\[
\text{Leading indicator} = \frac{\text{Number of near misses that are investigated to root cause}}{\text{number of loss time events}}
\]

Acceptable answers to the equation 2 are in the range of plus or minus 15.

Other forms of leading KPI such as housekeeping have been utilised in some cases. A study was conducted on a steel deck and associated production facility fabrication project for an offshore oil, and gas platform. The project took eighteen months and a total one thousand two hundred employees worked on the project. Sections 2.11.1 up to section 2.11.3 describe the leading KPI of H&S that were utilised in the project and the methods applied in evaluating them.

### 2.11.1 HOUSE KEEPING

Housekeeping was used as a leading KPI of H&S and a process to evaluate the house keeping factor was developed. If the average score dropped below a predetermined value (seven), operations were shut down and all the people involved were given the task to get things back in order. The model tracked the level of housekeeping as well as the number of shut downs experienced (Toellner, 2001).
2.11.2 BARRICADE PERFORMANCE
In the same fabrication project mentioned above, the use of Barricade Performance as a leading KPI was also being observed. Whilst performing fabrication work at elevated heights, the prevention of the danger associated with the mishap of operational instruments falling off and redundancy was incorporated into the operational process by introducing barricades. Initially the barricade scheme did not achieve the expected level of performance until the implementation of a measurement process. The flaws identified led to changes in the process and further barricade training was provided to persons involved. This ultimately resulted in an improved performance (Toellner, 2001).

2.11.3 SAFETY WALKS
The third leading KPI that was evaluated in the steel deck fabrication project was safety walks. Senior management and supervisors conducted safety walks with the intention to dynamically seek out hazards, motivate the workers by demonstrating their care about safety and to lead by example. The initial response from the workers was negative as the effort was perceived as a policing effort. Management took note of the most significant hazards and spent time talking to workers, and lobbying their input and solutions on the hazards. Overtime a significant improvement to management participation in health and safety matters was observed (Toellner, 2001).

2.12 ISSUES WITH LEADING KPI
Matters such as definitions, utilisation and overall efficiency can create uncertainty in the established qualitative data focused environment of engineering and heavy industry. Safety professionals are faced with the challenge of integrating leading indicators of safety into existing heritage safety programs. The adaptation curve can be steep to signify the normalization of leading indicator data into an existing matrix of lagging OHS Act dataset. Sufficient staff time and resources need to be provided by an organisation in order to efficiently hypothesize, operationalize and communicate the definitions of their particular leading indicators, for successful integration into the safety program. There are broad interpretations of the significance of leading KPI data and of the definitions, even amongst organisations that have incorporated them into their safety strategies (Hinze, Thurman & Wehle, 2012).
2.13 CONCLUSION

This chapter delivered an outline of leading indicators of health and safety. The literature review provided a valuable relation between leading KPI to occupational health and safety. Two essential qualities of leading KPI of health and safety were identified as commonly appearing throughout literature. These were the behavioural monitor basis of the KPI and their predictive nature.

Leading indicators can be used to identify weaknesses in the processes of a safety management system which can then be improved and strengthened. The literature suggests that it is advantageous for the indicators to be quantifiable for a more efficient tracking of progress towards goals. The use of leading indicators of health and safety has been recognised to improve the safety performance in a work environment. From consideration of this literature study it was decided to investigate the use of leading KPI in a steel industry environment as part of the safety improvement philosophy.

The following chapter describes the research methodology employed in conducting this study.
3. CHAPTER THREE: RESEARCH METHOD

3.1 INTRODUCTION
This chapter provides a description of the research design method that was utilised in conducting the research presented in this document. A justification for the choice of the specified research design and a brief description of design strategies that were employed is provided. This section also provides a depiction of the data collection and analysis methods that were utilised for the research.

3.2 CASE STUDY RESEARCH
The case methodology may entail strategies such as interviews, observations, review of historical documents and surveys (Marshall & Rossman, 2011). In case study research strategies, the researcher is required to reconnoitre an activity or process in profundity. The cases are restricted by time and activity. A collection of detailed information is collected using data collection procedures such as interviews, observations, documents, past records or audio visuals over a period of time (Creswell, 2009).

In a case study research, a specific individual, program or occurrence is studied in depth. A researcher may choose to concentrate on a single case maybe for its distinctive or extraordinary qualities which can endorse an understanding or advice for practice in similar situations. Sometimes a researcher may select two or more case studies to make comparisons, construct a hypothesis or put forward a generalization. A case study is particularly appropriate for learning about a little known or not well understood condition and is generally useful in providing support for a particular theory. The main short fall of case study research is that it can be certain that the case is generalizable especially when a single case was investigated (Leedy & Ormrod, 2010).

3.3 QUESTIONAIRE RESEARCH
Questionnaires may be sent to numerous people including those that reside far away from the researcher. Questionnaires reduce expenses in that there could be no travel expenses and that postage or emails are generally cheaper than extensive long distance telephone calls. The participants in a questionnaire have more assurance of anonymity and may be more truthful in answering the questions especially when dealing with sensitive or controversial matters. However there is often a low return rate on distributed questionnaires. The responses are generally restricted
to the participants reading or writing skills and perhaps their interpretation of the questions (Leedy & Ormrod, 2010).

