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DEPARTMENT OF CONSTRUCTION ECONOMICS

HEALTH CONDITION IN AND SURROUNDING CONSTRUCTION

Treatise submitted in partial fulfillment of the requirements

for the degree of

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– [BSc(Hons)QS]

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Chapter 1:

The problem and its settings.

1.1 Overview

The health condition in and surrounding the construction industry, and the role it plays on the environment that directly impacts on human health.

The health and environmental sacrifices are some of the biggest problems with construction and developing a world that better suits our needs and luxurious living standards. It is however unavoidable in most cases as we need to use toxic chemicals and materials like cement to make it possible for us to move forward and have sustainable growth in the industry. In general, construction is a very risky business and more so a risk to the health of humans. Construction does not only affect people working on a construction site, but also the public in general.

According to Earle (2012), Construction can have a major impact on the environment, which can in turn have a drastic influence on the people living in the surrounding areas. Construction also influences the health of people globally since the carbon footprint of construction has a negative influence on the planet.

The purpose of the research and surveys are to determine the severity of the effects that construction has on human health and the impact and effectiveness of methods that are being used to limit these effects. Construction impacts human health on different levels, which are: Site/construction workers; Social Impact; Environmental Impact and Global Impact.

Figure 1: The impact of Construction at different levels

1.2 Statement of the main problem

Does construction have an influence on human health?

1.3 Statement of the sub-problems

1.3.1. What are the specific effects that construction has on human health?

1.3.1.1 What role does the sun play on the health of construction workers?

1.3.1.2 What role do toxic materials play on the health of construction workers and people living in the surrounding areas?

1.3.1.3 What role does stress play on the health of construction workers?

1.3.1.4 What are the main or most common health problems on construction sites and surrounding areas?

1.3.2. How severe are, or can the health effects be that construction has on human health?

1.3.2.1 What are the most severe health problems?

1.3.2.2 Are the problems commonly fatal and what role does age play?

1.3.3 How effective are the policies and procedures that are being used to limit the health effects and their impacts?

1.3.3.1 What role do organisations like CANSA play?

1.3.3.2 How can policies, legislation and enhanced research better the prevention of accidents and illnesses?

1.3.3.3 Is the cost of implementing better health and safety measures in the construction industry worth paying and will it make a difference?

1.3.3.4 What are the available options for construction workers if they have been affected?

1.3.4. How do our safety measures compare with international standards?

1.3.4.1 How is HSE implemented in the Construction industry of Western Australia?

1.3.4.2 What are the client requirements for HSE in Australia?

1.3.4.3 How is the HSE risks minimized in Australia?

1.4 Statement of Hypothesis

Construction work definitely has an effect on the health of construction workers. There are also effects on human health surrounding construction sites.

1.4.1 What are the specific effects that construction has on human health?

Working on a construction site or even being in the surrounding areas of where construction work is being done can be very detrimental to the human body. Construction can even contaminate the environment which could cause a series of illnesses or at worst death. The sun has a major influence, if not the biggest, on the health of construction workers. Toxic materials can be very dangerous when exposed to. Stress can also contribute to ill health because it puts strain on the body. Skin problems which can lead to skin cancer and other problems like cement poisoning are some of the most common problems in construction for workers. Damage to the environment can be caused by construction through the contamination of the ground, air and drinking water of the area.

1.4.2 How severe are, or can the health effects be that construction has on human health?

Depending on the circumstances, health effects can be very severe. Some of the most severe problems include cancer, falling from high places and electrocution. In most cases illnesses and accidents are not fatal, but the numbers of fatalities are much too high. Age plays a major role, the older a person gets the higher the

probability of getting ill or injured due to construction. Injuries or illnesses are much more likely to be fatal as the age of the person involved increases.

1.4.3 How effective are the policies and procedures that are being used to limit the health effects and their impacts?

In some cases these health effects are avoidable, but mostly this is difficult to implement. The methods in policies and procedures that are being used are very advanced and there are little problems that have not been researched. Certain organisations do play a major role in the awareness, treatment and researching of health problems and come up with methods to combat these problems, however they can focus more strongly and specifically on construction. Some of these methods are either not as effective as they should be or they are not effective at all and can still be improved. The cost implications could be the reason that action is not being taken. The cost is sometimes not justified for the person or organisation with the money or responsibility. This is especially true when they look at the initial cost. In some cases the funds are simply not available. Due to the fact that health costs cannot be estimated or calculated accurately, it is mostly overlooked. The cost is however worth paying at the end of the day and it will make a huge difference if more money is spent on health and safety. Cost should not be a factor when considering the health of human beings.

1.4.4 How do our safety measures compare with international standards?

South Africa has good health and safety standards in place, although there is room for improvement. It can be made stricter to compare with the measures taken in countries like Australia.

1.5 Limitations

This survey is limited to the health and safety of humans. The influence of construction and the broader industry on the environment of humans will also be

considered. No other industries will be looked at. The influence of construction on the environment will be looked at directly in regards to the influence it has on the human body and not for instance animals etc.

1.5.1 Types of health and safety problems being researched

There are a lot of health and safety problems that are caused through construction work. The following categories of causes exist:

- Sickness
    - Could have less serious, or
    - more serious affects
- Death
- Injury
    - Could be serious with permanent consequences, or
    - It could only be a temporary injury
- Disability
    - Could be serious with permanent consequences, or
    - It could only be a temporary disability

1.6 Research Methodology

The quantitative method will mostly be used, but in certain cases the research might require the qualitative method. Information will be gathered from journals, catalogues, books, newspapers and websites of associations and organisations. Previous cases will also be investigated as far as possible and conclusions drawn from those incidents and the general statistics of the industry. Surveys will also be done and collected from various individuals working on a construction site, to determine their past experiences on health and safety and the efficiency and effectiveness thereof.

John W. Cresswell (2003) defines quantitative research as follows:

"A quantitative approach is one in which the investigator primarily uses post positivist claims for developing knowledge (i.e. cause and effect thinking, reduction to specific variables and hypotheses and questions, use of measurement and observation, and the test of theories), employs strategies of inquiry such as experiments and surveys, and collects data on predetermined instruments that yield statistical data."

1.7 Conclusion

The purpose of this research will be to prove that there are major health - and safety hazards for humans in and surrounding construction sites, that these hazards can be reduced, human health greatly improved and how this can be achieved. The research will indicate that health and safety can be time consuming and costly. The research will consist of a questionnaire and literature study which will be integrated as one and will test the effectiveness of health and safety methods currently taken in the construction industry. The research will aim to prove the shortcomings and how it can be improved and addressed.

Chapter 2:

Effects of construction on human health.

2.1 Introduction

Working on a construction site or even being in the surrounding areas of where construction work is being done can be very detrimental to the human body. It can have serious consequences on the people who choose or sometimes have no choice other than making their living from the construction industry.

According to Murie (2007), construction is a very large industry worldwide and has roughly 180 million people employed internationally; this makes it a major contributor to work-related ill health. “The construction industry worldwide is a USD (United States of America Dollar) 3 trillion giant, accounting for around 10% of the world’s gross domestic product and employing 180 million people, or 7% of global employment. It is also responsible for far more than its share of occupational accidents and work-related ill health.” (Murie: 2007)

This means that a large number of people are directly influenced and exposed to construction and its’ health hazards. All people are exposed to the hazards of construction in one way or another, even if it is only indirect exposure. One must consider the bigger picture. The hazards may be from global warming, damage to the ozone layer etc. The impact of construction can be divided into the following four main areas: Site/construction workers; Social Impact; Environmental Impact and Global Impact. Workers in the construction industry work very hard physically and very long hours; this could also have an impact on their health in the long run. Fatigue could cause accidents due to lapses in concentration as an example. Construction workers sometimes work up to 37 hour shifts which is one of the reasons for the high tendency of incidents that occur.

“Workers on a construction site may be exposed to various hazardous substance and physical agents, e.g. asbestos, lead, silica dust, organic solvents, sewer gases, welding fumes, radiation, noise and vibration. Excessive exposures to these substances/agents may result in acute injury, chronic illness, permanent disability or even death. Loss of concentration at work and fatigue arising from poor health conditions may increase the risk of accidents.” (Occupational Safety and Health Branch, Labour Department: 2004)

Construction also contaminates the environment which could cause series illnesses or even death. Contaminated water and air caused by construction is often consumed by humans, which causes less serious illnesses like an upset stomach due to bacterial infection or more serious illnesses like cholera. Care must be taken not to poison humans who are using the natural resources surrounding construction sites for their survival. Animals can also consume the water or plants which have been infected. Crops that people plant can be infected by the polluted water. When people or animals then eat these crops it can cause serious illnesses. Construction therefore does not only pose a threat to the workers on site, but also to humans in the surrounding areas, whether it is directly or indirectly contaminating their environment.

Figure 2: Impacts of the built environment.
(Zawya: 2010)

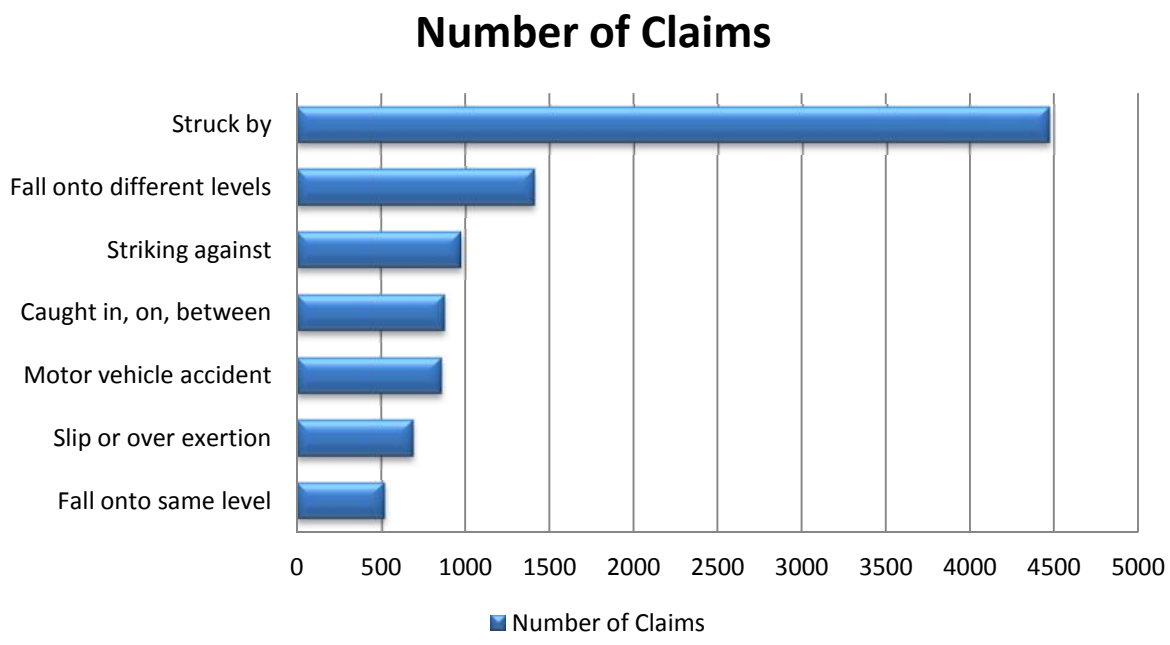
"A more detailed analysis of the FEMA (Federal Emergency Management Agency)statistics shows that:

- the dominating causes of injuries were struck by (44%), falls on to different levels (14%) and striking against (10%);
- the dominating causes of fatalities were motor-vehicle accidents (MVAs) (47%), struck by (17%) and falls on to different levels (17%);
- penetrating wounds (30%) and superficial wounds (31%) predominated in terms of the nature of injuries sustained;
- multiple injuries caused 47% of fatalities;
- injuries to hands (24%), head and neck (19%), and legs (16%) were common anatomic regions involved; and
- in terms of agency, automobiles (10%) and hand tools (6%) dominated as causes of injuries." (Smallwood et al: n.d.)

H&S Accidents by Cause: FEMA				
	2006		2007	
Description	Number of Claims	Number of Fatalities	Number of Claims	Number of Fatalities
Accident type N.E.C	43	1	95	3
Striking against	788	1	975	0
Struck by	4 031	17	4 474	10
Caught in, on, between	872	4	877	4
Fall onto same level	200	0	516	1
Fall onto different level	1 254	18	1 406	10
Slip or over-exertion	1 131	1	683	0
Contact with temperature extremes	89	1	92	0
Inhalation, absorption, ingestion	80	3	199	4
Contact with electrical current	14	1	36	0
Unclassified/ Not sufficient data	31	0	21	0
Motor vehicle accident	651	27	857	28
SA	**9 184**	**74**	**10 231**	**60**

Table 1: H&S Accidents by cause – Source: FEMA.

(Smallwood et al: n.d.)



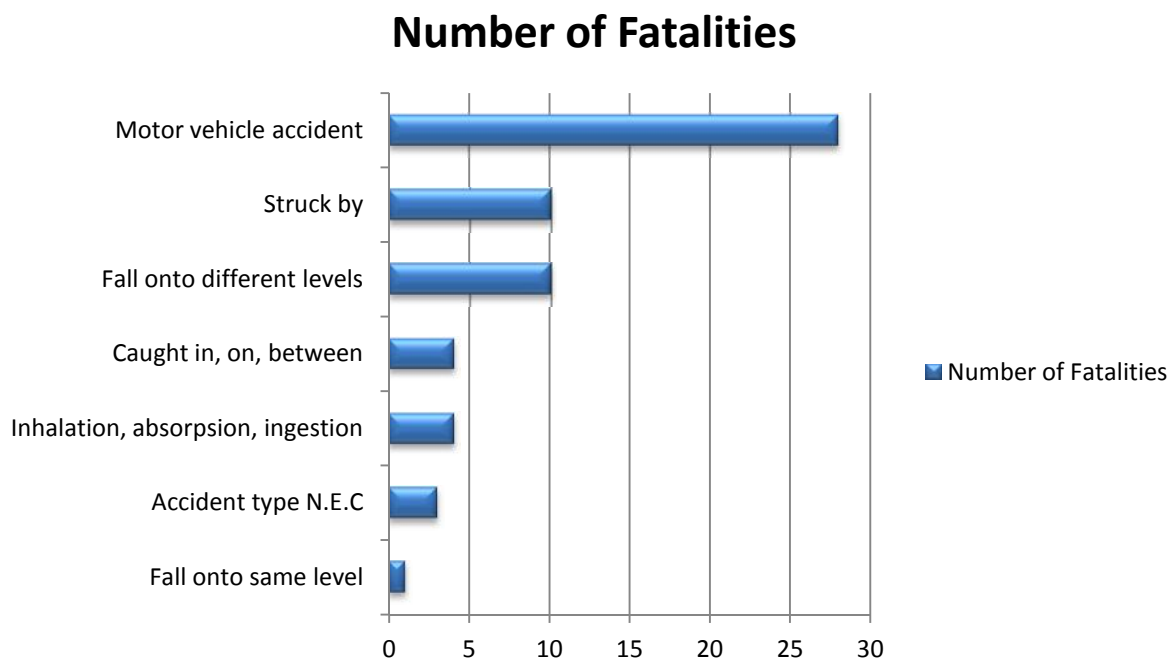


Figure 3&4: Comparison between the total number of claims and fatalities during 2007.

(Smallwood et al: n.d.)

2.2 What are the specific effects that construction has on human health?

Many people in the construction industry are killed every year. These fatalities can be minimized, but it will never be possible to avoid them completely. This is because although many incidents are caused by negligence, some incidents are pure accidents and cannot be avoided. Construction is a very hazardous environment to work in. Big objects have to be moved for instance, and most of the times work has to be done at heights.

Then there are materials that are toxic like flammable gasses, cement, asbestos, construction- and cleaning chemicals, acids etc. These can cause lung problems, blindness, serious burns etc.

Some work is dangerous to do such as working with electricity, moving tools or plant, welding, grinding etc. These can again cause serious burns, blindness, deafness, loss of a limb and many more. All of these can cause permanent incapacity to work. In the worst case it could cause death. On the other hand it could cause short term or lifelong sickness, such as cancer which is a growing problem for people exposed to these substances.

"As many people are killed on construction sites throughout the world each year as die as a result of armed conflict. According to the International Labour Organisation (ILO) at least 60,000 people are killed every year on construction sites. That's around one death every 10 minutes. The industry accounts for almost one in 5 of all fatal workplace accidents. Hundreds of thousands of people worldwide also suffer serious injuries and ill-health through working in construction. The main causes of death and injury are falls, crushes, impacts and electrocution. Common health problems include deafness, musculoskeletal disorders and exposure to hazardous substances such as solvents and asbestos." (Nebosh: 2012)

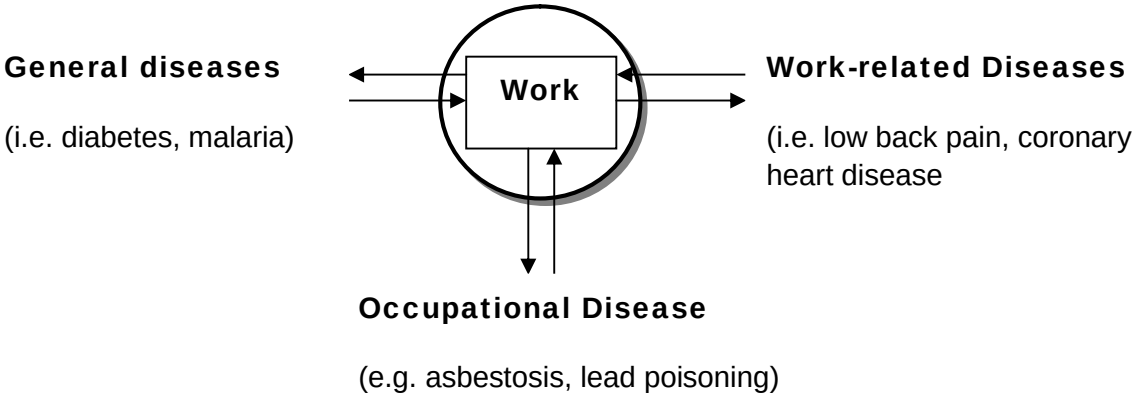


Figure 5: Categories of disease at the workplace.

(Koh and Jeyaratnam: 2001)

"Work may well have an adverse effect on health, but may also be beneficial. The worker who is healthy is more likely to be productive. Those workers with impaired health are likely to be less productive, possibly endangering themselves, other workers, and the community. Figure 4 illustrates the relationship between the

different categories of diseases to be found in the workplace that require management by OH (Occupational Health) professionals." (Deacon: 2003)

"A worker may suffer from a broad spectrum of diseases, like those prevalent in a specific community, such as diabetes, work-related diseases such as backache and occupational diseases such as asbestosis" (Koh and Jeyaratnam: 2001).

According to Koh and Jeyaratnam (2001), exposure to physical, chemical, biological or psychosocial factors causes occupational diseases in the workplace. Workers who are exposed to specific hazards such as silica are the ones who most of the times exclusively experience occupational diseases. It is also very possible for these diseases to occur within the general community due to contamination of the environment. Examples of these contaminations are for instance lead and pesticides. These aspects are demonstrated in Table 2. This table illustrates the differences between occupational and work-related diseases. According to WHO (World Health Organisation) work-related diseases are 'multi factorial' in origin and are diseases where factors within the workplace may have been the cause or can be associated with this disease occurring, although no specific risk factors may be relevant in each case.