The process of constructing a questionnaire can be complex in the sense that the use of inappropriate wording can lead to uninterpretable data and a truncated return rate. The twelve guidelines listed below can be utilised in enhancing the processes of constructing a questionnaire to a standard that encourages cooperativeness from participants and yields better responses (Leedy & Ormrod, 2010):

1. *Keep it short*;
2. *Keep the respondents’ task simple*;
3. *Provide clear instructions*;
4. *Use simple clear and unambiguous language*;
5. *Give a rationale for any items whose purpose may be unclear*;
6. *Check for unwarranted assumptions implicit in your questions*;
7. *Word your questions in ways that do not give clues about preferred or more desirable responses*;
8. *Determine in advance how you will code the responses*;
9. *Check for inconsistency*;
10. *Conduct one or more pilot tests to determine the validity of your questionnaire*;
11. *Scrutinize the almost final product one more time to make sure it addresses your needs*;
12. *Make the questionnaire attractive and professional looking*.

### 3.4 INTERVIEWS

Qualitative interviews can be defined as a construction site of information where two or more people discuss a subject of reciprocal interest. In a qualitative study an interview maybe one of several methods utilised in obtaining research data (Marshall & Rossman, 2011). Qualitative study interviews are formal and emotionally neutral. However it is advantageous; in terms of optimizing participant input; if the researcher is likable and friendly. Face to face interviews have the highest response rates and the highest percentages in terms of people agreeing to participate in the survey. However these can be very expensive and prohibitive if the interviewees are based in distant provinces or countries. Telephone interviews are cheaper and the researcher has a wider audience. The response rate is not as high as that of face to face interviews; some people may get annoyed or may not be interested; but the researcher is still able to build a similar rapport with the participants that is offered by a face to face interview (Leedy & Ormrod, 2010).
Interviews produce a large quantity of data in a short space of time. When more than one individual is interviewed, a broader spectrum of information is obtainable. The researcher is able to immediately follow up and get clarification on matters discussed. It can be said that the lushness of an interview is in the follow up question. Interviews are however dependant on factors such as trust and this may lead to some participants not willing to share information that is considered intimate. The large quantity of data obtained from an interview may take lots of time to analyse. The interviewee’s listening skills is a variable in an interview and in some cases the participants may have a good reason to be untruthful (Marshall & Rossman, 2011).

3.5 SAMPLING METHODS

The important aspects of the population and sample considered in planning a research design are as follows (Creswell, 2009):

- Identify the population in the study;
- Identify whether the sampling design for this population is single stage or multistage;
- Identify the selection process for individuals;
- Identify whether the study will involve stratification of the population before selecting the sample;
- Review procedures for selecting the sample from available lists;
- The number of people in the sample and the procedures used to compute this number.

There are two main categories of sampling a population to be researched, namely Probability Sampling & Non-Probability Sampling. These categories of sampling can be further broken down to the eight categories discussed in section 3.4.1 to section 3.4.8 (Leedy & Ormrod, 2010). The samples discussed in section 3.4.1 to section 3.4.5 discuss probability forms of sampling and section 3.4.6 to section 3.4.8 describe non-probable sampling methods.

3.5.1 SIMPLE RANDOM SAMPLING

This form of sampling is the least refined of all the sampling designs. It is recommended for use in small populations where all the members are known to the interviewer. This method is not practical nor possible in most cases where large population sizes are required (Leedy & Ormrod, 2010).

3.5.2 STRATIFIED RANDOM SAMPLING

Stratified random sampling has the advantage of assuring an equal depiction of each of the identified groups. The researcher takes an equal sample from each one of the different groups in the
overall research population. This method is suitable for use in cases where the different groups in the population are of equal size (Leedy & Ormrod, 2010).

3.5.3 PROPORTIONAL STRATIFIED SAMPLING
Proportional stratified sampling employs the processes for example of taking a singular sample from one group of the population for every two or three samples from another group in the population (Leedy & Ormrod, 2010).

3.5.4 CLUSTER SAMPLING
In cases where the area population to be studied is spread out over a great area, it is advantageous to use a map highlighting the different subdivisions within the population. The subsets within the subdivisions are then sampled randomly (Leedy & Ormrod, 2010).

3.5.5 SYSTEMATIC SAMPLING
Systematic sampling comprises of selecting individuals or groups in accordance with a predetermined sequence such as taking the eighth unit on the list of a population (Leedy & Ormrod, 2010).

3.5.6 CONVENIENCE SAMPLING
Convenience sampling is the process of choosing a sample by coincidence such as taking a sample from people or units who happen to be available or as they arrive on the scene (Leedy & Ormrod, 2010).

3.5.7 QUOTA SAMPLING
Quota sampling is an extension to convenience sampling. Respondents are selected in equal proportions that they are set up in the overall population, but not in a random manner (Leedy & Ormrod, 2010).

3.5.8 PURPOSEFUL SAMPLING
The sample is chosen from the population for a particular purpose. Samples can be chosen on the criteria that they represent diverse perspectives on a particular issue or because the group can be regarded as being typical of a population.

3.6 QUESTIONNAIRE DESIGN PROCESS
The questionnaire data collection was used for collecting data to be analysed and utilised in answering the research question. The primary basis for selecting the questionnaire was that it may be sent to numerous people that may be far away without incurring the costs of lengthy telephone
bills and the expenses related to long distance travel; to the steel company locations; that conducting interviews would introduce. The questionnaire was designed using table 3.1 to ensure a relation and relevance to the research question, and also with a view to keep it short as possible.

Table 3.1: Utilised Questionnaire Construction Design guideline

<table>
<thead>
<tr>
<th>Question</th>
<th>Relation to Research Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Please list the most significant key Performance indicator variables/parameters for your plant. Also please may provide the extent to which each one is measured</td>
<td>Determination of currently utilized KPI; In order to determine if leading KPI are already being utilized internally within the organization. Also to determine if the hypothesis that industry KPI does not inform on the root causes of the accident.</td>
</tr>
<tr>
<td>2. What are the organisation’s strategic goals with regard to health and safety?</td>
<td>This question aims to identify the forces behind safety decisions within the organization. The answer provided an overview of the safety targets in the organisation.</td>
</tr>
<tr>
<td>3. What are the important objectives for achieving good health and safety in your section?</td>
<td>The intention is to identify the key aspects for improving safety from the perspectives of different levels in the organizational structure.</td>
</tr>
</tbody>
</table>

Some questionnaires were printed and given to personnel from the steel industry by hand. Email was also utilised to distribute some of the questionnaires in cases where hand distribution was not possible or impractical. The purpose of the questionnaire was explained verbally to potential respondents. Email and phone calls were also utilised to explain, the questionnaire process as reassurance and reminder to those potential respondents whose email addresses were available.

3.7 SAMPLING DESIGN PROCESS

The population from which a sample was derived consists of steel industry workers from various divisions within the organisation. Question three of the survey was asked with the intention of obtaining the perception of safety objectives from different levels of the organisation’s hierarchy.
The cluster random sampling strategy was selected and utilised as the primary sampling method. Random sampling was applied to the following subgroups following groups within the population:

- Supervisors
- Specialists
- Engineering Staff
- Production personnel
- Management

The questionnaires were randomly distributed to the subgroups. The population was chosen based on that they are the dominant population subgroups in industry and also in the plant where permission was granted to distribute. The questionnaires were distributed to employees working for active organisations in the South African Steel industry. The organisations were chosen from the South African Iron and Steel Institute member companies. The SAISI was chosen because it was an employers’ organisation in the republic of South Africa. Employers’ organisation is any number of employers associated together for the purpose, whether by itself or with other purposes, of regulating relations between employers and employees or trade union, Republic of South Africa Labour Relations Act no 66 of 1995. The organisations were chosen based also on the ease of acquiring their employees’ contact details. It was explained to participants that the data collected would remain confidential.

3.8 DATA COLLECTION

Due to the distance between the researcher and the questionnaire respondents, the majority of the questionnaires were received via email and some as hardcopy through direct contact with the respondents.

3.9 RESEARCH ANALYSIS

The process of organising large amounts of data can be long, tedious and awkward. The electronic spreadsheet, Microsoft Excel was utilised in capturing and analysing the questionnaire data. Microsoft Excel allowed the researcher to manipulate data display in table form. The Excel spreadsheet is divided into columns and rows to form a grid (Leedy & Ormrod, 2010). The collected data was inserted into different grids and manipulated to filter, do calculations and arrange in an appropriate manner.
3.10 METHODOLOGY UTILISED IN ACHIEVING RESEARCH OBJECTIVES

The research methodology that was followed is the one displayed in figure 3.1. The research was conducted to follow the leading KPI determination methods established by the American Bureau of shipping, 2006 and by (Grabowski et al. 2007). The method involves the following six steps:

- Identify the safety decisions in the organization;
- Identify the fundamental objectives for achieving safety in the organization;

Figure 3.1: Research Methodology Flow Diagram
• Identify safety factors to achieve the fundamental objectives;
• Measure the organisation’s safety performance;
• Measure the safety factors;
• Determine the candidate leading indicators.

The approach was chosen based on that it is a methodology that has been proven, tested and is established as a method for determining leading KPI, (Grabowski et al. 2007).

3.11 CONCLUSION

This chapter highlights the research methodology that was applied utilised in conducting this study. The purpose of the research design was to obtain valid answers to the research question.

The research participants were contacted by the researcher and briefed telephonically on the study and in some instances where permission was granted the telephone interview participants were requested to distribute the questionnaire in their respective workplace.