"Examples of work-related diseases include hypertension, ischaemic heart disease, psychosomatic illness, musculoskeletal diseases and chronic non-specific respiratory disease or chronic bronchitis. In the examples cited, work may be associated in the causation of or be an aggravating factor in a pre-existing condition." (Koh and Jeyaratnam: 2001)

Work-related Diseases	**Occupational Diseases**
Occurs largely in the community	Occurs mainly among working populations
'Multifactorial' in origin	Cause-specific
Exposure at workplace may be a factor	Exposure at workplace is essential
May be notifiable and compensable	Notifiable and compensable

Table 2: Differences between occupational and work-related diseases.
(Koh and Jeyaratnam: 2001)

2.2.1 What role does the sun play on the health of construction workers?

Another major influence that construction has on the environment is its' carbon footprint. This problem poses a serious threat, not only in South Africa, but worldwide.

"The construction process and the use of buildings not only consume the most energy of all sectors in the UK (United Kingdom) and create the most CO2 emissions, they also create the most waste, use the most non-energy related resources, and are responsible for the most pollution. Building use in the UK contributes about 50% of the UK's CO2 emissions and construction contributes about another 7%." (Natural Building Technologies (NBT): 2010).

The construction industry is a major contributor to the depletion of our ozone layer. This in return causes the suns' rays to be much more dangerous to the human skin. Construction workers are directly exposed to the sun during most of a normal working day; this causes them to experience skin problems especially over a long period of time.

"Ozone layer depletion decreases our atmosphere's natural protection from the sun's harmful ultraviolet (UV) rays……. Understanding these risks and taking a few sensible precautions will help you enjoy the sun while lowering your chances of sun-related health problems.

- Skin cancer (melanoma and non-melanoma)
- Premature aging of the skin and other skin problems
- Cataracts and other eye damage
- Immune system suppression"

(United States Environmental Protection Agency (USEPA): 2011)

South Africa is a country that has one of the harshest climates in the world with hot summers and a scorching sun which makes it a very dangerous environment to work in. It is not known as sunny South Africa for nothing. If a person does not look after

his skin and take proper preventative measures, such a person might face serious problems over the long run.

“The main health effects of solar UV radiation are skin cancers, ocular diseases and immune suppression. International statistics suggest that between two and three million non-melanoma skin cancers and 132 000 melanoma skin cancers occur globally each year. Approximately one in three cancers diagnosed is a skin cancer. Worldwide about 18 million people are blind as a result of cataracts and 5% of this cataract disease burden is directly attributable to sun exposure. A third impact of excess sun exposure on human health is immune suppression. In a recent review paper, the consequences of immunosuppressant induced by UV radiation on human health were explained to be both positive and negative. Negative impacts included increased prevalence of skin cancer, possibly infectious diseases and impacts on vaccination (vaccines may be less effective following excess sun exposure); while positive impacts include increased vitamin D production and a feeling of wellbeing.” (Council of Scientific and Industrial Research (CSIR): 2012)

2.2.2 What role do toxic materials play on the health of construction workers and people living in the surrounding areas?

“Construction workers often underestimate the dangers and complexity of hazardous materials in the workplace because many of the same materials are used at home. Materials enter the body in various ways, for example, they can be absorbed though the skin, or inhaled and in this way affect the workers health (Ruhl and Kluger, 1995; Koningsveld and van der Molen, 1997). Skin diseases are among the most widespread occupational health conditions (Gibb, Gyi and Haslam, 1999a; Koningsveld and van der Molen, 1997). The most common disease in Germany is allergic cement eczema caused by soluble chromium (IV) compounds in cement that can occur after years of exposure to cement (Ruhl and Kluger, 1995; Berger, 1998). In addition to the chromates, slaked lime in cement is further thought to be responsible for cement burns on the legs and feet of workers where cement has spilled into their protective wellington boots (Wheeler and Smallwood, 1998; Gibb et al., 1999a).” (Deacon: 2003)

According to Deacon (2003), a number of substances such as dichloromethane, formaldehyde and lead chromate could be carcinogenic. Some mutagenic substances are also found in the construction industry such as toluene. Another type of substance that can also be found in this industry is neurotoxic substances such as ethanol and benzene. Steel structure and residential renovations work are very likely to contain embryo toxic chemicals such as lead and its compounds.

“Separating agents are used to separate shuttering from partially or dried concrete. Separating agents contain mineral oils, aromatic and halogenated hydrocarbons, as well as active agents such as paraffin, natural and synthetic fatty acids. Health effects include skin sensitisation as well as damaging various organs due to the product penetrating the skin barrier. Oils and mists cause irritation of the respiratory and eye irritation because of the manner of application, which is usually by roller or brush.” (Ruhl and Kluger: 1995)

“Carbon monoxide is encountered from internal combustion engine exhausts, and carbon dioxide welding. Welding fumes, the parent metal, and its coatings together with the weld metal and rod coatings release fumes that can cause the flu- like illness, metal-fume fever.” (Wheeler and Smallwood: 1998)

According to Ruhl and Kluger (1995), workers in construction may do specialised work which exposes them to hazards like for instance concrete renovations; flooring and tiling, and painting and varnishing. Deteriorated concrete has to be renovated to keep it safe for use. Epoxy resins are skin sensitizers which can cause allergic skin conditions or irritations. When flooring is done, it often requires sanding of stone and this can contain silica. Exposure to this could eventually cause silicosis. Chromate eczema could be caused by tiling and working with the adhesives. Thing like dust, cement dust, acetic acid from silicone rubber during polymerisation and many more, could cause respiratory irritation. Another substance which could cause respiratory irritation or skin irritation is paint. This includes paints and varnishes. Painting and varnishing can be done internally and externally. The irritation is caused by the solvents in these products which contain xylene and ethyl benzenes which are neurotoxic.

“A large amount of time is spent outdoors but cold weather and wind may affect the musculoskeletal and respiratory system, with sunlight increasing the hazard of skin disease. In fact conditions are often so poor that walkways have been suggested to be more suitable for mud fights than for efficient and safe work.” (Koningsveld and van der Molen: 1997)

Table 3 is based on the work of Smallwood and Ehrlich (1997) where the health hazards related specifically to construction are indicated. This includes stresses or agencies on the body. It also identifies the types of diseases that may develop as a result of exposure to these stresses or agencies.

System	Stress / Agency	Illness / Disease
Musculoskeletal	Lifting/ Loads	Muscular pain syndromes
	Repetitive strain	Tenosynovitis
	Abnormal postures	Bursitis
	Whole body vibration	Osteoarthrosis
Sensory	Noise	Hearing loss
Skin	Cement (chromates)	Allergic contact dermatitis
	Rubber, epoxies	Irritant contact dermatitis
	Tar, Pitch	Acne, skin cancer
	Solar radiation	Keratoses, cancer
Respiratory	Silica	Silicosis, TB
	Asbestosis	Asbestosis, cancer
	Spray paints, woods, epoxies	Asthma
	Irritant dusts, welding fumes	Bronchitis
Psychosomatic	Physical stress	Headaches
	Psychological stress	Depression, fatigue and substanc abuse
Nervous system	Lead	Peripheral and central neuropathy
	Organic solvents	Headaches, dizziness, mood disorder, dimentia

Table 3: Construction related health hazards.
(Smallwood and Ehrlich: 1997)

“Deacon and Smallwood (2001) did a report on the GC’s workers (General Contractor’s workers) and how often they used or came across materials or substances which contained hazardous chemical substances (HCSs). The report also contained the perceived influence that it had on the health of these workers. The study revealed an important index (II) which had a minimum value of 0.0 and had a maximum value of 4.0. If any material had an important index (II) that was above the midpoint value of 2.0, it could be regarded as having a substantial impact. There were however exceptions where the material or substance had scored below 2.0 and did not seem to be prevalent, but potentially could have an impact on the health of workers. The author also stated that Smallwood and Ehrlich (1997) did research in South Africa on GCs, during which they discovered that most of the contractors which were surveyed rarely or never did any medical surveillance before employing a worker, after that they also did not do any medical surveillance in the form of periodic screening, all of which would be so that the existence of any conditions relative to the stressors or agencies could be determined.”(Deacon: 2003)

Frequency		**Material/Substance**	**Perceived impact**	
II	**Rank**		**Rank**	**II**
2.42	7	Concrete additives	1=	2.22
2.08	11	Welding	1=	2.22
3.39	4	Concrete dust	3	2.10
3.69	2	Cement mortar / plaster / screeds	4=	1.90
2.15	10	Epoxies	4=	1.90
1.69	12	Sealants (joints)	6	1.80
3.92	1	Concrete	7	1.78
3.54	3	Block/Brick dust	8	1.70
0.2	15	Asbestos dust	9	1.67
2.39	8	Paint	10	1.60
3.17	6	Shutter oil	11=	1.44
2.17	9	Wood (treated)	11=	1.44
3.25	5	Wood dust	13	1.38
0.55	14	Waterproofing (torch on)	14	1.33
1.08	13	Premix	15	1.25

Table 4: Workers’ use of HCS-containing materials.

(Deacon and Smallwood: 2001)

"Hazardous and toxic substances are defined as those chemicals present in the workplace which are capable of causing harm. In this definition, the term chemical includes dusts, mixtures, and common materials such as paints, fuels, and solvents. OSHA (Occupation Safety and Health Administration) currently regulates exposure to approximately 400 substances. The OSHA Chemical Sampling Information file contains listings for approximately 1500 substances; the Environmental Protection Agency's (EPA's) Toxic Substance Control Act (TSCA) Chemical Substances Inventory lists information on more than 62,000 chemicals or chemical substances; some libraries maintain files of material safety data sheets (MSDS) for more than 100,000 substances." (Occupational Safety & Health Administration(OSHA): 2009)

Exposure to these toxic materials can be instantaneous or even over a long time after which the effects can be seen. Slow exposure can be just as dangerous although it cannot be seen at the moment of exposure, it could suddenly reveal itself as being a serious problem. Asbestos and cement are examples of this and could be deadly.

"An acute effect of a substance is one that occurs rapidly after exposure to a large amount of that substance. A chronic effect of a substance results from exposure to small amounts of a substance over a long period of time. In such a case, the effect may not be immediately obvious. Chronic effects are difficult to measure, as the effects may not be seen for years. Long-term exposure to cigarette smoking, low level radiation exposure, and moderate alcohol use are all thought to produce chronic effects." (University of California College Prep (UCCP): 2009)

Internationally the construction industry is not the only contributor to toxic waste, but could definitely be considered as one of the main role players if not the biggest. Construction accumulates huge amounts of waste as very little of the materials can be recycled. Over the last few years Green building has grown significantly and people have become more and more aware of this fact. This means that a process of using or making more construction materials recyclable has been undergone by the industry. Still however, large amounts of materials are being replaced as buildings are being renovated. The demolished materials and even waste of materials on new buildings that cannot be recycled are all dumped as waste. This waste contributes to a lot of pollution; this in turn affects people by contributing to their poor health.

“When environmental conditions are degraded such that the range of tolerance is exceeded, there will be a significant impact on human health. Our industrialized society dumps huge amounts of pollutants and toxic wastes into the earth’s biosphere without fully considering the consequences. Such actions seriously degrade the health of the earth’s ecosystems, and this degradation ultimately affects the health and well-being of human populations.” (University of California College Prep (UCCP): 2009)

“According to DEFRA (Department for Environmental, Food and Rural Affairs) the waste going to landfill from the construction industry in 2004 was about 100 million tonnes. This is more than 3 times the amount of domestic waste collection (28 million tonnes). It has gone up from about 70 million tonnes in 2000. In many situations this is equivalent to one house being buried in the ground for every 3 built. This is an important consideration when the embodied energy of a building is being calculated. Usually such calculations do not take into account an extra 25% energy for waste. This is obviously more serious for higher embodied energy products than low embodied energy products.” (Natural Building Technologies (NBT): 2010).

According to NBT (2010), many common products are today classified or labelled as being hazardous. This is done as a result of increasing regulations on waste disposal in construction. This means that products like gypsum plasterboard and mineral wool insulation have to be disposed of in a special manner as stipulated by the relevant regulation. The less processed any material is, the easier it is to recycle and re-use that material or to dispose of it in a way that is healthy for the environment. This means that the material is less hazardous at the end of the day. Government bodies such as WRAP (Waste and Resources Action Plan) find new uses for construction waste in projects which give the materials new life.

Construction sites are loaded with potentially toxic materials which could be in the form of gas, liquid or solid material. Materials, for instance cement seems harmless but must be handled with care. Some materials, like asbestos are only found to be toxic after being used for years. Sometimes one does not even realise the hazard until it is too late and workers have lost their lives. If such a hazard has been discovered, workers should be properly educated on what these materials are and how to handle and control them. They should also be strictly controlled to not

contaminate surrounding environments in which people, animals; plants and many more could suffer.

2.2.3 What role does stress play on the health of construction workers?

“Construction is a very stressful environment to work in (Smallwood and Ehrlich, 1997: 175; Akkers, 1999: 681). Causes are numerous and include aspects such as the physical environment, the actual organization itself, the way the organization is managed overall, interrelationships between workers, their own environment and the organization, as well as personal and social relationships and personal anxieties. Furthermore heart disease, depression and anxiety, low self-esteem and burnout are a number of the negative outcomes of such stress and stressors (Smallwood and Ehrlich, 1997: 175). In a study undertaken in Holland among twenty construction companies and among 35 000 workers, 50.0% of workers reported that they experienced considerable pressure at work and that measures were needed to reduce this high work pressure. A notable finding is that very few of the employers interviewed in this same study were of the opinion that stress was a problem (Koningsveld and van der Molen 1997: 7).” (Deacon: 2003)

Although a worker may not realise it, the reality is that stress could be very hazardous to a person’s health. Many factors can contribute to stress like the work environment that is created by an employer and co-workers etc. Examples of this could be for instance how well a worker gets along with his boss or co-workers, the type of work that needs to be done, working hours and many more. Another stress factor is illness and diseases, a healthy person would be more likely to handle stress better than an ill person although both might experience the same levels of stress.

“A study undertaken in South Africa among workers on construction sites indicated that workers believed that the following steps should be taken to improve their health (in order of importance):

- Improve the general tidiness on site;
- Improve facilities such as toilets;
- Reduce the physical demands of the job;
- Provide more Personal Protective Equipment (PPE);

- Reduce dust levels;
- Increase lighting levels, and
- Reduce noise levels

These issues relate to the physical environment, with the exception of the provision of PPE." (Smallwood and Ehrlich: 1999)

2.2.4 What are the main or most common health problems on construction sites and surrounding areas?

What are the problems that people face the most currently and historically in regards to their health as a result of construction, locally and internationally? As technology betters, the number of hazards increase so it is safe to say that today there are many more hazards than in the past. As time goes by however, new ways are implemented in containing or preventing these hazards. Internationally all the hazards are more or less the same, but do differ from one site to another depending on how well they are managed.

There are many contributing factors to poor health in construction. Many times labour workers have to live on site as it is too expensive for them to travel to the site from where they live. The workers often do not stay near to the site since every project has a new location which could be very far from their homes. These workers also work very long hours which makes it too time consuming to travel home every day. This all means that they have to be accommodated on site which could be very costly to their employer. As a result the employers tend to try and keep accommodation costs to a minimum. This leads to very poor living standards. They often have to share single sanitary facilities between hundreds of workers. Hostels are often dirty and no clean space for making food is provided. This could pose a serious health risk to workers living in these conditions. Alcohol misuse, smoking and violence among workers living in these conditions are also common. This creates a hazardous environment to live and work in. These are additional problems that are caused by living on site; which could lead to poor health due to infection or illness.

The most common illnesses or health problems on sites are:

- Skin cancer
- Other skin problems

- Musculoskeletal disorders
- Respiratory diseases or problems
- Exposure to chemicals which cause infection, poisoning etc.

“Accidents can cause injury or even death. The more common accidents or injuries that are caused by working on site can be as follows: (As set out in a SME (Small and Medium Enterprise) questionnaire by the ‘Masterbuilders’).” (Agumba: 2011)

Type of accidents/injuries		**Type of accidents/injuries**	
Construction site falls e.g. Falling from heights i.e. roof tops		Head injuries e.g. brain injuries, traumas etc.	
Electrical accidents e.g. electrical shock, electrocution		Burn injuries	
Trench collapse		Wounds e.g. severe wounds	
Fire & explosion on construction site e.g. gas explosion		Spinal cord injuries e.g. paralysis	
Welding accidents e.g. burning or skin injury		Dislocation e.g. dislocated shoulder etc.	
Unsafe construction equipment accidents e.g. faulty ladders, fault power tools etc.		Blinding injuries i.e. loss of eye	
Brazing accidents e.g. burns		Hearing loss e.g. deafness	
Cutting accidents e.g. finger cut		Skin disorders	
Struck by falling objects e.g. bricks etc.		Part of workers body caught between equipment or material	

Table 5: Types of accidents and injuries caused by working on site.

(Agumba: 2011)

The common hazards are in other words summarised as being:

- Heights
- Electricity
- Excavations
- Fire

- Construction tools, equipment and plant.
- Sharp objects
- Falling objects
- Noise

Which could cause:

- Head injuries
- Spinal cord injuries
- Loss or dislocation of a limb
- Burns
- Wound
- Deafness
- Blindness

2.3 Testing of the Hypothesis

The hypothesis has been proven to be correct that construction definitely has an effect on the health of construction workers and there are effects on human health in general. The sun has a major influence on the health of construction workers in harsh climates, but definitely does not play the biggest role as stated in the hypothesis. There are other factors that have a much more significant impact. Toxic materials are very dangerous or could even be deadly if exposed to. The hypothesis about cement poisoning playing a major role was proven wrong since this seems to be largely under control. Contamination to air and drinking water is one of the biggest problems to the environment caused by construction, but not the largest. The

biggest problem to the environment seems to be the amount of toxic waste that the construction industry dumps in the earth's biosphere.

Chapter 3:

Severity of effects that construction has on human health.

3.1 Introduction

There are various different causes to ill health, injury or even death. Depending on the circumstances, the injuries or sickness might be of a more serious or less serious nature. Construction could cause permanent damage which leaves the victim helpless to live with that problem for the rest of their lives. Although this would be difficult to prove without proper and long term research, construction most probably would cause premature death in people working on site due to the degradation of their health. This however will most certainly differ for each individual and circumstance and could even have no effect on individuals with access to the necessary resources and knowledge to prevent and combat any risks. There are different levels under which an incident can be classified and could have one of the following effects:

- Sickness:
  - Could have less serious, or
  - more serious and permanent affects
- Death.
- Injury:
  - Could be serious with permanent consequences, or
  - It could only be a temporary injury
- Disability:
  - Could be serious with permanent consequences, or
  - It could only be a temporary disability

3.2 How severe are, or can the health effects be that construction has on human health?

According to Deacon (2003), the health status of workers in the construction industry has to be considered before, during and after leaving this industry. The reason for this being that the construction industry is considered to be an extremely dangerous working environment for any worker. Deacon maintains that proper research has and is being done internationally on the occupational hazards relative to the construction worker. The author maintains that in spite of this fact there are not a lot of countries who undertake routine medical surveillance for which the purpose is to identify the health condition of a construction worker relative to the hazards that he is faced with. It is the duty of the employer to take care that identification of workers who could be a risk at work is done. This risk could be the result of work related or non-occupational related condition like for instance diabetes mellitus and hypertension. These conditions could get worse due to work, this exacerbate leading to poor work performance, absenteeism and ultimately leaving the industry due to ill health. Deacon claims that the majority of construction workers believe that they are healthy, although only a small number of these workers were in fact healthy and did not require being referred for further treatment.

According to The Health and Safety Executive (HSE) (2002), the reputation of construction is that it is a particularly unhealthy industry. This is because it has a very high rate of work-related illnesses, the highest of all occupational groups. There are a significant number of high-risk activities in construction which makes health problems very relevant. Another reason is the peripatetic nature of the workforce.