Chapter four discusses the research results.
4. CHAPTER FOUR: RESEARCH RESULTS

4.1 INTRODUCTION

This chapter provides a description of the research results and analysis. It aims to present the results in relation to the research objectives and the research literature. The research was conducted with the aim of addressing the four objectives listed below:

- Determine the KPI being utilised by organisations in the steel industry;
- Objectives for achieving good health and safety;
- Strategic goals with regard to health and safety;

The questionnaire was randomly distributed to a population consisting of fourteen supervisors, twelve engineering staff, eighty-six production personnel, twenty-one specialists and six management staff. The respondents’ level of experience in the industry varied from two years to forty years. In total the respondents have a combined experience level of one-hundred and thirty-five years excluding one respondent who chose not to indicate their level of experience. The questionnaire and responses can be found in the Appendix of this document.

4.2 CURRENTLY UTILISED KPI

The first objective of the research was to confirm the validity of previous research and literature theory that organisations in the steel manufacturing sector make utilisation of tradition OHS act KPI as part of running their operations. The results showed that all respondents utilised lost time injuries as a KPI. The following KPI were found to be in use, based on questionnaire respondent results:

- Lost Time Injuries
- Minor Injuries
- Restricted Work Injuries
- Frequency Rates
- First Aid injuries
- Lost time Injury free
- Annual Medical Examinations
- Fatalities

The methods used to measure the KPI were found to be either days or man hours. The studies conducted by previous researchers were found to be still reflective of the KPI utilised in the steel
industry although a few additions and omissions were present. Fifty percent of the safety KPI stated in the research conducted by Paul-Dauphin, 1998 were found to be in use. Seventy-three percent of the KPI determined by the International Council on Mining and Metal, 2009 were found to be in use. The literature hypothesis discussed in Chapter Two was confirmed to be valid: Industry makes use of traditional OHS Act KPI. ‘Lagging indicators are measures of a system that are taken after events and assess outcomes and occurrences’ (Grabowski et al. 2007). With the exception being the annual medical tests which are an OHS Act requirement for numerous regulations applicable to the steel industry, the statistical indicators mentioned above do not reveal the contributing factors to the improvement or deterioration in performance, they do not reveal what actually caused the problems (Hinze, Thurman & Wehle, 2012). These measures are associated with the outcomes of an accident and are dependent on numerous variables such as staff choosing to report or not report an accident. This creates a potential problem, in cases where the results are linked to money (Toellner, 2001).

Table 4.1: Research Comparison to previous results.

<table>
<thead>
<tr>
<th>Jean-Marie Paul-Dauphin, 1998</th>
<th>ICMM, 2009</th>
<th>Current Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost Time Injuries</td>
<td>Lost Time Injury Frequency</td>
<td>Lost Time Injuries</td>
</tr>
<tr>
<td>Major Injuries</td>
<td>Total Recordable Injuries</td>
<td>Minor Injuries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restricted Work Injuries</td>
</tr>
<tr>
<td>Frequency Rates</td>
<td>Injury Frequency Rate</td>
<td>Frequency Rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lost time Injury free</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Medical Examinations</td>
</tr>
<tr>
<td>Fatal Accidents</td>
<td>Fatality Frequency Rate</td>
<td>Fatalities</td>
</tr>
<tr>
<td>Near Misses</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Severity Rate</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accident Cost</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Contractor Accident</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

4.3 OBJECTIVES FOR ACHIEVING GOOD HEALTH AND SAFETY

The objectives for achieving good health and safety performance can be summarized as follows:

- Adherence to safety requirements;
- Annual medical examinations;
- Audits;
- Hazards Identification and Risk Assessment;
- Hygiene standards and surveys;
- Investigations;
- Permits;
- Personal protective equipment;
- Recognition;
- Reporting of incidents;
- Safety meetings;
- Safety standards;
- To provide a safe environment;
- Training;
- Visible felt leadership;

The use of PPE was identified as the most significant common objective, with seventy-three percent of the respondents recommending that it is an imperative to achieving good safety performance.

Figure 4.1: Graphical representation of respondents' suggestions to important objectives for achieving good health and safety.

Personal Protective Equipment, adherence to safety requirements and HIRA were the top three most recommended factors with regard to achieving good health and safety.
4.4 STRATEGIC GOALS WITH REGARD TO HEALTH AND SAFETY

Seventy-three percent of the participants responded that the organisation they worked for aimed to achieve zero in the following factors:

- Fatalities;
- Accidents;
- Loss time injuries;
- Contractor injuries
- Harm to people

The senior employees made reference to a Fatality Prevention Standard which addresses the safety risks within the organisation and the preventative actions to be taken to avoid the occurrence of an accident. Reference of zero professional diseases was made by a participant. The word accident in relation to the workplace can be defined as “an accident arising out of and in the course of an employee's employment and resulting in a personal injury, illness or death of the employee”, Act no. 85 of 1993. This definition incorporates the factors listed above. Therefore it can reasonably be deduced that the organisation aims to achieve zero accidents by implementing the Fatality Prevention Standard.

4.5 RESEARCH OBJECTIVES MEASURE

4.5.1 DETERMINE IF LEADING KEY PERFORMANCE INDICATORS OF SAFETY ARE BEING COMMONLY UTILISED TO IMPROVE SAFETY PERFORMANCE IN STEEL ORGANISATIONS

From the questionnaire results it is evident that leading KPI of safety has not been fully integrated into steel industry safety performance measuring. Understandably the current KPI being utilised are in line with the law enforcing adherence to the OHS Act. However the use of leading KPI has the potential to improve safety performance and can be used together with or in addition with the traditional OHS KPI.