All of these factors combined is what makes construction one of the most dangerous and hazardous industries to work in. The fatality rate in construction is very high in comparison to other industries as illustrated below in figure 5.

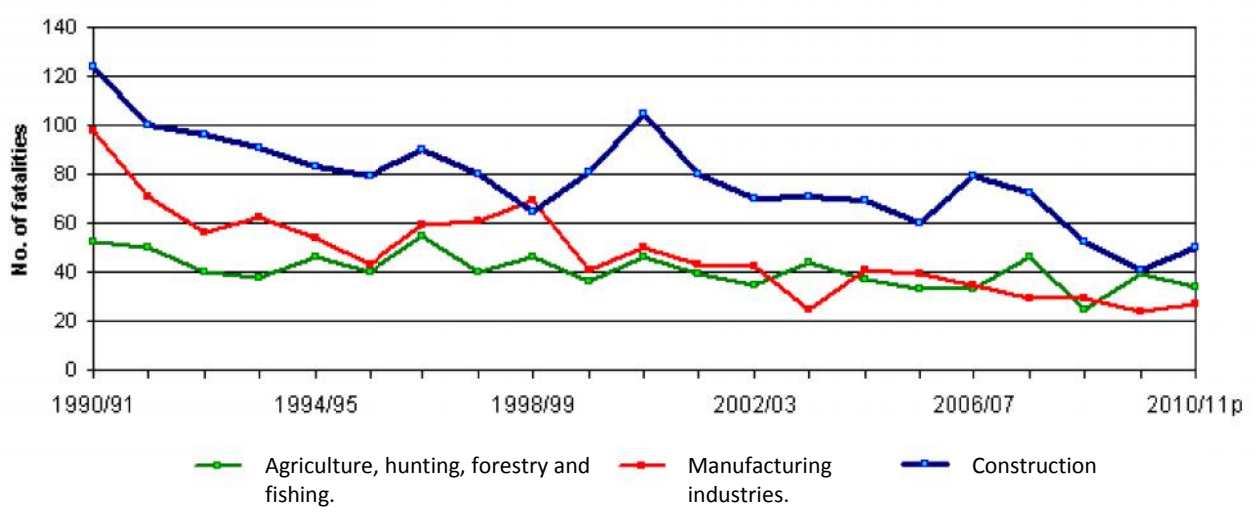


Figure 6: Twenty year trend in worker fatalities.

(Health and Safety Executive (HSE): 2011)

"Construction workers build, repair, renovate, modify, and demolish structures. These activities involve work that may vary from fully mechanized activities to hard physical labour. Work sites are sometimes isolated locations and at other times they may be in the midst of heavy traffic."(Ringen, et al: 1995)

3.2.1 What are the most severe health problems?

The results that construction could have on the human body are very serious and should not be underestimated. These could be more than merely physical, but could also have effects mentally, emotionally and are in most cases detrimental to the person's living standards.

"The most significant health problems identified between the GCs in the NMMM (Nelson Mandela Metropolitan Municipality) were the number of signs and symptoms of non- occupational diseases. Even though none of the workers were certified unfit, further interventions were required to maintain fitness. Even though in terms of legislation employers are not required to address non-occupational diseases, workers could eventually become too ill to work, and eventually leave the industry as maintained by Smallwood and Ehrlich (1997: 172). However, while performing

normal duties the potential risk of injury is raised, specifically of fellow workers. For example, the uncontrolled diabetic patient who has a peripheral neuritis, which affects his feet, may not feel the edge of a scaffold and fall to his death, or a poorly managed hypertensive who has a myocardial infarction on the 18th floor while operating a paring hammer or chipping hammer could fall, causing his death and/or the death of other workers below, as well as the loss of equipment, time, and productivity." (Deacon: 2003)

In every aspect of life it is a fact that for every action there is a reaction. This is no different when it comes to the health effects that construction has on human health. Every severe health problem has a specific or it could be more than one specific cause that was the result of construction. One of the major problems that construction causes is air pollution which in turn causes health problems for humans. This causes damage to the entire eco system that humans live in. Without an eco-system, humans cannot live healthily or live at all.

This is not the only pollution that construction causes. It also pollutes the water and contaminates the soil in which we grow our food. The soil and water pollution are mostly caused by waste from construction sites or activities. The soil and water are connected and thus the water in rivers can even be contaminated by contaminating the soil with chemicals like for instance insecticides. Although it looks harmless to the nearby water source, by contaminating the soil, you could be contaminating the underground water which runs into that river. This is literally breaking down our very life source. For the above mentioned action of construction polluting our environment, there are obviously massive reactions. These are illness and death for humans, especially those affected directly by construction in their surrounding environments. Specific health problems which are the most severe and caused by pollution includes headaches, repertory illness, fatigue, cardiovascular illness, gastroenteritis, cancer, nausea, skin irritation or infection. The figure below illustrates these severe human health problems caused by pollution.

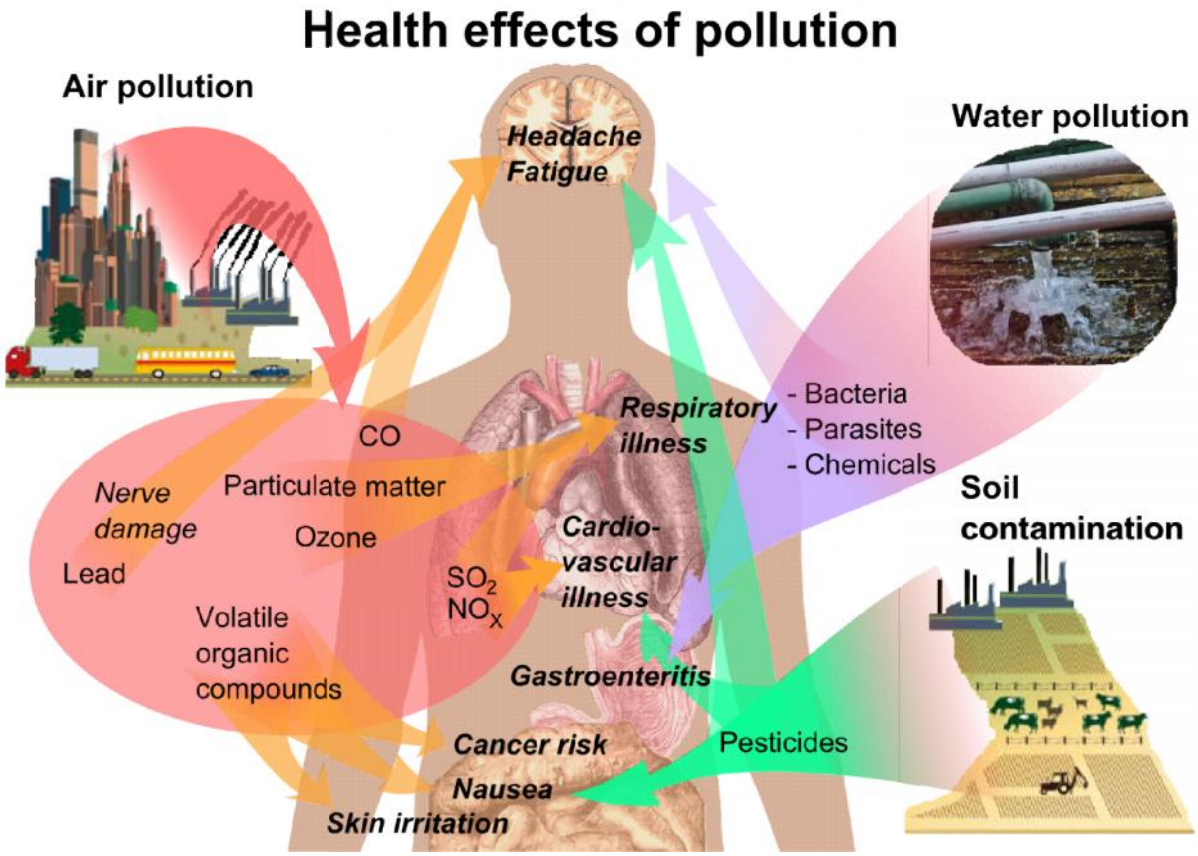


Figure 7: Health effects of pollution.
(Rani: 2010)

“Construction workers are exposed to risks that differ markedly from general industry relative to occupational health and safety (OH&S). Workers are exposed to a variety of health hazards, namely: musculoskeletal strain from the adoption of uncomfortable working positions; noise, resulting in noise induced hearing loss (NIHL); skin diseases from close contact with irritant or sensitising materials; respiratory irritation from dusts, fumes and gases, as well as developing more serious lung diseases related to exposure to asbestos and other fibrogenic materials (Smallwood and Ehrlich, 2001: 10; Ringen et al., 1995: 256, Koningsveld and van der Molen, 1997: 6).” (Deacon: 2003)

“It is because of the high number of incidence of accidents and fatalities throughout the world that the construction industry has often been incorrectly termed ‘inherently dangerous’. However it should rather be stated that the industry is a highly hazardous one where hazards may be identified, mitigated or eliminated” (Smallwood and Haupt: 2000)

Hazards that workers are exposed to in the construction industry are for instance heavy physically straining work, chemicals, physical and emotional stressors. These are just some of many hazards which workers must deal with daily in the construction environment. This means that workers have to perform their daily tasks under these conditions and it literally becomes a part of life for them. Unfortunately these aspects also then impacts on the health of these workers daily and becomes so part of who they are that they tend to think that it is normal and don't realise the hazards which they are exposed to. Although they are, they do not think of themselves as unhealthy. Construction can be a type of a silent killer at the end of the day. Ultimately these hazards influence the ability of construction workers to do their work. This is kind of a difficult situation since it was construction that caused the inability in the first place. Hazards causing a further exacerbation of illness and occupational disease may be impacted by underlying chronic conditions such as tuberculoses, HIV, emphysema, skin conditions etc. The severity of these conditions depends on the amount of exposure and the timely treatment thereof, but could be so severe that it could be fatal.

Smallwood and Ehrlich (1997) maintain that by its very nature a new building is an ergonomic problem. Construction workers have to work at different levels such as floor and ceiling levels. This results in a lot of kneeling; bending; reaching out and twisting. This generally creates the need to work in uncomfortable positions.
Gibb et al. (1999b), further maintain that workers who are handling loads increase their risk of getting injured. These loads may include things such as lifting, pushing, carrying, repetitive handling work, static work. This creates the need to work at the extremes of their range of movement of the body. Examples of such work include:

- Pipe fitters and riggers who move and handling loads;
- Most activities in the building and civil fields;
- Scaffolding operations;
- Commissioning and de-commissioning of pipes and valves, and
- Carpenters and joiners in the erection and stripping of formwork.

Another major problem or hazards which could be classified as one of the most severe problems that workers have in the construction industry, is exposure to hazardous materials or chemicals. The first example thereof is exposure to cement which is poisonous and could have very severe consequences for workers working with this material. Cement is most probably the material that is being used the most on any given site on any given day. This depends on what is being constructed, but cement is used in bricks, mortar, plaster, screed, glues for instance tile glue and grouts, precast concrete units such as capping, copings, lintels, walls, palisading etc. The most common use for cement is in concrete which we use in almost every single building today since it is a versatile and very strong material which can be shaped and poured differently to adjust to the need of every different project. This however means that workers are also exposed to this material the most which is firstly poisonous and secondly very heavy to lift and handle which causes injury.

“Concrete is the single most widely used material in the world – and it has a carbon footprint to match…. And the problem looks set to get worse: already produced in over 2 billion tonne quantities per year, by 2050, concrete use is predicted to reach four times the 1990 level.” (Crow: 2008)

Cement can poison through two basic methods, through contact with skin and through breathing in of the cement dust. The following is a good and complete list of quotes on the effects that concrete has been found to have on people exposed to cement, which is directly correlated to the effect that construction has on human health since this is a major health hazard to the human body and is the single most widely used material used in the world. It is also almost exclusively used in construction.

- “Some of the initial studies have shown that the incremental individual risk due to emissions of the cement plant is very low not only with regard to health effects, but also in relation to toxicological and cancer risks produced by pollutants emitted by the cement kiln (see, for example, Schuhmacher et al. 2004), but that conclusion has been challenged. Similarly, earlier conclusion that long-term exposure to cement dust does not lead to higher morbidity of severe respiratory disease than other types of blue collar work

(Vestbo and Rasmussen 1990) has also been challenged." (Singh and Pandey: 2011)

- "Studies have shown that adverse respiratory health effects seen in the people exposed to cement dust, exemplified in increased frequency of respiratory symptoms and decreased ventilatory function, observed among cement workers could not be explained by age, BMI (Body Mass Index) and smoking, thus are likely to be caused by exposure to cement dust" (Al-Neaimi et al: 2001)
- "Cement dust contains heavy metals like nickel, cobalt, lead, chromium, pollutants hazardous to the biotic environment, with adverse impact for vegetation, human and animal health and ecosystems" (Baby et al: 2008)
- "The population most exposed to cement dust pollution includes workers and managers in cement plants and factories, families of workers and managers living in staff houses of factories, and other neighbourhood habitations. Children studying in the schools situated in proximity to factories are particularly prone to cement dust exposure." (Singh and Pandey: 2011)
- "Several studies have demonstrated linkages between cement dust exposure, chronic impairment of lung function and respiratory symptoms in human population. Cement dust irritates the skin, the mucous membrane of the eyes and the respiratory system. Its deposition in the respiratory tract causes a basic reaction leading to increased pH values that irritates the exposed mucous membranes (see, Zeleke et al. 2010, and references cited therein)." (Singh and Pandey: 2011)
- "Occupational cement dust exposure has been associated with an increased risk of liver abnormalities, pulmonary disorders, and carcinogenesis. Decreased antioxidant capacity and increased plasma lipid peroxidation have been posed as possible causal mechanisms of disease" (Aydin et al: 2010)
- "Total cement dust exposure has been found to be related to acute respiratory symptoms and acute ventilatory effects. Implementing measures to control dust and providing adequate personal respiratory protective equipment for the production workers are highly recommended" (Zeleke et al: 2010)

- “Chronic exposure to Portland cement dust has been reported to lead to a greater prevalence of chronic respiratory symptoms and a reduction of ventilatory capacity. The seriousness of pulmonary function impairment and respiratory disease has not been consistently associated with the degree of exposure” (Al-Neaimi et al: 2001)
- “Inhale able dust concentrations in cement production plants, especially during cleaning tasks, are usually considerably higher than at the construction site” (Peters et al: 2009)
- “People of cement dust zone area badly affected by respiratory problems, gastrointestinal diseases etc” (Adak et al: 2007)
- “The observed acute respiratory health effects among the workers are most likely due to exposure to high concentrations of irritant cement dust. The results also highlight the usefulness of the questionnaire for health surveillance of the acute respiratory health effect” (Mwaiselage et al: 2006)
- “Diseases such as chest pain, cough, and eye problems in the villages affected by cement dust are likely to be derived due to cement dust. Indeed, the higher percentage of related diseases occurs near the source of pollutant. A relative risk ratio assessment indicates that the exposed subjects are 7.5 and 22.5 times as likely to develop the disease during the follow-up period compared to the unexposed subjects” (Yhdego: 1992)
- “A study to evaluate the mutagenic effects of occupational exposure to cement dust in such workers concludes that the chromosomal damage was more pronounced in the workers who are also smokers when compared with the non-smokers both in control and exposed groups. A significant increase in the frequency of chromosomal aberrations was also observed with increase in age in both control and exposed subjects” (Fatima et al: 2001)
- “There is good evidence for cement dust exposure acting as a tobacco, alcohol and asbestos independent risk factor for laryngeal carcinoma” (Dietz et al: 2004)
- “As the cement dust comes in contact with water, hydroxides are formed that impair natural water alkalinity. A fine layer of cement covers the surface of wells and ponds. The addition of salts of Ca, Na, K, Mg and Al as hydroxides, sulphates and silicates affect the hardness of the water that

subsequently are responsible for the respiratory and gastro-intestinal diseases in the area" (Mishra: 1991)

- "The results obtained from the analysis of the production process and of the exposure levels determined by the cement workers showed that it is possible to reconstruct the history of exposure to cement dust during each worker's occupational history. The results also showed that estimated exposure is related to respiratory damage; higher exposure resulted in more serious diseases" (Alvear-Galindo et al: 1999)

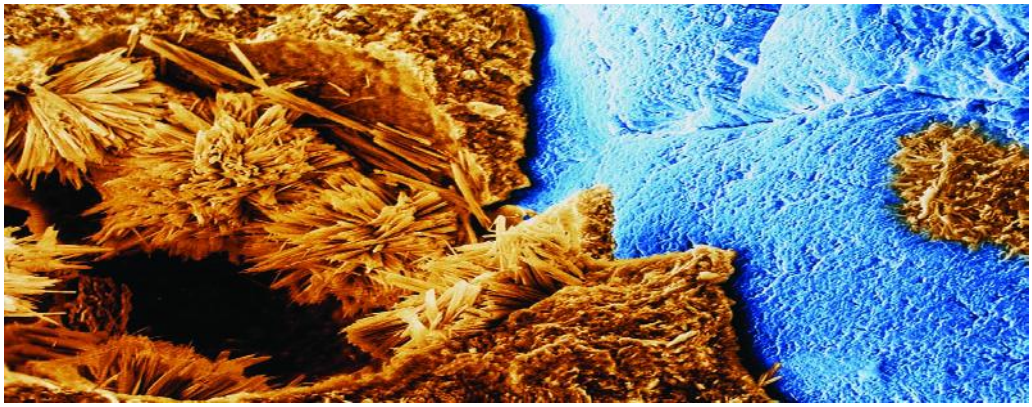


Figure 8: Electron micrograph of gypsum crystals (brown) formed in setting concrete (blue).

(Crow: 2008)

The second most severely hazardous product that has been used in construction is asbestos. Asbestos could be very dangerous to human health when humans are exposed to it in certain ways. Asbestos in itself is not a dangerous or poisonous material when touched, so in the initial stages of it being used in construction, the severe effects that it could have wasn't realised. The great risk with asbestos is when it is inhaled, so methods have to be devised to minimize the forming of dust when asbestos is drilled into etc. One such method is for instance to put a wet cloth over the area where the drilling has to take place to keep the dust to a minimum. The effects thereof were however discovered much later and methods have been developed to prevent the use of where possible or to phase out the use of asbestos. Other less severe hazards are things like exposure to paint, paint stripping material,

mortar lift and other chemicals, petrol, welding which releases chemicals into the air and also damages the eyes by giving arch eyes if special glasses aren't worn.

"The revised Asbestos Regulations were promulgated in February 2002, and the employer is also required to undertake a health risk assessment, which includes air monitoring. Workers who are exposed to asbestos are required to undergo medical surveillance within 14 days after commencement of employment and thereafter intervals not exceeding 2 years (Harmse, 2002: 8, RSA: 2002: 12)." (Deacon: 2003)

According to the Environmental Protection Agency (EPA) (2012), asbestos is what a material is called when more than one naturally occurring fibrous minerals that can be woven together, has a very high tensile strength and resistance to most chemicals and heat. These good properties made asbestos fibres the material of choice in many products and highly popular when manufacturing for instance:

- Roofing shingles,
- Ceiling and floor tiles,
- Paper and cement products,
- Textiles,
- Coatings,
- Friction products such as automobile clutch, brake and transmission parts.

The Toxic Substances Control Act (1976) defines asbestos as the asbestiform varieties of: chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite/grunerite); anthophyllite; tremolite; and actinolite.

The Environmental Protection Agency (EPA) (2012) maintains that when a person is exposed to asbestos his/her risk of developing a lung disease increases and this risk increases even more when that person is a smoker. The more a person is exposed to asbestos, the higher the chances are of such a person developing harmful or negative health effects, although symptoms may only start to develop years after exposure. The hazard in working with airborne friable asbestos is that the asbestos fibres are breathed in by such a worker, which with continued exposure increases the amount of fibres that remain in the lungs of that person. Lung diseases which are caused by such exposure may include:

- Asbestosis,
- Lung cancer, or
- Mesothelioma.

“Three of the major health effects associated with asbestos exposure include:

- **Asbestosis** -- Asbestosis is a serious, progressive, long-term non-cancer disease of the lungs. It is caused by inhaling asbestos fibers that irritate lung tissues and cause the tissues to scar. The scarring makes it hard for oxygen to get into the blood. Symptoms of asbestosis include shortness of breath and a dry, crackling sound in the lungs while inhaling. There is no effective treatment for asbestosis.

- **Lung Cancer** -- Lung cancer causes the largest number of deaths related to asbestos exposure. People who work in the mining, milling, manufacturing of asbestos, and those who use asbestos and its products are more likely to develop lung cancer than the general population. The most common symptoms of lung cancer are coughing and a change in breathing. Other symptoms include shortness of breath, persistent chest pains, hoarseness, and anemia.

- **Mesothelioma** -- Mesothelioma is a rare form of cancer that is found in the thin lining (membrane) of the lung, chest, abdomen, and heart and almost all cases are linked to exposure to asbestos. This disease may not show up until many years after asbestos exposure. This is why great efforts are being made to prevent school children from being exposed.”
  (Environmental Protection Agency (EPA): 2012)

3.2.2 Are the problems commonly fatal and what role does age play?

“Accident, injury and fatality rates in construction are higher than in most other industries. In 1991, the National Safety Council (NSC) in the United States of America found that construction injuries accounted for almost 11.0% of all work

related injuries, and 30.0% of all fatalities (Eppenberger and Haupt, 2003: 79). In comparison, occupational injury rates in South Africa in all industries are high in comparison to the rest of the world. In 1993, the accident rate was 33.4 accidents per 1000 workers covered by the Compensation Fund (Grainger and Mitchell, 2003: 73)." (Deacon: 2003)

Eppenberger and Haupt (2003) suggested that the chances of getting a serious occupational injury increases with age and chances of getting a less serious injury decreases with age. These injuries usually then involve death or disability. Construction workers over 44 years of age tend to get injured by falls. In this age group 60% of all injuries were from falling off a ladder. These events were most likely caused by poor balance and body weight. Most of the older workers tend to have a lower level of education. They are therefore employed as unskilled labour and this makes them a higher risk for serious injury. The employment of unskilled migrant workers and illiteracy among workers are also causes of injury.

According to Deacon (2003), a study among 311 South African workers that has previously been injured while working on a construction site, indicated that 51.8% were workers over the age of 40. The older cohort of these workers was made up of both unskilled and skilled workers. 'Bony injuries' were amongst the highest under older workers. These included mostly fractures and tumours, followed by strains and torn ligaments. Older workers injured the following body parts the most:

- eyes (17.6%),
- fingers (17.0%),
- trunk (13.3%) (upper body).

Causes of injury to older workers included:

- Struck by,
- Struck against, and
- Falls onto different levels.

"A fit 50-year-old may be more productive than a physically inactive, obese 18-year-old. Requirements of the task that the worker has to undertake can be affected by age. While age is only one of many factors that could affect the workers ability to

undertake physical tasks, it should be noted that the maximal muscle strength of a 65year-old male is approximately 75 to 80% of that at 20- years-old" (Cox and Edwards: 1995)

"Knowing the leading causes for morbidity and mortality in different age groups is important and can be helpful in the health promotion, and identifying worker or occupational risk" (Coetzee and Pretorius: 1997)

According to Deacon (2003), the South African (SA) Health Review maintains that in South Africa, there has been a high number premature adult mortality cases due to poverty-related diseases. Some of these diseases include for instance tuberculosis and diarrhoea. Emerging chronic diseases and injuries such as hypertension and diabetes mellitus are also amongst the main factors contributing to premature adult mortality. This pattern is however now changing due to the AIDS pandemic. The most common causes of death among males are injuries, followed by tuberculosis. This is applicable to all age groups. Cancers, stroke, ischaemic heart disease and diabetes mellitus has a significant influence on 45 to 59 year old age group.

Keller (n.d.) commented on the influence of construction on workers in the United States of America (USA). He maintains that when construction workers go to site, they assume that they are protected by their employer through the necessary safety precautions and measures which has been taken. Such a worker can assume that they are in a safe environment and in no danger, assuming that his/her fellow workers have been properly trained and that all of the equipment is functioning correctly. This is however not the reality in most cases. In reality, construction workers are injured in their tens of thousands each and every year while at work. In average, about a 1000 of these workers die. Keller also maintains that the Occupational Safety and Health Administration (OSHA) reports that:

- 1/10 construction site workers are injured yearly.
- Fall hazards are the leading cause of injury at construction sites.
- Workers between 25 and 34 years old are most likely to be injured on a construction site.

- Construction site injuries commonly involve construction workers' backs, spines, and trunks.
- Construction site workers amount to a full 15 percent of workers' compensation costs.

According to Keller (n.d.), the National Institute for Occupational Safety and Health (NIOSH) reported 1224 construction workers died at work during 2005. This makes construction the most dangerous industry in the United States of America. The Bureau of Labour Statistics (BLS) reports that there are roughly 150,000 construction site accident injuries each year in the United States of America. The BLS reported that falling from heights make up for the majority of the construction site accidents; however contact with equipment was also one of the most prevalent causes of injury for workers.

The following statistics are given by the Construction Industry Development Board Smallwood et al. (n.d.). These statistics are for South Africa and can be compared internationally to the statistics of the USA. According to these statistics, it is clear to see that the number of fatalities is quite significant and that the total number of incidents and claims has also significantly increases from 2004 to 2008. These statistics are a bit outdated and needs to be revised, but this pattern would most likely still look the same. It is also quite noticeable that the age of a person does play a major role, which means that less old workers or labour should be used on construction sites as far as possible. According to Smallwood et al (n.d.), Global H&S performance of the construction sector looks as follows:

- "60 000 fatal accidents - one every ten minutes;
- One in every six work-related fatal accidents occurs on a construction site;
- In industrialized countries, more than 25% to 40% of work-related deaths occur on construction sites despite the sector only employing between 6% and 10% of the total employment;
- About 30% of construction workers suffer from back pains or other musculoskeletal disorders; and
- There is a 50% higher incidence rate for non-fatal accidents among workers aged 15 to 24 years"

(Smallwood et al: n.d.)

Construction H&S Statistics Excluding Motorvehicle Accidents				
Department of Labour: OH&S				
	2004/05	2005/06	2006/07	2007/08
Fatal	54	81	79	162
Non-fatal	159	250	245	396
Non-casualty	11	7	10	20
Total	**224**	**338**	**334**	**578**
Source: Department of Labour				

Table 6: Comparison between fatal and non-fatal accidents.

(Smallwood et al: n.d.)

"According to national statistics drawn from the records of FEMA for 2007:

- 10 231 claims were registered (which is 1047 more than for 2006);
- The amount paid out in claims was R104 million (R7 million less than in 2006); and
- 60 fatalities were registered (14 less than in 2006)." (Smallwood et al: n.d.)

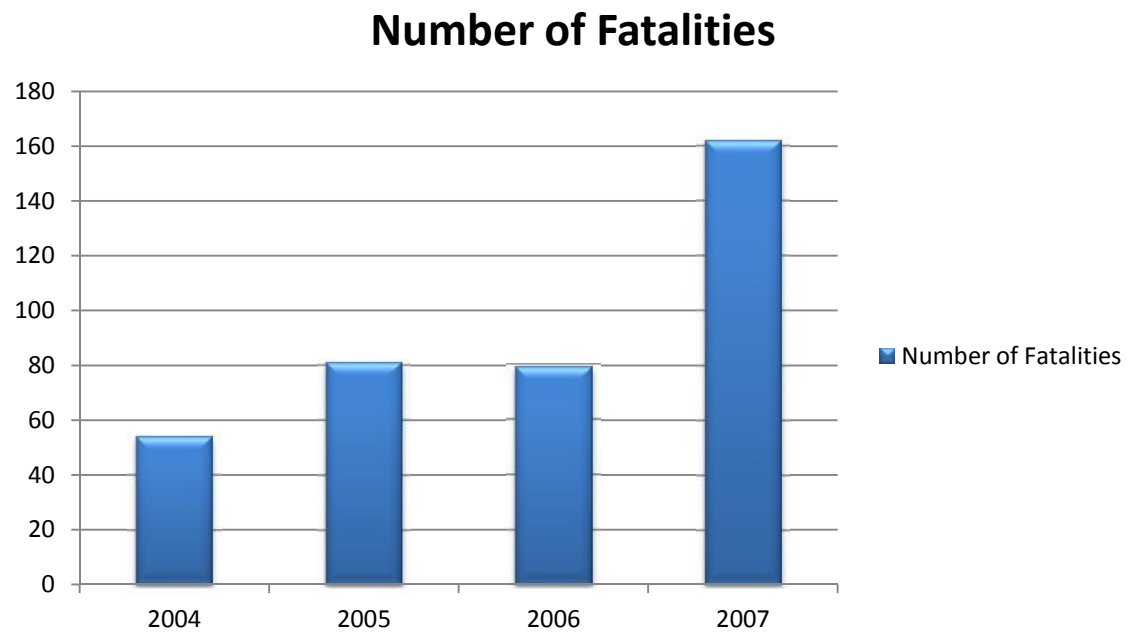


Figure 9: Number of fatalities between 2004 and 2007.

(Smallwood et al: n.d.)

Construction H&S Claims and Fatalities: FEMA				
	2006		2007	
Province	Number of Claims	Number of Fatalities	Number of Claims	Number of Fatalities
Gauteng	4 257	32	5 143	30
KwaZulu-Natal	1 207	13	1 311	10
Eastern Cape	943	7	929	7
Boland	1 577	12	1 629	6
Western Cape	827	3	814	1
Kimberley & Northern Cape	28	0	43	0
Free State	345	7	362	6
SA	**9 184**	**74**	**10 231**	**60**
				Source: FEMA

Table 7: Number of claims that were fatal in 2006 and 2007.

(Smallwood et al: n.d.)

3.3 Testing of the Hypothesis

The Hypothesis that the effects that construction has on human health can be very severe has been proven and it does depend on the different circumstances in different countries and on different construction sites. The Hypothesis has been supported by especially the statistics which has been obtained from institutions like the CIDB. The fact is that construction is not only the most dangerous industry to work in, in terms of having a negative effect on the well being or health of workers, but also causes a huge number of fatalities as stated in this chapter. Cancer and electrocution are some of the most severe problems in construction, but falling from a height is by far the most severe hazard faced in construction. The hypothesis also states that in most cases problems are not fatal, which has also been proven, but in a shocking amount of cases it is fatal and age plays a major role in this, the older a person gets the higher the probability of getting ill or injured due to construction is

absolutely true. Older people tend to have lapses in concentration and their balance is no longer what it should be, which can be very dangerous especially on a construction site. It has also been proven in this chapter that the chance of this illness or injury being fatal also increases with age.

Chapter 4:

Effectiveness of policies and procedures

4.1 Introduction

Some methods that are being used in policies and legislation are more effective in limiting the effects that construction has on the human body than others. All of these methods have an impact in one way or another, whether positive or negative. It all comes down to the 'every action has a reaction' principle. This makes some methods the better option to use since they have a more positive result. Each method has its own sacrifices or negative sides. The methods that do actually make a difference, should be focused on and implemented in policies and legislation by government.

4.2 How effective are the policies and procedures that are being used to limit the health effects and their impacts?

4.2.1 What role do organisations like CANSA play?

Organisations like CANSA (The Cancer Association of South Africa) play a vital role in the awareness of certain hazards and causes of ill health in humans. CANSA does cancer research. As an organisation specialising in cancer, CANSA and their role in the construction industry will be looked at. This is because of the health risk that the sun causes and many other hazards in construction that causes cancer and ill health.

According to Antoinette Joubert (2012), CANSA does not have a specific focus on construction and can play a bigger role in the awareness of cancer in construction. Not only making workers aware of the causes of cancer, but also in making the government aware of these hazards and pushing them to implement preventative measures. CANSA can also play a significant role in raising funds to help implement these policies and procedures since this is a very expensive exercise for all involved, especially employers. They could run campaigns where sites are visited and

investigated. Further involvement could be the regulation of the working environments by advising on better preventative methods. This will also help make the public more aware. One of the most prominent risks that cause cancer is the sun. Lighter skin is of a higher risk. The biggest risk would be albinos, then red heads; blonde with blue eyes and so on it progresses to the people with darker eyes and hair. This usually is an indicator of how dark their skins are. The people with the smallest risk to get skin cancer are black people and the darker they are the less the risk, although they are not immune and still need to be cautious and take preventative measures. The best methods are to stay out of the sun between 10 am and 3 pm and this is exactly why there is such a big problem in construction since they have to work in the sun during these hours and in most cases there is nothing that can be done about that. Alternatives must thus be looked at like wearing UVA and UVB resistant clothing, hats and sunscreen lotions. This is also where cancer research comes in by testing and regulating the standards of products like UV resistant clothing and sunscreen lotions. Exposure to the sun for long periods of time is very dangerous. Rules must be implemented to make these preventative measures law and thus compulsory. Black people must still use sunscreen lotions although they may use a lower SPF rating because they are of lower risk. White and coloured people are very high risk in general and should use high SPF ratings.

" Acknowledging that there is no such thing as a total sun-block nor any form of safe tanning the Cancer Association of South Africa (CANSA) has always promoted sunscreens as the 3rd line of defence in its SunSmart solar radiation protection strategy encompassing maximum sun avoidance and sun protection, particularly during the heat of day i.e.:

C- Cover up with suitable clothing with adequate UV-protection.

A- Avoid the sun between 10:00 and 15:00 when solar radiation is most intense.

R- Rub on an effective broad-spectrum UVA/UVB (with a minimum SPF20 – maximum SPF50) on all exposed parts of the body

E- Examine your skin regularly and have a friend examine your back. Have a medical skin examination once every winter when your skin is at its lightest."

(CANSA: 2012/2013)

4.2.2 How can policies, legislation and enhanced research better the prevention of accidents and illnesses?

The South African government does have a strong focus on setting up, improving and implementation of policies and legislation for safe work environments. This is to assist all people working in South Africa and is a basic human right. They also focus strongly on health and safety in the construction industry although some of the research in this regard is out of date and thus not relevant anymore. It would thus help a lot for the accurate setting up of policies and legislation to do new research and get new statistics on the current situation or stand of matters. One of the important aspects that they do comply with is the inspection of sites which plays a very important role.

“Construction sector health and safety numbers had not been improving in tandem with the industry, said Construction Industry Development Board (CIDB) construction industry performance programme manager Dr Rodney Milford at Thursday’s launch of the CIDB health and safety report, held in Tshwane. He added, however, that statistics available to measure fatalities and injuries in the industry were severely lacking, which made painting an accurate picture of current trends difficult.” (Venter, 2009)

According to Moloi (n.d.), even in some of the safest workplaces in which workers are careful and skilled, mistakes, accidents, oversights and injuries do happen and they usually happen when they are least expected and inadvertently cause harm. This does not mean that the employers and employees were irresponsible or negligent in going about their work and daily tasks in a hasty and incompetent manner just to cause harm. They are called accidents because mostly they are caused accidentally and not because of negligence. Even people priding themselves in being professionals sometimes make fatal mistakes, although they know very well what is expected of them and how to do their jobs. Some of these accidents are however not caused by negligence. Injuries and diseases which are sustained and then diagnosed do impact on worker compensation.

“Irene Louw of the Business Day reported, in 2002, that a new occupational health and safety accord was signed by representatives of business, labour and government, committing them to minimise workplace injury and to securing a healthy

and safe workplace. Labour Minister, Membathisi Mdladlana, said that "The socio-economic damage of health and safety incidents and fatalities on enterprises, the workers and their families, as well as the entire society, have reached the levels where the social partners deemed it proper and fitting to find a common solution and co-operative approach to the problem". This, he said after the signing of a new occupational health and safety accord by representatives of business, labour and government, committing themselves to minimise workplace injury and to securing a healthy and safe workplace. The intention of the new occupational health and safety accord is to "debunk the misconception that occupational health and safety is the sole responsibility of government", said Congress of SA Trade Unions second vice-president Joyce Pekane. She further added that the ultimate responsibility rested with the employers. The accord strives to realise the ideals of a healthy and safe working environment, the development of best practices in occupational health and safety and the elimination of incidents and fatalities in the workplace." (Moloi: n.d.)

According to Moloi (n.d.), South Africa has some of the best legislation in the world, despite this the industries in this country kill and maims thousands of people each year. This clearly shows that policing alone is not the answer, although employers do need a reason and motivation which forces them to maintain a healthy work environment. Another reason is the protection of those employees who report unscrupulous employers that to not adhere to the COIDA. Starting reformation needs to be done by the re-evaluation of employer immunity which they currently enjoy and the legal constitutional and social arguments need to be considered. Employers and employees should both respect the principle of common law in South Africa at all costs, to ensure the protection of the rights, health and property of other people.

Some interesting statistics according to Ramutloa (2009), on construction from March 2008 to August 2008 are:

- Amount of workplaces inspected: 1909
- Number complying: 975
- Number not complying: 815

- Improvement notices issued: 255
- Contravention notices issued: 1028
- Prohibition notice issued: 172

Another area which can be more strongly focused on by government for the setting up or inclusion thereof in policies and legislation is workplace drug testing. Drugs especially in construction is a very real threat and workplace drug testing should be enforced as far as possible.

“Drug testing in the workplace has gone from virtual non-existence to widespread employer acceptance during the past two decades. This growth is particularly significant for the construction industry. High rates of alcohol and other drug use, coupled with the high-risk, safety-sensitive nature of the industry, have prompted the development of a variety of drug surveillance and prevention strategies. Despite this growing vigilance, no scholarly works have examined the impact of drug-related policies in the construction industry. To address this limitation, we investigate the efficacy of workplace drug-testing programs in reducing injury incident rates and workers’ compensation experience-rating modification factors (MODs) within the construction industry. Analyses indicate that companies with drug-testing programs experienced a 51 percent reduction in incident rates within two years of implementation. Moreover, companies that drug test their employees experienced a significant reduction in their MODs. Policy implications are discussed in light of the current findings.” (Gerber and Yacoubian: 2002)

4.2.3 Is the cost of implementing better health and safety measures in the construction industry worth paying and will it make a difference?

It is easy to say that everything in life comes at a price; some are just a lot more expensive than others. Then why is it that we do not put a high value on life itself. The one thing that no one can or has ever been able to put a price on, is the value of a human life or the value of good health.

How great are the costs that have to be sacrificed in order to reach the ultimate goal of construction not having a negative influence or death on humans, directly or indirectly involved in construction, and is this goal at all achievable?