4.5.2 TO DETERMINE IF THE TRADITIONAL KPI REVEALED ANY INFORMATION ABOUT THE CAUSES OF ACCIDENTS.

The list of KPI that the respondents listed as being used in their sections is as follows:

- Lost Time Injuries
• Minor Injuries
• Restricted-work Injuries
• First Aid injuries
• Frequency Rates
• Lost time Injury free
• Annual Medical Examinations
• Fatalities

The above mentioned KPI are all relevant given the nature of the steel making environment. With the exception of medical examinations the KPI do not reveal the root cause of the accident. “An employer or user shall keep at a work place or section of a workplace, as the case may be, a record in the form of annexure 1 for a period of at least three years, which record shall be open for inspection by an inspector, of all incidents he or she is required to report in terms of Section 24 of the Act and also of any incident which resulted in the person concerned having had to receive medical treatment other than first aid”, The Occupational Health and Safety Act of the Republic of South Africa Act no. 85 of 1993. The OHS Act requires organizations to keep records and conduct investigations where necessary. In saying that the KPI do not reveal the root cause of an accident, it does not mean that health and safety incidents are not recorded, investigated or that root causes are not identified. Discussion of those records and investigations is outside the scope of this research however the results of root cause analysis and accident investigations have the potential to be incorporated in a leading KPI of safety program.

4.5.3 TO IDENTIFY THE INITIAL KPI DEVELOPMENT REQUIREMENTS THAT MAY BE USED TO PRODUCE LEADING KPI OF SAFETY IN A STEEL MANUFACTURING ENVIRONMENT.

Based on the leading KPI derivation method that was utilized by ABS Guidance Note,2006 & Grabowski et al. 2007, which state that the two requirements in the producing of leading KPI in an organisation are to determine the safety decisions in the organisation and to identify the fundamental objectives for achieving good safety in the organisation. The questions were addressed as follows:

• To identify the safety decisions in the organization:
This was addressed by the questionnaire where the most frequently referred answer was zero harm and zero fatalities. Fatalities occur where there has been harm to persons therefore the safety goals of the organization were identified as being to achieve zero harm.

- **Identify the fundamental objectives for achieving safety in the organization:**
  1. The use of personal protective equipment;
  2. Hazard Identification and Risk Analysis (HIRA); and
  3. The adherence to health and safety requirements.
  4. Other objectives that had a high recommendation rate were the reporting of incidents, training and the use of permits.

4.6 **CONCLUSION**

This chapter has validated the suggestions from the literature, that the steel manufacturing sector uses traditional OHS Act KPI were to an extent true. The most significant objective for achieving good health and safety are the use PPE, HIRA and the adherence to safety requirements. The strategic goals with regard to health and safety that were identified are to achieve zero harm to people. Some respondents mentioned the implementation of the Fatality Prevention Standard. The conducted research has been able to address the research objectives.

The chapter that follows will highlight the research contributions, limitations and provide conclusions to the study.
5. CHAPTER FIVE: CONCLUSIONS

The purpose of this chapter was to establish the extent to which the research objectives were achieved. The findings from the study are presented and discussed. Recommendations and suggestions for future research are also conferred.

5.1 REVIEW OF FINDINGS

The conducted research indicates that within the Iron and steel industry there is a reliance on the traditional lagging, law enforced OHS Act indicators of safety. The KPI’s found to be in usage were lost time injuries, minor injuries, restricted work injuries, first aid injuries, frequency rates, lost time injury free, fatalities and annual medical examinations. The safety KPI being utilised in the steel industry have not evolved considerably over the past fifteen year. Organisations are however affected by Laws such as the OHS Act in South Africa and use the traditional lagging KPI so as to avoid being penalised.

Table 5.1: Evolution of KPI research results over the years

<table>
<thead>
<tr>
<th>Jean-Marie Paul-Dauphin, 1998</th>
<th>ICMM, 2009</th>
<th>Current Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost Time Injuries</td>
<td>Lost Time Injury Frequency</td>
<td>Lost Time Injuries</td>
</tr>
<tr>
<td>Major Injuries</td>
<td>Total Recordable Injuries</td>
<td>Minor Injuries</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Restricted Work Injuries</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>First Aid injuries</td>
</tr>
<tr>
<td>Frequency Rates</td>
<td>Injury Frequency Rate</td>
<td>Frequency Rates</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Lost time Injury free</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Annual Medical Examinations</td>
</tr>
<tr>
<td>Fatal Accidents</td>
<td>Fatality Frequency Rate</td>
<td>Fatalities</td>
</tr>
<tr>
<td>Near Misses</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Severity Rate</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accident Cost</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Contractor Accident</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 5.1 illustrates that the KPI within the steel industry have remained consistent over the years and although statistical results in figure 1.1 illustrates a steady decrease in incidents within the
industry, the use of KPI cannot be attributed to that. Therefore there use of leading KPI can make a contribution to the improvement of the safety of steel industry workers.