“NUMSA (National Union of Metalworkers of South Africa), however, argued that the law provides "hopelessly inadequate payouts" to those injured at work. It prevents workers from taking employers to court for negligence. It fines employers small amounts for negligence. This makes it cheaper for the employer to pay a fine and have the accident happen repeatedly, than to stop, as a result, the accident from happening at all by correcting the problem. For example, in their website, it is reported that a worker who lost three fingers in an accident at work a few years ago was paid R3 330 for his amputated fingers. But two years later, the condition deteriorated to such an extent that he could not use any of his fingers properly. An appeal was lodged with the Compensation Commissioner and R10 000 and small monthly pension was an offer put forward by the Compensation Commissioner. NUMSA felt that the Compensation Commission had done its bit, but it seemed, according to NUMSA, that the employer had gone unscathed. NUMSA also argued that the employers are highly subsidised. At present an employer pays a modest levy that bears little or no relation to the harm that his/her unsatisfactory health and safety practices cause. In turn a company is granted immunity against any claim that an injured employee might otherwise bring.”

(Moloi: n.d.)

According to Moloi (n.d.), employers should be held responsible and liable for any harm that they inflict on their employees, to the full extent of such harm. Companies which benefit financially from setting high and up to standard health and safety environments for their employees will take steps to remedy the situation if it is poor and it would cost them money. The first step to reforming the current immunity of the employers is to challenge it with the correct legal, constitutional and social arguments.

“Employers have a legal obligation to provide safe and healthy working conditions to all employees, and their work activities may not expose others – such as customers or suppliers, or the surrounding community, - to hazards and risks. If an employer

does not comply with legislation, a penalty or prosecution or even criminal liability will be the result." (Boshoff: n.d.)

According to Boshoff (n.d.), the implementation of these measures will save your business money on the long run by improving productivity and increasing worker morale. Organisations often lose profit directly through occupational injuries and illnesses which could amount to a huge financial loss, which could include but is not restricted to costs such as legal fees, fines, compensatory damages, investigation time, lost production, lost goodwill from the workforce, from customers and from the wider community.

Boshoff (n.d.) also maintains that to ignore these risks that are part of the daily running of a business also impacts on:

- Health and safety of employees and others like contractors, customers, visitors and the community.
- The business' and owners' reputations, credibility and status
- Public and customer confidence in business or organisation
- Business' financial position
- Damage to plant, equipment and the environment

Boshoff (n.d.) has also stated that poor occupational health and safety has a cost to the State through things like social security payments to the incapacitated, loss of 'employability' of workers and costs for medical treatment. There are cases where consequences could be detrimental to both man and the environment. Potential risks and hazards should be properly managed to avoid loss to organisational resources. Decreased productivity, morale and profits could also result from injuries and illnesses. The difference between operating in the black and ending up in the red could be caused by these costs which if pro-actively managed could be the preventative measure of occupational and environmental accidents and ill health. Hard-earned profits go to waste when things go wrong. Incidents will be reduced and production will rise when pro-active and proper management is implemented which will also limit insurance premiums. Safe workplaces create an environment of consistency and reliability which builds and grows a business to its full potential.

Fewer injuries occur when active safety and health leadership is implemented in the workplace. Employees often also consider these as “better places to work” and have more satisfaction and are more productive. These workers are more dedicated and return to work quickly after an illness or injury and they have a higher-quality product and service rating. This is directly caused by higher employee morale in a safe environment.

A business which implements effective health and safety management systems operate more efficiently. There is no question to whether or not a workplace with a safety and health management system in place would reduce injury and illness costs. A health and safety system helps to effectively manage hazards, dangers and all other risks within a business, which avoids unwanted and unnecessary loss. In short, to invest in health and safety would most likely be a great investment on the long run.

“Accidents at work and occupational injuries represent a considerable economic burden to employers, employees and to society as a whole. Some of these costs, like lost workdays or lost income, are clearly visible and can readily be expressed in monetary value.” (Mossink and de Greef: 2002)

According to Mossink and de Greef (2002), economic consequences of accidents are hidden to a degree and cannot be calculated or priced in most cases. Things like administrative activities that follow an accident may be forgotten and it is hard to quantify damage to a company’s image. Pricing on human suffering and damage to health is subject to discussion. Although all of this is true, it is still possible to get a better insight into the costs of accidents and the benefits of preventing these accidents. It is important to realise that accidents and their prevention have simultaneous effects on the performance of the company and the health of an employee. An example can be that an employee gets injured and the company he works for has a scarred image because of that injury.

Mossink and de Greef (2002) further argue that improvements in health and safety in the workplace can have economic benefits to not only companies, but to societies as

a whole. A company can incur serious costs due to accidents and occupational diseases. This is especially true for small companies on which it could have a major financial impact. Decision-makers and employers are very hard to convince on the profitability of improving working conditions. Financial and economic estimations are often useful in reaching this objective. Calculations or analysis of costs and future benefits does not need to be complicated, although potential difficulties do often putt of health and safety professionals. There are indeed some issues in economic appraisal which are very complicated like for instance the value of health or human life. With all this said and done, however, there are basic principles that are quite straightforward. These basic principles can easily be performed by health and safety managers and professionals.

“Work accidents are a burden for many parties in many ways. Accidents and occupational injuries lead to costs for other companies, individual workers, and for society as a whole. The economic effects of accidents and injuries can sometimes be identified as financial expenditures, damages or loss of resources, but often there are adverse effects (such as health damage) that are difficult to express in terms of money. In several countries, estimations of the costs of accidents or occupational injuries have been made. Table 8 gives an overview of some of the results of these studies. In general, the cost estimations require careful interpretation. For instance, definitions may differ from country to country. In this report, ‘costs’ refers to all loss and burden that result (directly or indirectly) from work accidents and occupational injuries.” (Mossink and de Greef: 2002)

Country	Ref	Year	Cost (million EUR)					'Number of Workers (x1 000 000)'
			Lost workdays	Damages	Medical costs	'Administration, recruitment'	Loss of welfare	
United Kingdom	-1	1995/6	739	9-58	77-337	251-279	2 109	25
Germany	-2	1998	5 905					32
Netherlands	-3	1995	158	363	122			6
Belgium	-4	1999	865					2,7

(1) HSE Statistics (www.hes.gov.uk/statistics/dayslost.htm).

(2) Koningveld, E.A.P., Mossink, J.C.M., Societal costs of occupational safety and health in the Netherlands (Kerncijfers maatschappelijke kosten arbeidsomstandig-heden in Nederland), The Hague, VUGA, 1997.

(3) Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund (www. Baua.de/info/statistik/stat_1998/kost98.htm).

(4) Statistics occupational accidents in occupational diseases (Statistieken Arbeidsongevallen en beroepsziekten), Prevent, Brussels, 2001.

Table 8: Summary of estimations of costs of accidents at society level in some countries. (Mossink and de Greef: 2002)

"At company level, accident prevention can have benefits in the form of reducing anticipated losses, savings in expenditures or additional gains. In many situations, additional (or unintended positive side-effects of prevention) benefits are even more important than the benefits that are directly related to reduction of sick leave and disability (see Figure 8)." (Mossink and de Greef: 2002)

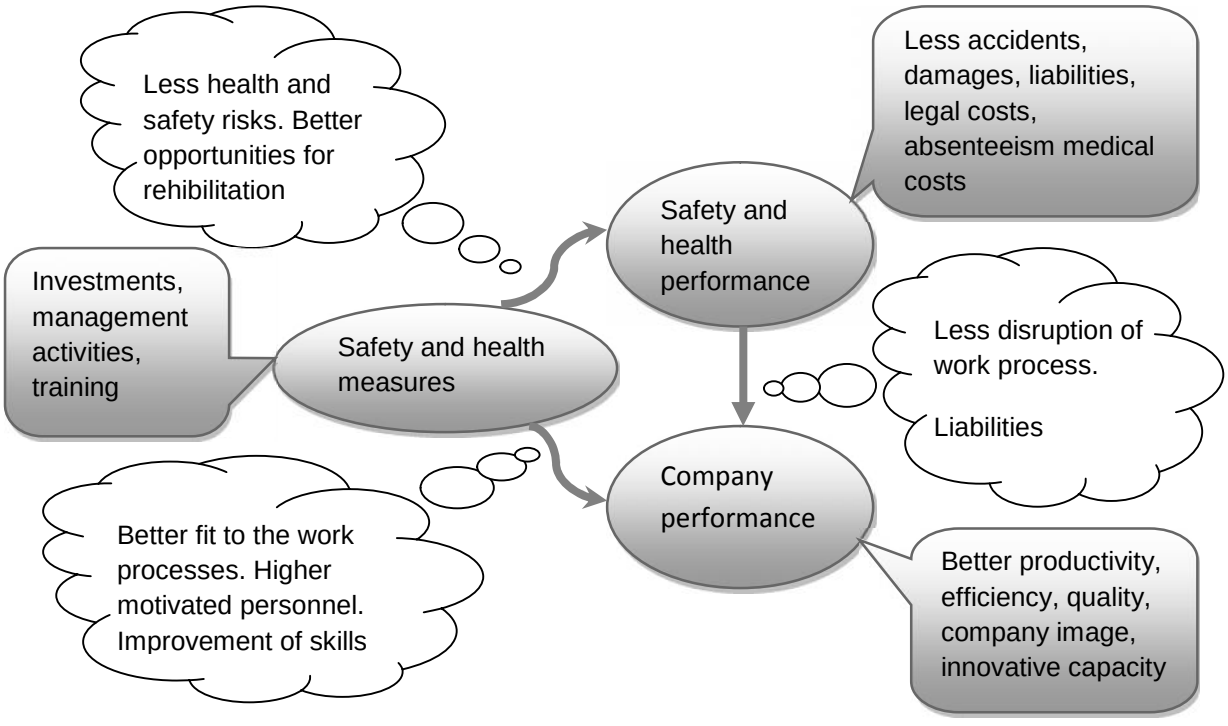


Figure 10: Economic effects of health and safety at company level.

(Mossink and de Greef: 2002)

	Examples of prevention activities (preventative costs)	Examples of consequences or effects of an accident and diseases	Possibilities of analysis or evaluation of costs and benefits
Individual employees:	• Using personal safety equipment • Effort in adopting safety attitudes and healthy life and workstyles	• Pain and suffering • Consequence to relatives and friends • Losses in second job or household	• Evaluation of own safety and health activities
Enterprises:	• Developing safety and health management • Carrying out workplace safety and health inspection • Developing a safety climate • Planning production • Measures to improve working conditions	• Production losses • Insured and uninsured costs of accidents • Quality losses • Legal sanctions	• Evaluation of effects of preventative measures, efficiency measurements • Insurance: compensations and premiums • Evaluation of production process • Costs and benefits in decision-making techniques • Profit – loss analysis
Society as a whole:	• Social attitudes and values • Safety and health legislation and inspection • Trade union and sector organisation activities • Safety and health research, education and information	• Medical treatment and rehabilitation • Accident investigation and administrative and legal actions • Insurance activities • Costs to the national economy • Social costs	• Evaluation of national safety attitudes and safety programmes • Cost-benefit analysis of new regulation • Evaluation of trade union and sector organisation activities

Table 9: A classification of safety and health costs and benefits, as well as examples of methods to evaluate the costs and benefits (adapted from: Aaltonen & Soderqvist, 1988).

(Mossink and de Greef: 2002)

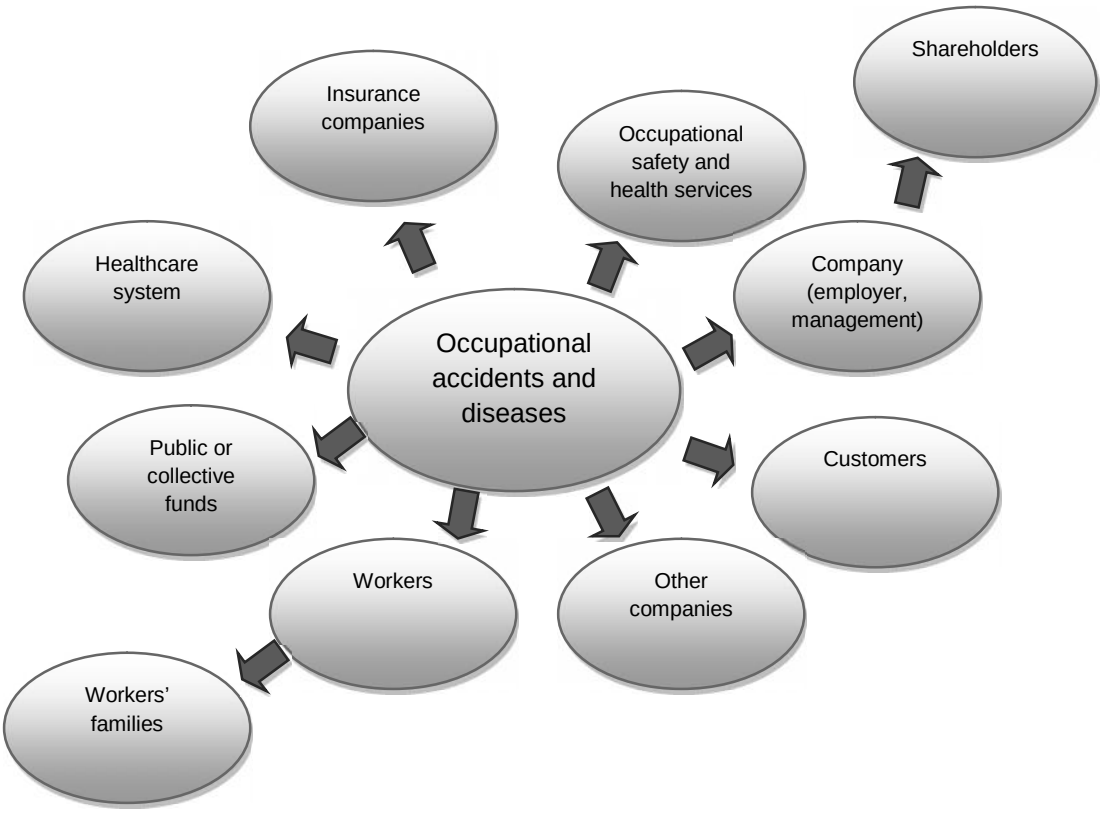


Figure 11: Work accidents inflict costs on many parties (adapted from Kruger, 1997).

(Mossink and de Greef: 2002)

Variable	Description	How to obtain money value
Investments	Costs of specific 'OSH' equipment or additional costs of other investments related to top OSH	Market prices, quotations, invoices
Additional investments	Changes in non-OSH-related capital goods to facilitate functioning of OSH equipment (e.g. reconstruction of building)	Market prices, quotations, invoices
Engineering, consultancy and planning costs, related to investments	Expenditures for internal and external activities for design and implementation of new equipment or working procedures	Marker prices, quotations, invoices, total wages of time spent
Additional costs of substitution products (recurring costs)	Price differences (e.g. for non-toxic chemicals, lighter products)	Market prices, quotations, invoices
Purchase of personal protective equipment (recurring costs)	Costs of protective equipment	Market prices, quotations, invoices
Additional costs for changed working procedures and maintenance (recurring costs)	Price difference between old ways of working and new, directly related to the preventative action; note that new ways may also result in cost savings (e.g. extra costs to work according to safety standards)	Market prices, quotations, invoices

Extra work time of direct personnel (recurring costs)	Time spent on meetings, training safety inspections, participatory developments	Total wages of time spent
Costs of internal or external OSH services, other preventative services (recurring costs)	Also includes occupational health services	Market prices, quotations, invoices
In-company activities	Human resource management, health promotion, OSH policy and management	Total wages of time spent
Other workplace costs	Anything that is not covered in the previous headings	Marker prices, quotations, invoices, total wages of time spent
([1]) Note that the cost factors have to be selected according to the intervention.		

Table 10: Overview of costs of preventive activities at company level.

(Mossink and de Greef: 2002)

Variable	Description	How to obtain money value
Increased productivity and other operational effects	Reduced costs for facilities, energy, materials, increased productivity; reduced personnel costs	Total of cost reduction directly related to intervention to be estimated from effects on the company's operation
Improved quality of products and services	Changes in product or service quality; reliability of deliveries	Value depends on company strategy. Reduction in repair costs and warranties.
Improved well-being, job satisfaction and working climate		Only indirect effects, e.g. on productivity, quality or flexibility. Increased capabilities to deal with unexpected situations.
Compensation and subsidies received from insurance authorities	Support for prevention only, compensations received for sick leave or disability are to be excluded	Compensations and subsidies received.
Company image effects	Attractiveness to customers, attractiveness on labour market, attractiveness to contractors, ability to recruit personnel	Indirect effects
Impact on non-economic company values	To be derived from mission statements and the like, typically strategic considerations	Indirect, long-term effects
Innovative capacity of the firm	Ability to innovate in products and production processes	Indirect, long-term effects. No operational benefits

Table 11: List of potential additional benefits from preventive activities at company level.

(Mossink and de Greef: 2002)

4.2.4 What are the available options for construction workers if they have been affected?

Any worker that was injured on duty has a right to claim monetary compensation for his/her injuries that might be awarded to such a worker depending on the circumstances. The following are circumstances, reasons and types of compensations that can be claimed by an employee that was influenced, according to The South African Labour Guide (n.d.):

What are these circumstances and when can workers claim compensation?

- If such a worker is injured in an accident which happens while at work. The law calls these accidents 'in the course and scope of duty'.
- If you get a disease that was caused by your work (an occupational disease).
- Workers dependants can also claim in the case of a workers death from the accident or disease caused by his/her work.

According to, The South African Labour Guide (n.d.), drivers or workers who have to be transported as part of their duties at work may get into a motor vehicle accident while working. These accidents are covered by the Road Accident Fund Act. The normal compensation procedure will be followed after the accident has been reported to the Compensation Commissioner; the money will then be paid by the Road Accident Fund. The Road Accident Fund also pays out for extra things which are not covered by the Compensation Fund.

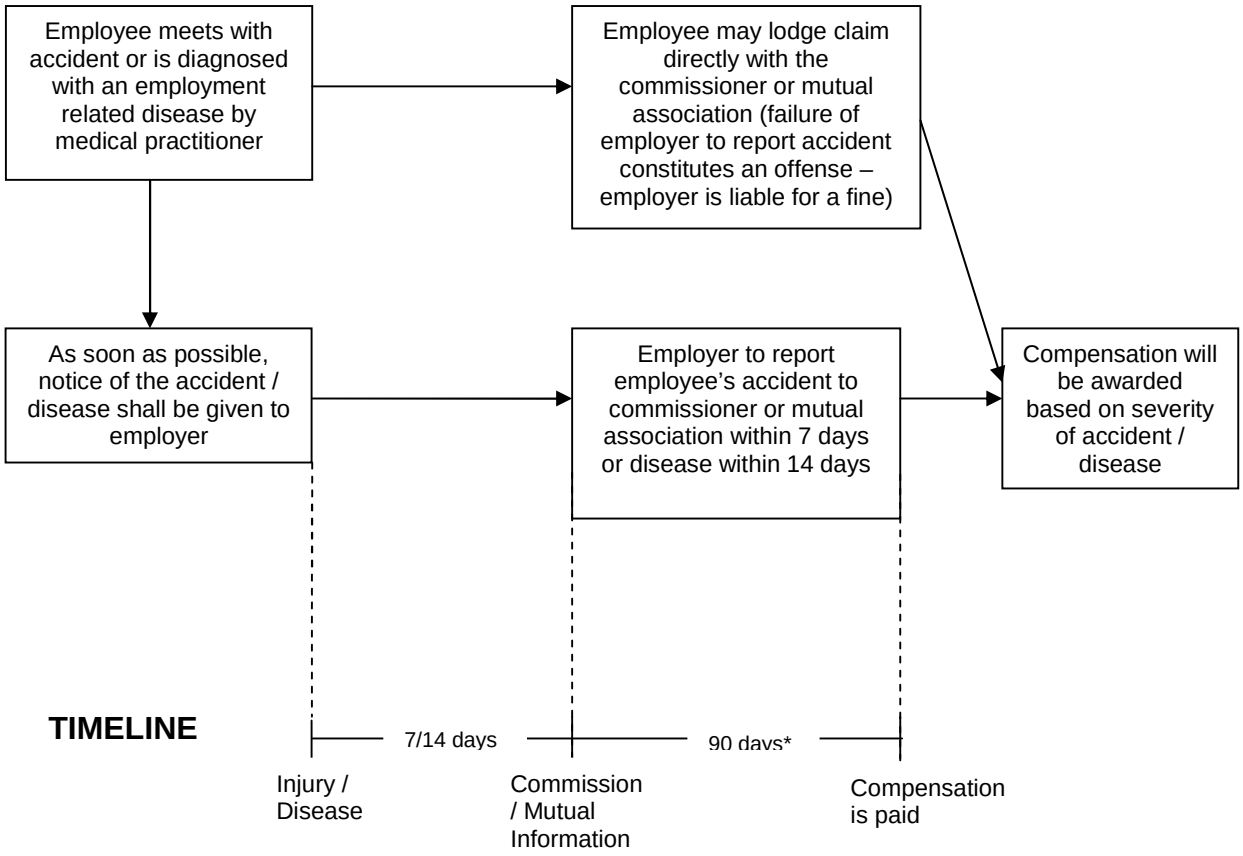
What are the types of compensation payments that are made?

Compensation gets paid out for injuries or diseases at work or caused by work. These are the four main types of compensation payments that are paid out:

- Temporary disability, where the worker does eventually recover from the injury or illness.

- Permanent disability, where the worker never fully recovers from his injury or illness.
- Death
- Medical expenses and,
- Additional compensation.

According to The South African Labour Guide (n.d.), a percentage of the wage that the worker was earning or would have earned at the time of diagnosing the injury or disease is always used to calculate compensation. The Compensation Fund does however not pay out for any pain or suffering. It does however pay for loss of movement or use of your body.



Source: COIDA and Interviews

*Compensation Fund turnaround – Mutual Associations have faster turnaround times

Figure 12: Claim Process under the Compensation for Occupational Injuries and Diseases Act (No 130 of 1993) (COIDA).

(The Compensation Fund: n.d.)

4.3 Testing of the Hypothesis

The Hypothesis has been supported and proven to be right in this chapter. It is absolutely true that in some cases the effects that construction has on human health are avoidable to some extent and the reason for this being that no matter how well the rules are written, without implementation they mean nothing and most of the times implementation is the most difficult thing to enforce. This means that it comes down to one simple rule, health and safety is the responsibility of each and every person. This means that the hypothesis has been proven that the methods in policies and procedures that are being used are very advanced and there are little problems that have not been researched, but individuals also need to play their part. It has been supported that certain organisations do play a major role in the awareness, treatment and researching of major problems and come up with methods to combat these problems, however they can put their focus more specifically towards construction. An example of such an organisation has been proven to be CANSA. It is clear from this chapter that the cost on the long run would be worth paying. It is however also true that this cannot easily be calculated so it is overlooked. So in support of the hypothesis, yes the cost is worth paying, and yes it will make a huge difference if more money is spent.

Chapter 5:

International standards comparison

5.1 Introduction

Construction is internationally used and sometimes even across border or inter-continental projects are undertaken, international standards for health and safety is thus important and can be necessary for the execution of almost every project, no matter the size. Every country across the world has their own standards; some are just stricter and more focused than South Africa. This is something from which we could learn, and not only from their stricter rules but also on how these are implemented. As a comparison the standards of Australia will be looked at, where they use drastic measures to resolve these problems in comparison to SA standards. We can improve by looking at other countries like Australia and the methods that they put in place.

5.2 How do our safety measures compare with international standards?

According to Swarts (2012), a former Construction Manager in South Africa and now a Quantity Surveyor and Contracts Manager in Perth, Australia, the rules for health and safety in Australia are much stricter and strictly implemented. HSE (Health Safety and Environment) in the Construction industry of Western Australia (WA) is very different to South African health and safety. An example of this is that every worker on site has to put on sun block before he is allowed on site and there are places at which sun block can be obtained on site as part of health and safety. In Australia, they are so strict on health and safety, that every worker on site has to even have a bottle of water on him at all times almost as part of his PPE (Personal protective equipment).

5.2.1 How is HSE implemented in the construction industry of Western Australia?

“In a sector of the market where construction, and particular the construction in the resources and Energy economies, are at a high point in the cycle, it is absolutely imperative for each and every construction firm, small and large, to maintain safety statistics to a level that will keep them competitive in the market place.” (Swarts: 2012)

According to Swarts (2012), in Western Australia (WA), and within the Australian construction industry, the main goal for the construction contractor is to maintain a TRIFR (Total recordable incident frequency rate) of less than 10. That is 10 recordable incidents for every 1,000,000 man-hours spent. This is the first and foremost key point indicator by which every contractor is measured in the vetting of tenders, appointment of contracts and performance measurement as a holistic point of view. It is not uncommon for a company to have a TRIFR target of 4. As a matter of reference, the subject Company for his interview has a TRIFR target of 3.6 for the 2012-2013 financial year.

So he maintains that the question then is what is classed as a recordable incident?

“A recordable incident is classed as either one of the following:

- a LTI or lost time injury where time is lost by the employee or others as a result of the incident;
- a RWI or restricted work incident where the employee is not able to continue work as normal as a result of the incident;
- a MTI or medical treated injury where the employee needs medical attention and/or advise in order to return to normal duties;” (Swarts: 2012)

Any of these injuries or incidents will be classed as a recordable incident and will affect the safety statistics of the Company.

“Incidents that are not recorded as part of the TRIFR for reporting purposes are:

- FAC or first aid case injury;
- Incidents;
- Near miss incidents and
- Procedural breaches;” (Swarts: 2012)

5.2.2 What are the client requirements for HSE in Australia?

According to Swarts (2012), the reason for this huge direction in the market to become more and more safety conscience is predominantly driven by the client and their requirements for safety performance as an integral part of performing the works under the contract. The client puts in place a full set of policies and procedures that forms part of the contractual agreement between the parties. These documents contain a procedure on every activity that might be performed and the save performance thereof. A sample list of safety policies and procedure is listed below:

DOCUMENT NUMBER	REV	TITLE
100-CK-EM-0001	1	HSES Checklist- Incident Management Team Roles & Responsibilities
100-FR-CT-0011	6	HSES Form- Contractor HSES System KPI’s
100-FR-EM-0048	13	HSES Form- Journey Management Form
100-FR-EM-0056	1	HSES Form- Cyclone Situation Site Report Form
100-FR-HE-0002	0	HSES Form- Heritage Incident Report Form
100-FR-RK-0003	4	HSES Form- Risk Matrix
100-FR-RK-0004	4	HSES Form-Job Hazard Analysis (JHA) Worksheet
100-FR-RK-0005	3	HSES Form- Five Step
100-FR-RK-0006	3	HSES Form- Risk Assessment
100-FR-SA-0018	4	HSES Form- Incident - Event Reporting Form
100-FR-SA-0033	1	HSES Form- Fitness For Work Self Assessment
100-FR-SA-0047	1	HSES Form- Hazard Report
100-FR-SA-0048	1	HSES Form- Safe Act Observation (SAO)
100-FR-SA-0049	4	HSES Form- Alcohol & Drug Test Form
100-FR-SA-0096	2	HSES Form- Incident - Event Time Line

100-FR-SA-0160	1	HSES Form- Incident - Event Statement
100-FR-SA-0163	1	HSES Form- Incident - Event Interview Report
100-FR-SA-0221	1	HSES Form- Incident Reporting & Analysis Process Chart
100-FR-SA-0222	0	HSES Form- Incident Reporting & Analysis - Field Notes
100-FR-SA-0223	0	HSES- Incident Reporting & Detailed Analysis Flowchart
100-MA-SA-0004	0	HSES- Health and Safety Management System Manual
100-PL-SA-0001	9	HSES- Safety Management Plan
100-PO-EN-0001	0	HSES- Environmental Policy
100-PO-SA-0002	3	HSES- Alcohol and Other Drugs Policy
100-PO-SA-0007	1	HSES- Fatigue Management Policy
100-PO-SA-0010	3	HSES- Health and Safety Policy
100-PR-EM-0001	4	HSES Procedure- Cyclone Management Procedure
100-PR-EM-0005	0	HSES Procedure- Journey Management Procedure
100-PR-EM-0007	0	HSES Procedure- Fire Protection and Prevention
100-PR-EN-0004	2	HSES Procedure- Ground Disturbance Permits
100-PR-RK-0001	2	HSES Procedure- Risk Management Procedure
100-PR-RK-0002	1	HSES Procedure- Job Hazard Analysis
100-PR-RK-0003	1	HSES Procedure- Mobile Equipment Risk Assessment
100-PR-SA-0003	2	HSES Procedure- Change Management
100-PR-SA-0011	5	HSES Procedure- Incident-Event Reporting
100-PR-SA-0012	3	HSES Procedure- Safety Issue Resolution
100-PR-SA-0013	8	HSES Procedure- Alchohol and Other Drugs
100-PR-SA-0027	5	HSES Procedure- Fatigue Management Procedure
100-PR-SA-0032	1	HSES Procedure- Health Surveillance Procedure
100-PR-SA-0047	2	HSES Procedure- Pre-Employment Medical Procedure
100-PR-SA-0051	1	HSES Procedure- Fitness for Work
100-PR-SA-0087	0	HSES Procedure- Field Leadership Procedure
100-PR-SE-0003	0	HSES Procedure- Security Management
100-ST-SA-0027	4	HSES Standard- Fatigue Management Procedure
100-ST-SA-0051	3	HSES Standard- Fitness for Work
100-ST-SA-0079	0	HSES Standard- HSES Management Standards
100-ST-SA-1000	2	HSES Standard- Major Hazard Control Standards
200CO-0000-CK-SA-0001	0	HSES Checklist- Construction Management HSE Readiness Checklist
200CO-0000-FR-SA-0001	1	HSES Form- HSES Pre-Qualification Questionnaire

45-FR-EM-0005	0	HSES Form- Confined Space Rescue Plan
45-FR-SA-0001	1	HSES Form- Critical / Non Standard Lift
45-FR-SA-0004	0	HSES Form- Area Inspection
45-FR-SA-0008	1	HSES Form- Floor Roof Wall Opening Certificate
45-FR-SA-0009	1	HSES Form- Working at Height Certificate
45-FR-SA-0010	1	HSES Form- Confined Space Entry Certificate
45-FR-SA-0011	1	HSES Form- Excavation Certificate
45-FR-SA-0012	1	HSES Form- Hot Work Permit
45-FR-SA-0017	1	HSES Form- New Chemical Product Request
45-FR-SA-0019	0	HSES Form- Working At Height Equipment Check
45-FR-SA-0020	0	HSES Form- Working At Height Supervisor Check
45-FR-SA-0021	0	HSES Form- WorkBox Permit
45-FR-SA-0022	1	HSES Form- Work Permit
45-FR-SA-0023	1	HSES Form- Permit To Work Assessment Checklist
45-FR-SA-0025	1	HSES Form- Live Electrical Work Permit
45-FR-SA-0026	0	HSES Form- RadioActive Sources Permit
45-FR-SA-0027	0	HSES Form- Critical Safety System Permit
45-FR-SA-0032	0	HSES Form- Electrical Equipment Register
45-FR-SA-0035	0	HSES Form- Working At Heights Harness Register
45-FR-SA-0036	0	HSES Form- Plant Machinery Vehicle Access Request
45-FR-SA-0037	0	HSES Form- Guidelines for Barricading
45-FR-SA-0038	0	HSES Form- Duties Of The Stand By Person For Confined Space Entry
45-FR-SA-0041	0	HSES Form- Power Line Vicinity Access
45-FR-SA-0043	0	HSES Form- Crane Inspection Checklist
45-FR-SA-0044	0	HSES Form- Pre-Mob - Vehicle Check
45-FR-SA-0046	0	HSES Form- Trench Safety Report
45-FR-SA-0047	1	HSES Form- Master Permit
45-FR-SA-0048	0	HSES Form- High Voltage Equipment Authority
45-FR-SA-0049	0	HSES Form- HV Isolation Request
45-FR-SA-0052	1	HSES Form- Gas Test Sheet
45-FR-SA-0053	0	HSES Form- Signature Lock Or Tag Removal Authorisation
45-FR-SA-0054	0	HSES Form- Confined Space - Hazard Identification Guidelines
45-FR-SA-0055	0	HSES Form- Confined Space Risk Assessment
45-FR-SA-0057	0	HSES Form- Duties Of Fire Watch For Hot Work

45-FR-SA-0058	0	HSES Form- Guideline For Hot Work
45-FR-SA-0059	0	HSES Form- Operations Inspection
45-FR-SA-0060	0	HSES Form- Office Inspection
45-FR-SA-0061	0	HSES Form- Workshop Inspection
45-FR-SA-0064	0	HSES Form- Supervisor Daily Inspection
45-FR-SA-0066	0	HSES Form- Manual Handling Assessment
45-FR-SA-0067	0	HSES Form- Manual Tasks Assessment
45-FR-SA-0068	0	HSES Form- Isolation Plan
45-FR-SA-0072	0	HSES Form- High Voltage Access Permit
45-PL-EN-0011	2	HSES Plan- Chemical and Hydrocarbon Management Plan
45-PL-EN-0012	2	HSES Plan- Construction Dust Management Plan
45-PL-EN-0013	2	HSES Plan- Weed Management Plan
45-PL-EN-0014	1	HSES Plan- Waste Management Plan
45-PL-EN-0015	2	HSES Plan- Chicester Operations Surface Water Management Plan
45-PL-EN-0016	0	HSES Plan- Greenhouse Gas Management Plan
45-PL-EN-0018	1	HSES Plan- Borrow Pit Management Plan
45-PL-EN-0020	3	HSES Plan- Fire Management Plan
45-PL-EN-0023	1	HSES Plan- Rehabilitation & Revegetation Management Plan
45-PR-EN-0006	0	HSES Procedure- Weed Control
45-PR-EN-0013	4	HSES Procedure- Vegetation Clearing and Topsoil Management
45-PR-EN-0014	0	HSES Procedure- Chemical and Hydrocarbon Spills Procedure
45-PR-EN-0015	0	HSES Procedure- Cloudbreak Chemical and Hydrocarbon Storage Procedure
45-PR-SA-0002	2	HSES Procedure- Working at Heights Procedure
45-PR-SA-0003	1	HSES Procedure- Barricades
45-PR-SA-0004	0	HSES Procedure- Scaffolding Procedure
45-PR-SA-0005	2	HSES Procedure- Permits To Work
45-PR-SA-0007	1	HSES Procedure- Confined Space Entry Procedure
45-PR-SA-0008	3	HSES Procedure- Crane Management
45-PR-SA-0009	1	HSES Procedure- General Electrical Safety
45-PR-SA-0010	1	HSES Procedure- Excavation & Penetrations Procedure
45-PR-SA-0011	1	HSES Procedure- General Pilbara Isolation and Tagging

45-PR-SA-0012	0	HSES Procedure- Hazardous Materials
45-PR-SA-0014	0	HSES Procedure- Heat Illnesses
45-PR-SA-0015	1	HSES Procedure- High Voltage Switching
45-PR-SA-0016	1	HSES Procedure- Hot Works
45-PR-SA-0017	0	HSES Procedure- Housekeeping and Waste Disposal Procedure
45-PR-SA-0018	3	HSES Procedure- Personal Protective Clothing and Equipment
45-PR-SA-0019	1	HSES Procedure- Uniform and Jewellery Procedure
45-PR-SA-0020	0	HSES Procedure- Portable Electrical Equipment
45-PR-SA-0021	0	HSES Procedure- Lightning Procedure
45-PR-SA-0022	1	HSES Procedure- Safety Signage
45-PR-SA-0023	0	HSES Procedure- Traffic Management
45-PR-SA-0024	0	HSES Procedure- Fibrous Material Management (Asbestos)
45-PR-SA-0025	1	HSES Procedure- Dust Management
45-PR-SA-0026	0	HSES Procedure- Manual Handling
45-PR-SA-0027	0	HSES Procedure- Workplace Inspections
45-PR-SA-0028	0	HSES Procedure- Explosives Management Procedure
45-PR-SA-0029	1	HSES Procedure- Noise Management
45-PR-SA-0030	0	HSES Procedure- Vehicle Spotting
45-PR-SA-0031	1	HSES Procedure- Drinking Water Sampling Method
45-PR-SA-0034	0	HSES Procedure- Occupational Noise Assessment Methodology
45-PR-SA-0035	1	HSES Procedure- Buy Quiet Program
45-PR-SA-0043	1	HSES Procedure- Vehicles and Driving Procedure
45-ST-EM-0001	0	HSES Standard- Journey Management
45-ST-EM-0002	0	HSES Standard- Radio Communication
45-ST-SA-0005	0	HSES Standard- Permit to Work
45-ST-SA-0019	0	HSES Standard- Personal Protective Equipment (PPE)
45-ST-SA-0025	0	HSES Standard- Fibrous Material Management (Asbestos)
45-ST-SA-0028	0	HSES Standard- Mobile Phone Use

Table 12: Safety Policies and Procedures or Western Australia.

(Swarts: 2012)

5.2.3 How are the HSE risks minimized in Australia?

Swarts (2012) maintains that there are 5 ways in the order mentioned below on how we manage risk:

1. ***Identify risk:*** "For this we have document 45-FR-SA-0054 above to identify the risks and address it." (Swarts: 2012).

An example would be where scaffold is set up with bricklayers working at heights. People are however able to freely walk below the scaffolding. The risk is that a person can get struck by falling material;

2. ***Assess the risk:*** An assessment of the risk should be made, based on its likelihood of occurring and its level of consequence as a result thereof. Table 13 can be used for the purposes of this assessment. Getting struck by a falling object is a likely occurrence and can result in an LTI, therefore a risk score of Extreme 21;

		Consequence				
		1 **Minor** First Aid Injury $10k - $100k	2 **Medium** MTI $100k - $500k	3 **Serious** RWI $500K – $2M	4 **Major** LTI $2M – $20M	5 **Catastrophic** Fatality > $20M
Likelihood	**A - Almost Certain** >1 per week (>25%)	**MODERATE 11**	**HIGH 16**	**EXTREME 20**	**EXTREME 23**	**EXTREME 25**
	B - Likely 1/week – 1/month (10-25%)	**MODERATE 7**	**HIGH 12**	**HIGH 17**	**EXTREME 21**	**EXTREME 24**
	C - Possible 1/month – 1/year (1-10%)	**LOW 4**	**MODERATE 8**	**HIGH 13**	**HIGH 18**	**EXTREME 22**
	D - Unlikely 1/year – 1/10 years (0.1-1%)	**LOW 2**	**LOW 5**	**MODERATE 9**	**HIGH 14**	**HIGH 19**
	E - Rare < 1/10 years (0.1%)	**LOW 1**	**LOW 3**	**LOW 6**	**MODERATE 10**	**HIGH 15**

Table 13: Severity risk assessment table.

(Swarts: 2012)

3. ***Put controls in place:*** In order to minimize the likelihood of the incident occurring, controls need to be put in place. This is to prevent the incident from happening. Controls can and should be implemented in the following order of precedence as per the Hierarchy of controls. Through elimination for instance, barricading can be set up in order to prevent people from working under the scaffolding and thus eliminating the risk.