Table 5.2: The full research results in determining the important safety objectives for achieving safety.

<table>
<thead>
<tr>
<th>Safety Objective</th>
<th>Percentage Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence to Safety Requirements</td>
<td>36%</td>
</tr>
<tr>
<td>Annual Medical Examinations</td>
<td>18%</td>
</tr>
<tr>
<td>Audits</td>
<td>18%</td>
</tr>
<tr>
<td>Investigations</td>
<td>9%</td>
</tr>
<tr>
<td>Personal Protective Equipment.</td>
<td>73%</td>
</tr>
<tr>
<td>Recognition</td>
<td>9%</td>
</tr>
<tr>
<td>Reporting of Incidents</td>
<td>27%</td>
</tr>
<tr>
<td>Safety Meetings</td>
<td>9%</td>
</tr>
<tr>
<td>Safety Standards</td>
<td>18%</td>
</tr>
<tr>
<td>To Provide a Safe Environment</td>
<td>18%</td>
</tr>
<tr>
<td>Training</td>
<td>27%</td>
</tr>
<tr>
<td>Visible Felt Leadership</td>
<td>18%</td>
</tr>
<tr>
<td>Hygiene Standards &amp; Surveys</td>
<td>18%</td>
</tr>
<tr>
<td>HIRA</td>
<td>36%</td>
</tr>
<tr>
<td>Permits</td>
<td>27%</td>
</tr>
</tbody>
</table>

The industry workers’ perception of the imperative objective for achieving good health and safety performance was the appropriate use of PPE. This is illustrated in the research results tabulation in Table 5.2. This view was overwhelmingly shared by the respondents with fewer years’ experience and the more senior respondents with a greater number of years’ experience. Other noted objectives included adherence to safety requirements, annual medical examinations, Audits, HIRA, Hygiene standards and surveys, the use of permits, investigations, recognition, reporting of incidents, safety meetings, safety standards, and training, visible felt leadership and an overall communal culture to provide a safe working environment. The strategic goal for achieving a good safety performance was found to be the target for zero harm.

5.2 RESEARCH LIMITATIONS

A number of constraints and limitations were encountered during the studies conducted for the purpose of this research. These constraints can be viewed as short comings or limitations to the
research. The main limitation is that the questionnaire was distributed to a numerous workers, working for different organisations but due to the recent layoffs and retrenchments within the steel industry, at the time of print; retrenchments and layoffs within the steel industry, there existed a general fear amongst works to participate in activities not related to their job description or that could be viewed in negative light by the employer. Safety performance is viewed as a very confidential aspect of any manufacturing company, because it could influence public perception of the company therefore data that organisations in the steel industry are willing to avail is very limited. Only books and publications that were published after the year 1992 were considered in compiling the research.

5.3 ANSWER TO RESEARCH QUESTIONS
1. Is the use of leading KPI being adopted in steel manufacturing organisations to assure good health and safety performance? The answer is no.

2. Do the KPI being utilised inform on the causes of accidents? The answer is no.

3. What are the strategic ingredients to develop leading KPI in a steel manufacturing organisation? The answer is the “the use of personal protective equipment, conformance to safety standards and HIRA.

5.4 CONTRIBUTION OF THIS STUDY
The study has verified the theory of literature that organisations in the steel industry make use of traditional lagging OHS KPI as a safety control mechanism. The study has also provided the platform upon which leading KPI may be generated for an organisation that is active in the steel manufacturing industry. This was achieved by determining the initiating parameters essential in deriving leading KPI.

5.5 FUTURE RESEARCH
This research focused on determining the KPI in use in the steel manufacturing industry but the author suggests a further case study be conducted on an organisation in the steel industry to determine the actual values for factors such as near misses, and also to assess the safety climate in the organisation. This case study has the utility value to provide clarity on the correlation between the important safety factors established in this research and the safety performance of the
organisation or division concerned. The establishment of a correlation would allow for a derivation of leading KPI to be utilised in a steel manufacturing company.

5.6 CONCLUSION AND RECOMMENDATIONS

This study was conducted with the aim to:

- Determine if leading key performance indicators of safety are being commonly utilised to improve safety performance in steel manufacturing organisations.
- To determine if the KPI's being used reveal any information about the causes of accidents.
- To identify the KPI development requirements that may be used to produce leading KPI of safety in a steel manufacturing organisation in South Africa.

These research objectives were achieved through subdividing the problem and developing a research plan. The research plan was utilised as a control system mechanism and guide in conducting the rest of the study. Post formulation of the plan a review of available literature was conducted based on the problem statement. Data collection methods such as questionnaires were used to assess the current practices and trends in industry and for research analysis purposes. Using the literature and research input, the research questions were answered. The best leading KPI determination methodology was determined through the literature review and was proven from previous research in other similar industries.
REFERENCES


Bennet J,2007, Quarry health and safety management systems, Camborne School of Mines


Bridges B., 2012, Leading Key Performance Indicators (L-KPIs) for EHSQS, Process Improvement Institute.