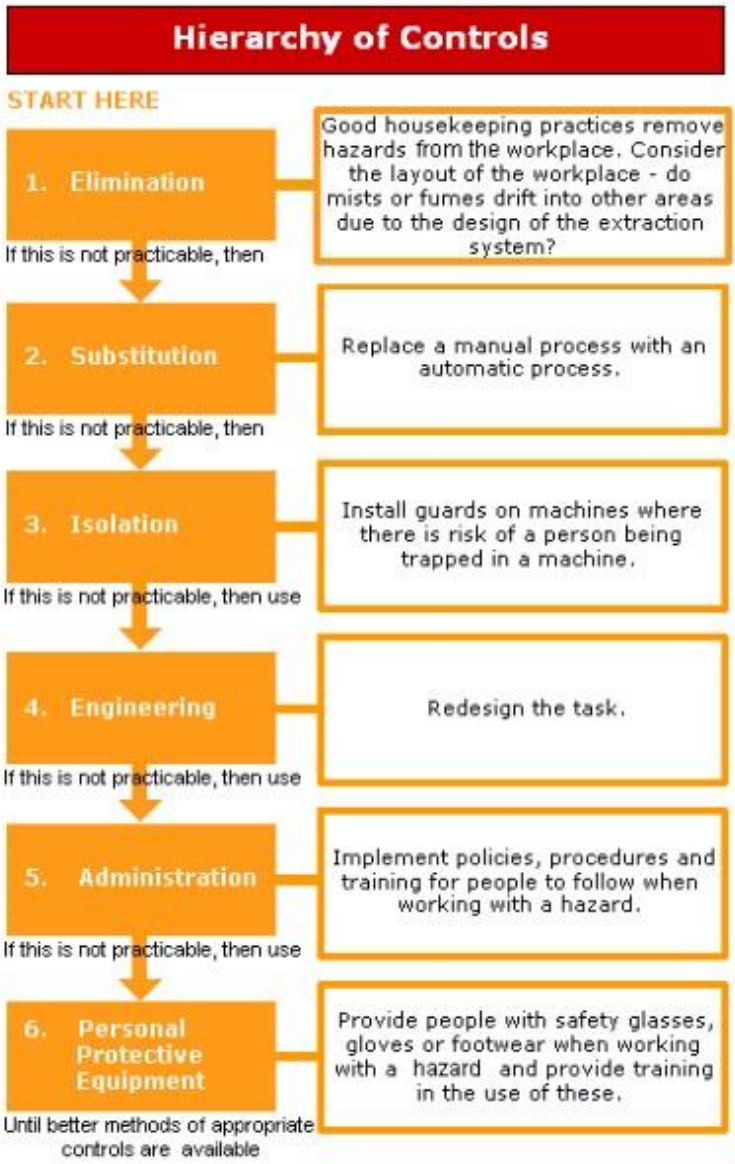


Figure 13: Hierarchy of Controls.

(Swarts: 2012)

4. ***Supervise and monitor progress:*** There are numerous tools to monitor safety progress. The effectiveness of the controls should be measured by a company and put into place as a minimum by the following:

a. Work place inspections;

b. LPI (Loss prevention inspections) which run through a check sheet for a certain trade or activity;

c. SAO (Safe act observation) which observes safe acts by a worker;

5. ***Work the Plan:*** A plan is only as good as the execution thereof, so in order to ensure a safe working site, there needs to be a holistic change in the culture and a paradigm shift from everyone involved to make safety their main point of concern and first priority.

5.3 Testing of the Hypothesis

The hypothesis stated that South Africa does have good standards for health and safety in place; this has been proven and supported. This chapter challenges those findings. It goes further in comparing the South African standards to the standards and methods currently used in other countries like Australia. By completing this comparison it has been found that the hypothesis has been proven. This means that although the standards used in South Africa are more than adequate, they can be improved and made stricter to compete with measures used in Australia. The research indicated that this could make a big difference since one of the major health problems in construction was skin problems. Making use of the specific standard that Australians are being forced to wear sun-block at all times on site and before they enter the site, proves that if we follow their example, it can make a big difference in preventing skin problems and cancer. This could save lives and improve the health condition of construction workers significantly.

Chapter 6:

The data, the treatment of the data and questionnaire results

6.1 Introduction

The data was obtained through the use of a questionnaire. The questionnaire was sent to and recovered from a range of different class workers on a construction site. The purpose was to determine how construction has influenced their health. These workers include skilled; semi-skilled; unskilled and professionals such as Labourers; Foreman; Carpenters; Construction Managers; site Quantity Surveyors; Electricians; Safety Officers; Civil Engineers; Plumbers and Store men. The data that was requested in the questionnaire was aimed at testing two of the four research questions with regards to the influence of construction on human health.

6.2 Method of data collection

Questionnaires were hand delivered to respondents and the workers that were not able to complete the questions on their own were assisted by either a peer or the researcher. 20 Respondents replied by hand. All of the questions in the questionnaire were questions that could simply be answered by the respondents marking the applicable box or by filling in the relevant information on the open line next to the questions. All questions were factual based on the personal health history or current status of the respondents. The main focus was on the general health status of the workers. The questionnaire also focused on their family health history and whether the illness or injuries were construction related.

6.2.1 Procedure of data collection

Procedure of data collection was by means of a questionnaire. The questionnaire was only relevant and applicable on the first two sub-problems. This was done to compare the literature study with the results from the questionnaire. The aim is to support or to undermine the findings in the literature study by doing a comparison. The procedure of data collection within the questionnaire was done in a specific manner as to keep the focus of the research on the topics at hand. The questionnaire was designed to test the response of the various workers on site at different work and class levels. In other words workers that do office work as well as physical labour work. It was set up in a manner as to answer the first two research questions and therefore the hypothesis mentioned in chapter one would also be tested. It ultimately aims at answering the main problem.

6.2.2 Difficulties encountered

There were no major difficulties encountered. All of the subjects did respond immediately. The questionnaire was distributed to 20 subjects and all 20 subjects responded. The literacy level of some of the labourers was a minor difficulty. Two of the labourers had to be assisted to some extent and others found it difficult to correctly interpret the questionnaire. The researcher was present at all times to interpret questions.

6.2.3 Statistical design

All data was collected and extrapolated from the questionnaires to an excel spreadsheet where the findings of each question was placed next to the relevant question in a sequence as to relate relevant questions to one another. All variables were thus categorised so that data could effectively be quantified.

6.3 Respondent's background information and responses

6.3.1 Respondent's occupation and level of occupations

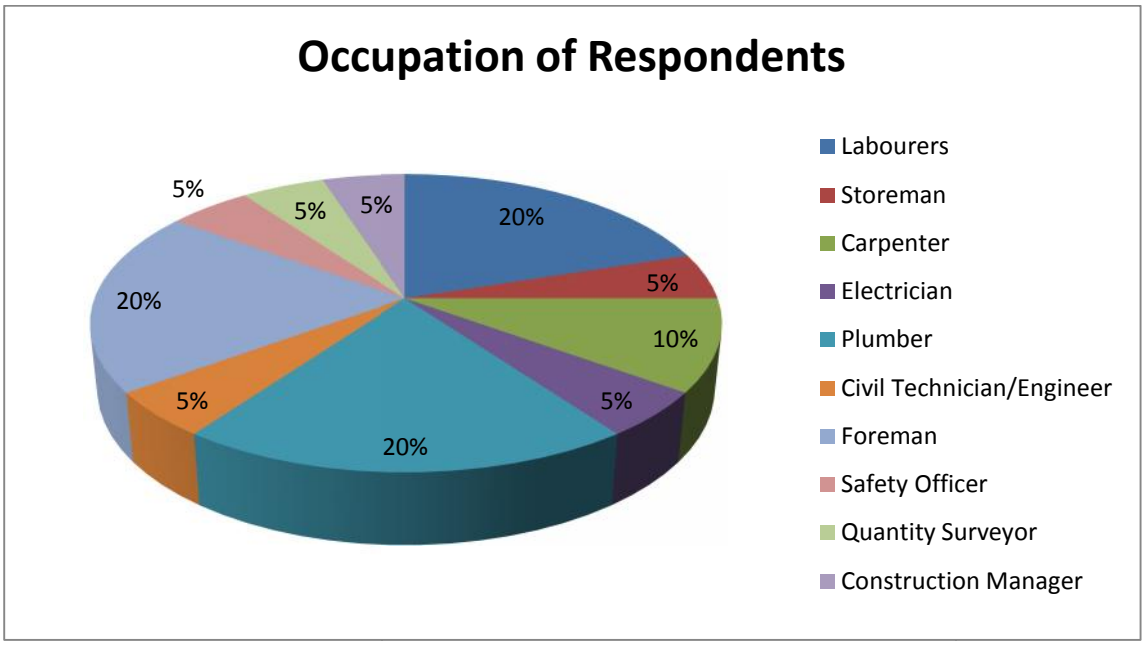


Figure 14: Occupation of Respondents

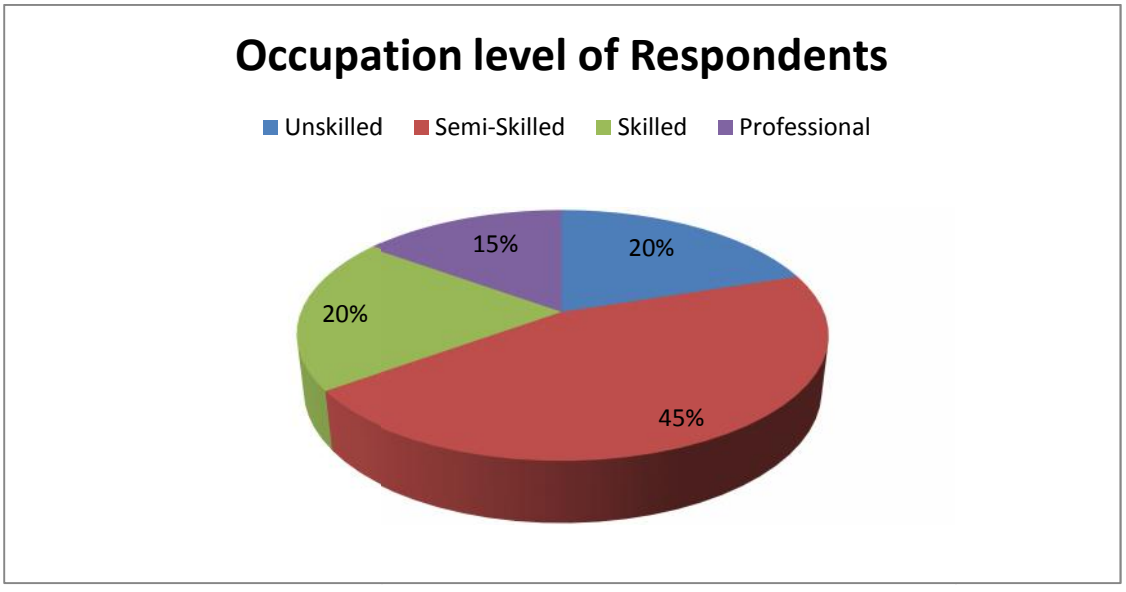


Figure 15: Occupational level of Respondents

6.3.2 Questions specific on the health status and the influence of construction on the health of respondents

6.3.2.1 The symptoms/problems shown by different occupations

	Symptoms/ Problems with:													
	Lungs (TB)	Stomach	Throat	Skin	Heart (cholesterol, blood pressure, shortness of breath)	Headaches / Migraines	Eyes	Back	Bones / Joints	HIV/ AIDS	Cancer/ Tumours	Hospitalisation	Operations	Injured at work
Labourers	1	0	0	1	2	1	2	2	1	3	0	2	0	1
Storeman	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Carpenter	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electrician	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plumber	0	0	0	1	0	1	1	0	0	1	0	1	1	1
Civil Technician	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreman	0	1	1	0	2	1	1	0	1	1	0	3	1	0
Safety Officer	0	0	0	0	1	0	0	0	0	0	0	1	0	0
QS	0	0	0	0	0	0	0	0	0	0	1	1	1	0
Construction Manager	0	0	0	0	0	0	0	0	1	0	0	0	0	0

Table 14: Health problems in different occupations in construction

6.3.2.2 The impact of age on the number of symptoms/problems

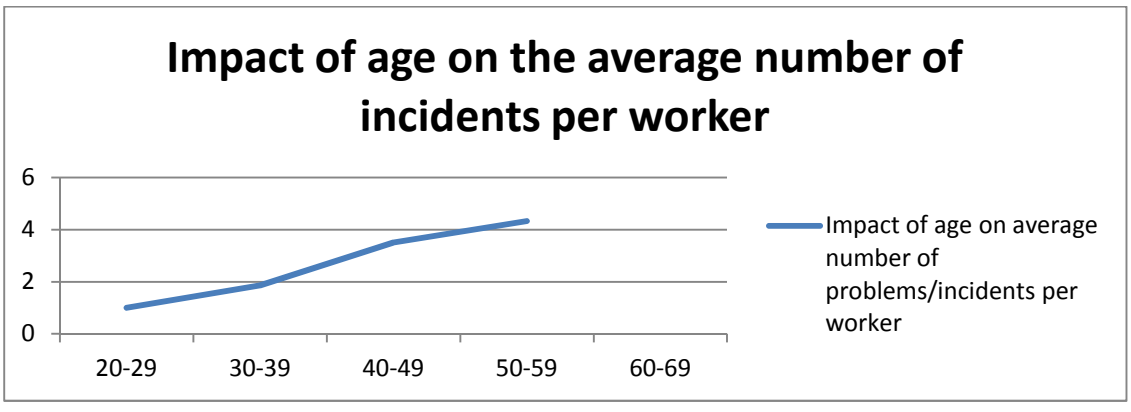


Figure 16: Impact of age on the health of construction workers

6.3.2.3 The contribution that smoking, drugs, drinking and being physically inactive has on the ill health of construction workers

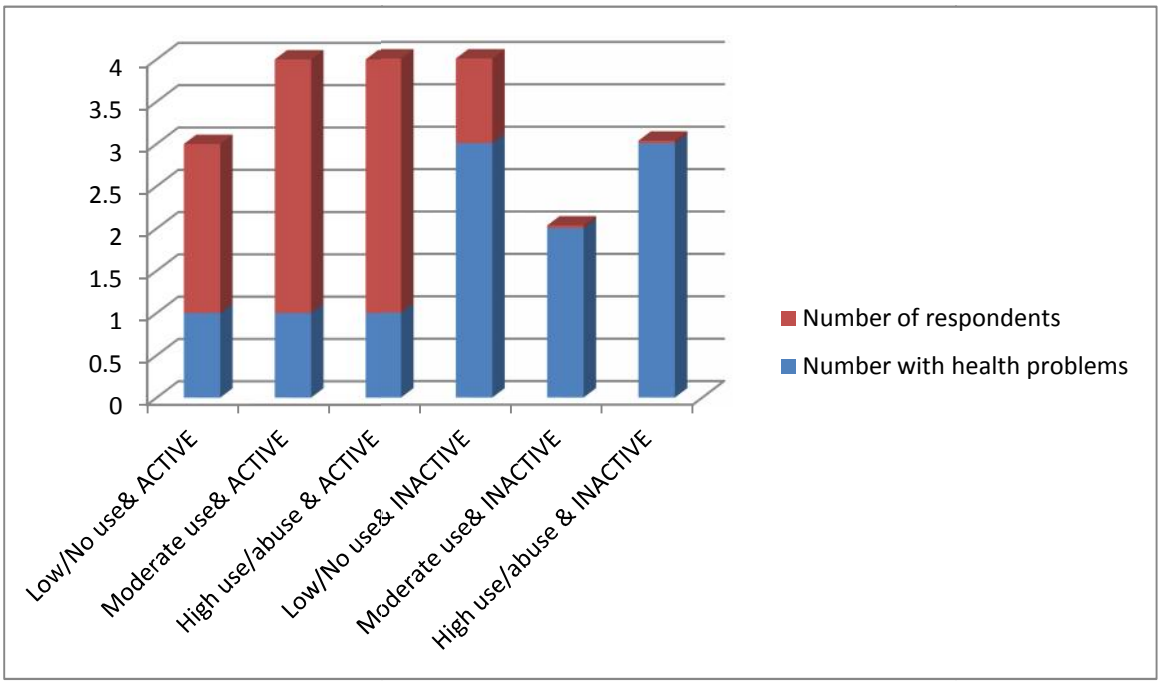


Figure 17: The contribution to ill health that smoking, drugs, alcohol and being physically inactive has on construction workers

6.3.2.4 The number of incidents as a result of occupational level

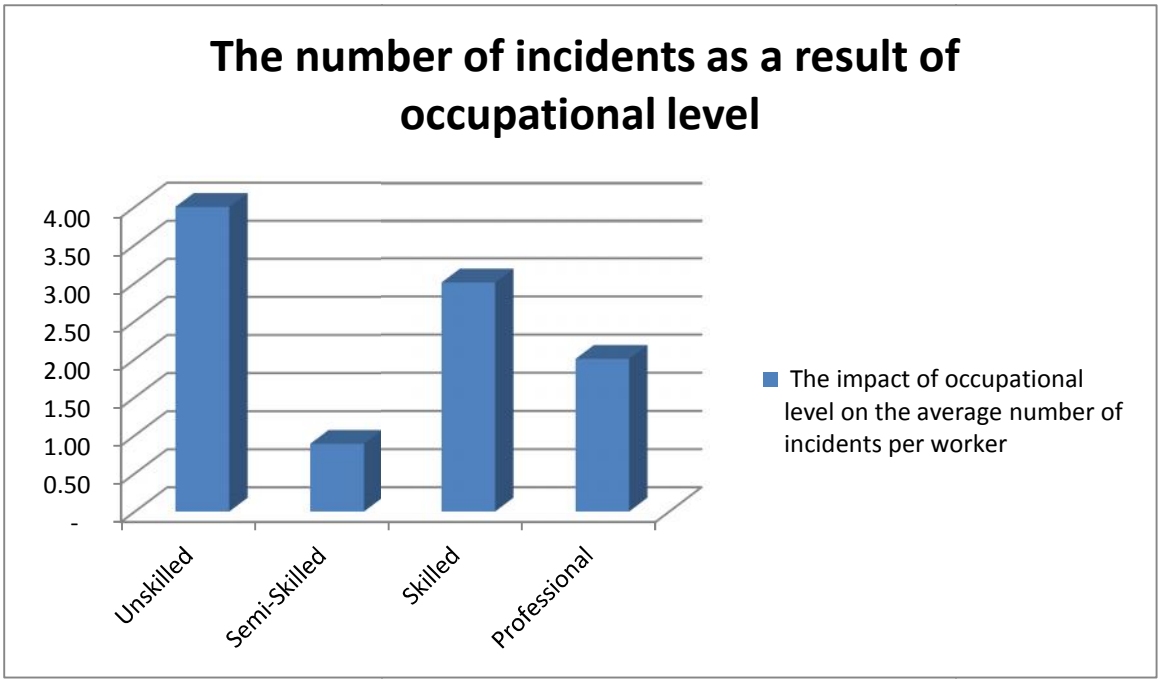


Figure 18: Impact of occupational level on the health of construction workers

6.3.2.5 Research questions concerning the specific effects that construction has on human health

75% of unskilled workers, 22.22% of semi-skilled workers, 100% of skilled workers and 33% of professionals on site showed symptoms that could have been indirectly caused by working on a construction site. Symptoms included problems with their eyes, backs, bones and joints, skin, headaches. Other symptoms include more serious illnesses like TB and HIV/AIDS which could possibly be the result of the social impact that the environment of construction and the conditions they live in on site causes. These workers had these symptoms or problems, but one cannot say for certain if construction was the result, although in most cases the chances are that it was. Even the workers themselves cannot say for certain that construction was the cause and this makes it hard to determine.