Cayce E., 2008, Basic Tools for process improvement, The Air University 21(3), 73-82


The Republic of South Africa Labour Relations Act no 66 of 1995

The Occupational Health and Safety Act of the Republic of South Africa Act no. 85 of 1993

APPENDIX A. Questions in Questionnaire

Name (Optional): _________________________________________________________________

Position in organisation:_________________________________________________________________

Level of Experience in industry: eg. 2years_______________________________________________

**Question 1**: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

Question 2: What are the important goals for achieving good health and safety in your section?

Question 3: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

2.

3.

4.

5.
APPENDIX B. Questionnaire Cover Letter

The people who received the questionnaire by email were contacted telephonically prior to being sent the email.

Kindly receive the attached questionnaire as per telephonically discussed. The questionnaire will be used as part of research at UJ and if you required it, the full mini dissertation report may be forwarded to you once completed. If you have any questions or queries please feel free to contact me thank you.
APPENDIX C. Questionnaires

Key Performance Indicators of Safety Questionnaire

Name (Optional): ________________________________

Position in organisation: Engineer

Level of Experience in industry: eg. 2 years ______ 4 yrs ______

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm....)

- Zero harm
- Zero fatalities
- Zero Lost Time Injuries

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm....)

Question 3: What are the important objectives for achieving good health and safety in your section?

PPE: Lock out systems (adheres to all safety requirements); Annual medical examinations; Fatality prevention standards; Reporting and auditing of any deviation on plant; Visible felt leadership
Key Performance Indicators of Safety Questionnaire

Question 4: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

2. Minor Injuries, 760

3. Lost Time Injuries, 2 million man hours

4. Fatalities, 760

5.

6.

7.

8.
Key Performance Indicators of Safety Questionnaire

Name (Optional): D. De Bruin
Position in organisation: Production Specialist
Level of Experience in industry: eg. 2 years 40 years

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm....)

1. **Creating a Safe Environment for all to Live and Work In**
2. **Fatality Prevention Standards, Lock Outs, Confined Space, Gas Hazardous Areas, Working at Heights, Rail Safety, Skip Floor Audits, Vehicles and Driving, Falls, and Lifting, Contractor Management, Incident Investigation.**

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm....)

3. **Legal Requirements**
4. **Training**
5. **Safety Workshops**
6. **Hiras**
7. **Permit to Work**

Question 3: What are the important objectives for achieving good health and safety in your section?

1. **Audits, Internal and External**
2. **VFL, Visible Feel Leadership, Weekly Report Visit**
3. **Safety Meetings**
4. **Recognition**
5. **Training.**
6. **Investigations**
7. **Personal Protective Equipment (PPE).**
Key Performance Indicators of Safety Questionnaire

Question 4: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>LTIFR</td>
<td>Lost Time Injury Frequency Rate</td>
</tr>
<tr>
<td>3</td>
<td>LTIH</td>
<td>Lost Time Injuries Free Hours</td>
</tr>
<tr>
<td>4</td>
<td>RWI</td>
<td>Restricted Work Injuries</td>
</tr>
<tr>
<td>5</td>
<td>MI</td>
<td>Minor Injuries</td>
</tr>
<tr>
<td>6</td>
<td>FAI</td>
<td>First Aid Injuries</td>
</tr>
<tr>
<td>7</td>
<td>YMEH</td>
<td>Yearly Medical, Eye, Hearing, General Health Examination</td>
</tr>
</tbody>
</table>

Page 2 of 2
Key Performance Indicators of Safety Questionnaire

Name (Optional): ____________________________

Position in organisation: ______________________

Level of Experience in industry: eg. 2 years __________

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

- **Journey to zero → zero injuries / harm.**
- **Zero fatalities**
- **Zero accidents**
- **Zero professional diseases**
- **Lost time injuries → 0.**

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

Question 3: What are the important objectives for achieving good health and safety in your section?

- Adhere to safety requirements i.e. wear PPE required, be vigilant, know safety standards, correct and report any deviations,
Key Performance Indicators of Safety Questionnaire

Question 4: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. **Lost Time Injuries, 1-million-man-hours.** days
2. **Lost Time Injury frequency rate, days**
3. **Minor injuries**
4. **Yearly medical**
5. **Health Examinations**
6. 
7. 
8. 

Page 2 of 2
Key Performance Indicators of Safety Questionnaire

Name (Optional): Brian Ndlovu

Position in organisation: Technologist

Level of Experience in industry: eg. 2 years 6 yrs

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm....)

We have fatality prevention standards, this standard across all the risk that exist within our company, and they provide preventative actions on how to minimise or prevent occurrence of accidents.

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm....)

Question 3: What are the important objectives for achieving good health and safety in your section?

The objective is to prevent occurrence of accidents and incidents, by providing a safe environment for our employees.
Key Performance Indicators of Safety Questionnaire

Question 4: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

2. **Lost Time Frequency Rate**

3. **Restricted Work Cases**

4. **First Aid Cases**

5. **Minor Injuries**

6. 

7. 

8. 


Page 2 of 2
Name (Optional): 

Position in organisation: MANAGER MAINT. PROCESS

Level of Experience in industry: eg. 2 years 11 YEARS

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

We believe all accidents can be prevented therefore our target is zero accidents. We utilise our safety prevention standards to achieve this goal.

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

Question 3: What are the important objectives for achieving good health and safety in your section?

We strive to create a safe environment for all to live and work in, this includes our employees and the communities in which we operate.
Question 4: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

2. LTI FR = 0.27 for the year

3.

4.

5.

6.

7.

8.
Name (Optional): _________________________________________________________________

Position in organisation: __Electrician______________________________________________

Level of Experience in industry: eg. 2years __ 6 years________________________________

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

Zero Fatalities

Zero Lost Time Injuries

Zero contractor Injuries

Question 2: What are the important goals for achieving good health and safety in your section?

Wearing sufficient PPE specified for area

Conduct HIRA for a specific jobs prior to starting with it

Completed relevant permits prior to entering a restricted area

Conduct SHEQ training for all contractor prior to doing a job
**Question 3:** Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. **Lost Time Injuries, 1 million man hours**

2. 2 million man hours – LTI free

3. 5 million man hours – LTI free

4. 

5. 

6. 

7. 

8. 
**Name** (Optional): _________________________________________________________________

**Position in organisation:** Master fitter ____________________________________________

**Level of Experience in industry:** eg. 2years __ 10 years _______________________________________

**Question 1:** What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

- Zero Harm
- Zero Lost Time Injuries
- Zero fatalities

**Question 2:** What are the important goals for achieving good health and safety in your section?

- Wearing sufficient PPE specified for area
- Conduct HIRA for a specific jobs prior to starting with it
- Completed relevant permits prior to entering a restricted area
- Report all incidents (no matter how minor they are)

**Question 3:** Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is
measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. **Lost Time Injuries, 1 million man hours**

2. 2 million man hours – LTI free

3. 5 million man hours – LTI free

4. 10 million man hours – LTI free

5. 

6. 

7. 

8. 


Name (Optional): _________________________________________________________________

Position in organization: Superintendent – Electrical _________________________________

Level of Experience in industry: eg. 2 years ___ 12 years __________________________

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

Zero Harm

Zero Fatalities

Question 2: What are the important goals for achieving good health and safety in your section?

Wearing sufficient PPE specified for area

Conduct HIRA for prior to all jobs in the plant

Completed relevant permits

Adhere to 5 Cardinal Rules

Fatality Prevention standards
**Question 3:** Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually…). Item 1 on the list below is an example.

1. **Lost Time Injuries, 1 million man hours**

2. 2 million man hours – LTI free

3. 5 million man hours – LTI free

4. 10 million man hours – LTI free

5.

6.

7.

8.
Key Performance Indicators of Safety Questionnaire

Name (Optional): __________  LORRAINE TALJAARD __________

Position in organisation: __________  ADMIN __________

Level of Experience in industry; eg. 2 years __________  40 YEARS __________

**Question 1**: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

* To achieve zero injuries & zero fatalities
* To reduce the loco & vehicle collisions to zero.
* To achieve a work related health incident frequency rate of zero
* To achieve a sustained level 3 during the Fatality Prevention standard (FPS) Audit.

**Question 2**: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

**Question 3**: What are the important objectives for achieving good health and safety in your section?

* Reduce total no. of incidents (including contractors)
* Train, inform & refresh all personnel
* Do medical surveillance on all artisans
* Do hygiene survey.
• Ensure effectiveness of hearing protection devices
• Manage sick leave out of control.

Question 4: Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

2. Minor Injuries

3. Restricted Work Day Cases

4.

5.

6.

7.

8.
Name (Optional): ____________________________________________

Position in organisation: ________________________________________

Level of Experience in industry: eg. 2 years ______________________________

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

With regards to safety it's the FPS (Full prevention standards) and making employees aware of their surroundings and coworkers.

__________________________

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

__________________________

Question 3: What are the important objectives for achieving good health and safety in your section?

Following good hygiene standards and adhering to the 5S programme.

__________________________

Page 1 of 2
**Question 4:** Please list the most significant key Performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours
2. 1 million man hours
3. 150 million man hours
4. Zero
5. 
6. 
7. 
8. 

Page 2 of 2
Key Performance Indicators of Safety Questionnaire

Name (Optional): ____________________________

Position in organisation: Mechanical Candidate Technician

Level of Experience in industry: eg. 2 years 2 years

Question 1: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

To attain zero harm and zero fatalities every time during the production of steel

Question 2: What are the organisation’s strategic goals with regard to health and safety? (Eg. Minimise accidents, zero harm.....)

Question 3: What are the important objectives for achieving good health and safety in your section?

- To ensure quality work is executed with minimum risk behaviour/conditions
- Continuous hazard identification
Question 4: Please list the most significant key performance indicator variables/parameters of health and safety for your plant. Also please may you provide the extent to which each one is measured, eg (one million man hours, per incident, annually...). Item 1 on the list below is an example.

1. Lost Time Injuries, 1 million man hours

2. Lost Time Injury Frequency Rate (LTIFR): 0.06

3. Injury Free Days: 0 days

4.

5.

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