50% of unskilled workers, 11.11% of semi-skilled workers, 0% of skilled workers and 0% of professionals on site showed symptoms that could have been directly caused by working on a construction site. These include injuries that were obtained while working on site like hurting a back while working on a forklift or cutting open of the upper leg with an angle grinder. This is much more certain and one has no doubt whether or not these symptoms were caused by working on a construction site. The statistics show that the more skilled or professional workers which do not do physical work, show a lower percentage of incidents as a result of working on a construction site. The workers that do physical work and who are exposed to hazards daily were more prone to obtaining injuries or poor health. This clearly shows that construction does have a negative effect on workers in construction.

In general workers tend to have 20% more symptoms and/or problems for every 10 years that they are older than 20. This shows that construction does progressively impact the health of the workers negatively. Workers that were at least physically active in some way by partaking in sports were up to 75% more likely to show no symptoms at all. In average the amount of workers that showed symptoms under the workers that were physically active was 25% - 33.33%, but under workers that were physically inactive it was 75% - 100%.

6.3.2.6 Research questions concerning the severity of effects that construction has on human health

100% of the respondents were capable of doing their work as a result of being sufficiently cured from the injury or illness. They were cured from the injury or illness to such an extent that it does not severely alter their lifestyle or living standard. To say that this means that construction does not severely influence workers to the extent where they die or become disabled is not true. To prove that construction does cause disability or even death is difficult, due to the fact that those parties which were in fact killed or disabled by construction is no longer on site to partake in the questionnaire. However the statistics in the literature study does indicate that construction causes quite a lot of disabilities and fatalities. These statistics are unfortunately the only data that can be relied on. 20% of the respondents are still struggling with one or more of the effects that construction had on their health. These effects include things like for instance back problems, skin problems, eye problems and headaches. These effects are mostly permanent and can thus be seen as quite severe.

6.4 Conclusion

The data indicates that construction does influence the health of construction workers. There are some factors like being physically inactive that make it worse. On the other hand the environment in which these workers work and live make them more susceptible to injuries and poor health. This means that construction directly contributes to their ill health. The questionnaire together with the data received as feedback from the respondents, answers the main problem which is whether or not construction does influence the health of humans. The answer is that it does. Hypothesis one and Hypothesis two has also been supported by the questionnaire. The data indicates that construction does have a negative influence on human health which can be avoided by for instance being physically active. The hypothesis which states that construction can be detrimental to human health, especially the over exposure of construction workers to the sun, has also been supported. This hypothesis is however only partially supported since no effects of chemicals could be

identified. One of the main preventative factors that has been revealed in the questionnaire, but was not mentioned in the hypothesis, is that physically active workers are much healthier in general. They are less likely to be influenced negatively by the dangerous work environment that they are in, because their bodies are healthier, stronger and has better immune systems. Lastly the data also revealed that although a construction site is a dangerous environment to work in, the most obvious hazards are usually prevented through good health and safety management. This means that professionals and skilled workers are not influenced as badly, it is the accidents that cannot be reasonably foreseen or prevented that happen to the unskilled or semi-skilled workers. This is due to the fact that they do the physical work. They are the ones that are affected the most by working on a construction site.

Chapter 7:

Summary, Conclusions and Recommendations

7.1 Background

Does construction have an influence on human health? In this study, in depth research has been done in the form of a literature study and a questionnaire to research the question of whether or not construction has an influence on the health of humans, both directly and indirectly. These impacts that construction has on human health can be on different levels, these levels are: on site or construction workers directly; social impact; environmental impact and global impact. The health condition in and surrounding construction and the role it plays on the environment directly impacting human health was the main focus of the study.

Construction is one of the most dangerous environments to work in and the influence that it has on human health is a serious matter. The sacrifice of human health and human lives is one that we must weigh up to the importance of our demand for better and more luxurious living. The real question is if construction does have an influence on human health and if so, how severe is it and is it manageable and avoidable by taking the necessary precautions.

The purpose of the research and surveys are to determine the severity of the effects that construction has on human health and the impact and effectiveness of methods that are being used to limit these effects.

7.2 Summary

The research was done by collecting information from an in depth literature study of four sub-problems all relating back to the main problem. A questionnaire was also given to 20 subjects from which the information that was gathered was analysed and quantified. The variables were categorised and put into graph form. These questionnaires were done to either support or challenge the first two sub-problems and therefore the main problem. The sources of the literature study included South African, American, English and Australian literature. Interviews were conducted. The participants included one South African Safety Officer, a Cansa worker and a South African Contracts Manager that has been living and working in Australia for the last five years. The data that was requested in the questionnaire and all data gathered from the literature study was aimed at testing the four research questions and relating back to ultimately answer the main problem that is the influence of construction on human health. Throughout the whole study there were no major difficulties encountered. There was more than enough information available on the subject for the literature study and when the questionnaire was sent out, all of the subjects responded immediately.

7.3 Conclusion

The conclusions relative to each chapter and thus sub-problem/objective are discussed. The results of the research and the testing of the hypotheses of each are presented in a separate conclusion and finally the conclusion to the main problem is presented.

7.3.1. Conclusion of the first chapter

In this chapter the problem and its settings were set out into a main problem and four sub-problems. The main problem was whether or not construction has an influence on human health. The four sub-problems all relate to the main problem in a way as to answer the main problem by answering each of the sub-problems. Each of the sub-problems had a hypothesis to answer the question stated, which will then be

tested in the following chapters. No research was done in this chapter. The methodology and limitations to the research set out in this chapter.

7.3.2. Conclusion of the second chapter (first sub-problem)

The first sub-problem that was dealt with was what the specific effects are that construction has on human health. This question was then further broken up into questions which could help in answering this sub-problem.

The sub-problem was answered and it was found that especially working on a construction site could have seriously detrimental effects on the health of a worker. Even just by being in the surrounding areas of where construction work is being done could be very dangerous to a person's health. The research showed that construction contaminates the environment in which the workers and the public have to live. This causes serious illness or even death.

Specific problems include things like skin problems which could in turn cause cancer. Another example would be the problems that asbestos poisoning causes. Asbestos is very dangerous since in contains very fine particles which could be inhaled. It then makes its way into the person's lungs where it causes permanent damage. Similarly serious but less often encountered are problems like blindness, burns and deafness. They are the most common problems found although they do not occur that often. The biggest health risk for workers on a construction site is by far falling from heights and second is being struck or crushed by something. Usually falling objects from scaffolding or moving plant and machinery. In terms of the environment being polluted and indirectly causing ill health to people living or working in the area, toxic waste has been proven to be the biggest concern. The construction industry causes massive amounts of toxic waste worldwide every year which seriously harms the environment. This makes toxic waste in construction the largest contributor to poor human health. Human life and health depends directly on a healthy environment. The research has answered the question and the hypothesis has proven to be correct.

7.3.3. Conclusion of the third chapter (second sub-problem)

The second sub-problem that was dealt with was how severe the effects are that construction has on human health. This question was then further broken up into questions which could help in answering this sub-problem. The main concern was whether or not the effects could be fatal.

Statistics often speak for themselves for they are a true image of what has been happening up to that moment in time. No one can ever determine what will happen in future, but by looking at the statistics one can easily predict what might happen. In this chapter the statistics clearly answered the question asked and the hypothesis was also supported. The statistics indicated that a significant number of cases reported on construction sites were indeed fatal. Although most of the time the incidents are not fatal, the number of incidents that are fatal were very high. This shows that the impact that construction has on human health could be very dangerous and severe. The effects can be fatal or could even cause permanent illness or disability. The fatalities are quite often from serious injury or even illness, which is caused or worsened by working in the construction industry. This is especially true where workers are working on site which exposes them to dangerous conditions in their direct environment. On the long run, if not properly prevented, this can cause weakening of the worker's immune system. This makes workers more susceptible to infections and diseases. Tuberculoses and HIV/AIDS are very common amongst construction workers, and may be caused by environment in which they have to live and work. These conditions are very serious and have been found to be made worse by working on a construction site. Even common colds or flu can be very dangerous and affect the workers performance if he/she has a weak immune system. The research showed that the end result is simply that construction is a very risky business which is severely dangerous to human health. The question has been answered and the hypothesis has been supported, construction has severe affects on human health. Another important question that was answered and hypothesis that was confirmed, is that the risk of injury or illness does increase with age under construction workers.

7.3.4. Conclusion of the fourth chapter (third sub-problem)

The third sub-problem that was dealt with was the effectiveness of policies and procedures that are being used to govern the effects that construction has on human health. This question was then further broken up into questions which could help in answering this sub-problem.

The research in this chapter indicated that there are organisations which could make a difference. The negative effect that construction has on human health is a very big problem and organisations need to put a much bigger effort into fixing this problem. Some organisations like CANSA do have the means to make a difference, but their focus is currently not on the construction industry. They can play a big role in preventing poor health in construction. Especially in making workers aware about the dangers of excessive sun exposure and the importance of sun-block. They just need to focus more on construction specifically.

Legislation in South Africa is also a key in preventing poor health under construction workers. Legislation alone cannot make the difference, it is the tool that helps in making the difference, but it is not enough. Every individual has to make sure that they participate and do their share in helping to make construction a healthier place to work in and also to live around. Companies, employers and employees should each play their role. Legislation is adequate, but there is room for improvement. The fines that can be charged to employers who do not provide their workers with a safe working environment has to be raised quite a bit and the claims that employees can make to compensate them for being injured or disabled has to also be increased. The capitalists have to ask themselves if it is really worth saving a little bit of money or saving a life. With more money, legislation and the implementation thereof can be improved as well as the capabilities and resources of organisations like CANSA. A human life is invaluable, but the capitalists of this world only care for money, no matter the cost. These people must be better governed and kept in place by more effective implementation of the already effective legislation. The question has been answered and the hypothesis has been supported in this chapter. It is absolutely true that in some cases the effects that construction has on human health are avoidable to some extent and the reason for this being that no matter how well the rules are

written, without implementation they mean nothing and most of the times implementation is the most difficult thing to enforce.

7.3.5. Conclusion of the fifth chapter (fourth sub-problem)

The fourth sub-problem that was dealt with was about how South African safety standards and measures compare with international standards. This question was then further broken up into questions which could help in answering this sub-problem.

Health and safety standards differ from country to county. The safety standards in South Africa are adequate, especially the ones that are being used in construction. There is however some standards that are being used in South Africa, that can be improved. These standards can be significantly improved by looking at the standards which are being used in countries like Australia. The standards that are being used in Australia are much stricter than the ones we use in South Africa. They also regulate the implementation of their health and safety regulations and legislation much more efficiently. In many ways our standards do not measure up to the standards that are being used in Australia. The health and safety standards and procedures of Australia were used for the international comparison. The conclusion was that our standards do not compete with the best standards internationally. The Australian health and safety standards were looked at separately in this chapter and not directly compared to the South African standards. The information in this chapter was however compared to findings made on South African health and safety standards and procedures in previous chapters. When this chapter was compared to previous chapters, it could clearly be seen that South African health and safety standards can be improved. Safety measures taken in Australia are serious, whereas in South Africa the implementation thereof was lacking. If health and safety in Australia is not properly adhered to and managed, one or two recurring incidents may cause the downfall of a company. This is because it is a requirement in order to be awarded a tender to have a good Health and Safety record. This is not the case in South Africa, where companies can get away with a lot more incidents and still manage to stay in business. Like in South Africa, Australia also has harsh natural environments, especially on the mines in the outback, where construction worker

have to work in the sun. Australian measures to control and manage the exposure of workers to hazardous elements are much stricter. South Africa can learn a lot from Australia with regards to health and safety, in order for us to improve our standards. South Africa can especially learn from the implementation of these measures in Australia, to minimize risks, since rules are nothing if not properly and effectively implemented. The question has been answered and the hypothesis supported. The fact that South Africa does have good standards for health and safety in place has been proven and supported by the previous chapter. This chapter challenges that finding by going further and comparing the South African standards to the standards and methods currently used in other countries like Australia. In this comparison the hypothesis has been proven for this chapter that although these standards are more than adequate, they can be improved and made stricter.

7.3.6. Conclusion of the sixth chapter (questionnaire)

The questionnaire was sent to 20 construction workers and dealt with the first two sub-problems. The purpose of the questionnaire was to either support or challenge the findings on the first two sub-problems. These were ‘what the specific effects are that construction has on human health’ and ‘how severe are these health effects’. It also focused on directly answering the main problem. The data was then quantified in order to draw conclusions and relating them back to the questions asked.

The data received from the recipients clearly indicates that construction influences the health of construction workers. Some factors like being physically inactive can make it worse. The environment on a construction site makes construction workers more susceptible to injuries and poor health. In many cases these workers do not only work in these harsh environments, but they also have to live on site in these conditions. This means that construction directly contributes to their ill health. The data received as feedback from the respondents, answers the main problem of whether or not construction does influence the health of humans. The answer is that construction does influence the health of construction workers on site. The influence on humans surrounding construction sites, but not directly working on site is somewhat unknown and could not be answered. The hypothesis of the sub-problems was partially supported by the research and the data indicates that construction does

have a negative influence on the health of construction workers, although the influence on the general public has not been supported or answered.

7.3.7. Final conclusion to the main problem

Four sub-problems in a literature study and data gathered from a questionnaire was used to relate back to the main problem in order to for it to be answered. These questions were asked in order to answer whether or not construction influences the health of humans and if these health effects of construction can be avoided or at least managed properly.

It has clearly been found in the research that construction does influence the health of humans. There are significant amounts of fatalities caused by construction. Construction has been found to be the industry with the highest number of incidents of all industries. These incidents included less serious or temporary injuries or illnesses up to disabilities and fatalities. Every respondent on the questionnaire that has been working on a construction site for at least more than two years has had their health influenced in a negative way by construction. It was clear to see that the health condition of these construction workers were as a result of working on a construction site. This means that construction does have negative effects on human health.

The number of hazards and problematic health effects that were found also indicates a very dangerous work environment. Some of these hazards or problems included noise; being struck by something; falling from heights; being crushed; cuts; burns; back problems; joint problems; bone problems; lung problems; blindness and eye problems; skin problems; cancer; electrocution; exposure to toxic materials and chemicals etc. These findings alone show that construction is a very dangerous industry. In the literature study, construction has also been found to have negative effects on the environment through toxic waste. Construction pollutes the air and water in its surrounding area, which is a serious health risk for humans. Without a healthy environment humans cannot survive or live healthily. The statistics showed that the construction industry was one of the largest contributors to toxic waste, which means that indirectly in influences the health condition of all humans.

All of the sub-problems were answered and hypotheses were either fully supported, or supported to a large extent. This means that the main problem has also been answered and supported.

The answer to the first sub-problem was that there are many specific and very dangerous health effects that construction has on human health, which if related back to the main problem means that construction does have a influence on human health. The answer to the second sub-problem was that the health effects that construction has on human health can be very severe or even fatal. This relates back to the main problem in the sense that the severity of health effects indicates that the influence of construction on human health is a serious problem and worth looking at. This then concludes that construction does have a significant influence on human health. The third sub-problem was the effectiveness of legislation and the influence that organisations can play in managing the effects that construction has on human health. It has been found that the implementation is in place, but the implementation thereof is lacking. This could be related back to answer the main problem in the sense that if strict legislation is in place, it shows that construction does have a severe effect on human health and if strict legislation is not in place it shows the reason why and that construction would as a result have negative effects on human health. The answer to the fourth sub-problem was that the health and safety standard in South Africa are adequate, but not up to international standards. This relates back to the main problem in the sense that if construction internationally has high standards for health and safety, it means that construction does pose a threat to human health and definitely does affect the health of humans; otherwise no strict standard would have been in place. The research indicated that construction does have a serious effect on human health in South Africa, which could be the result of poor implementation of health and safety standards in South Africa if it is compared to international standards.

The research and above conclusions indicate clearly that construction does have an effect on human health.

7.4 Recommendations for further research

The conclusions that have been reached led to some recommendations for further research.

In this study it has clearly been identified that there is a need for further research. Further longitudinal research can be undertaken to determine the effectiveness of the preventative role that the Government plays in the prevention of poor health under construction workers. Best practice in health and safety on and around a construction site for both employees and employers can be looked at in more detail. Requirements for fitness for duty can also be researched even further and a stronger focus can be put on the difference that construction has on people living in an urban, township or rural area. The health impact that it has on different income groups can also be researched. The research from the questionnaire was mostly focused on construction workers; the research can be expanded to include people not working directly on a construction site but whose health may be influenced negatively by construction. Lastly there is a need for further research to determine the international comparison of South African regulations and standards in more countries than just Australia.

Recommendable resources for possible further research:

- The Protection of Workers' Health Series - Silica
- Guidance Notes on Protection of Quarry and Construction Workers from Silicosis
- Respirator for Silica Dust
- Code of Practice for Control of Lead at Work
- Code of Practice on Safety and Health at Work with Asbestos
- Health Hazards of Welding
- Code of Practice on Safety and Health at Work in Confined Spaces
- The Protection of Workers' Health Series - Solvent
- Prevention of Occupational Dermatitis - Guidelines for Employers and Employees
- The Protection of Workers' Health Series - Respiratory Protective Equipment
- Guidance Notes - Factories and Industrial Undertakings (Noise at Work) Regulation
- http://www2.worksafebc.com/portals/construction/Statistics.asp
- http://www.worldculturepictorial.com/blog/content/air-pollution-lethal-earth-ecosystems-7-major-pollut

- http://ecologic.eu/3749
- http://www.world-nuclear.org/education/wast.htm
- http://www.centerforsustainability.org/resources.php?category=5&root=176
- http://www.citywindsor.ca/residents/environment/Environmental-Master-Plan/Goal-C-Green-Windsor/Pages/Pesticide-Use-Indicator.aspx
- http://www.docstoc.com/docs/594455/human-health-effects-of-untreated-sewage-discharges#
- http://www.vbgov.com/government/departments/housing-neighborhood-preservation/homeowners/pages/green-building.aspx
- http://www.sciencedirect.com/science/article/pii/S0360132308000450
- http://www.annualreviews.org/doi/abs/10.1146/annurev.environ.033108.102650
- http://www.claimsjournal.com/news/national/2012/05/29/207542.htm
- http://www.masterbuilders.com.au/informationsheets/effects-of-a-carbon-price-on-building-and-construction
- http://www.sitra.fi/en/construction
- http://www.elcosh.org/en/document/1222/d001097/green-jobs%253A-safety-%2526-health-outlook-for-workers-a-view-from-under-the-hard-hat.html
- http://www.bls.gov/news.release/cfoi.nr0.htm
- http://www.civils.org.za/Portals/0/pdf/pa/pa-md-2005.pdf
- http://www.newstouse.org/new-statistics-show-that-the-construction-industry-is-anything-but-safe/
- http://www.axisantislip.co.za/facts.html
- http://www.randwater.co.za/CorporateResponsibility/WWE/Pages/WaterPollution.aspx
- J S Damtoft *et al*, *Cem. Concr. Res*., 2008, 38,115 (DOI:10.1016/j.cemconres.2007.09.008)
- K L Scrivener and R J Kirkpatrick, *Cem. Concr. Res*., 2008, 38, 128 (DOI:10.1016/j.cemconres.2007.09.025)

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ANNEXURE A:

CONSENT FORM USED IN STUDY

CONSTRUCTION WORKER MEDICAL CONDITION SURVEILLANCE CONSENT FORM

Dear researcher,

I have had the aims of the research explained to me, and I agree to voluntarily undergo a medical examination in order to participate in the research study titled 'The influence of construction on human health'. I understand that all findings are for research purposes only and will be kept highly confidential.

Construction workers signature:

_____

Date:

_____

Researchers signature:

_____