

TITLE

A Comparative Study of Responsible Care and ISO 14001 as an Effective Environmental Management System in the Chemical and Allied Industry in South Africa.

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Abstract

With the ever increasing promulgation of environmental legislation in recent years in South Africa, enforcement of these laws is a threat to the chemical and allied industries. In order for these industries to secure operating licences and facilitate international trade, the need for environmental management systems has become imperative.

South Africa, being behind the rest of the first world countries in adopting Environmental Management Systems(EMSs), had only recently in the 2000s started to realise the importance of the EMSs in ensuring environmental legal compliance and increasing trade across barriers. The chemical and allied industries chose to adopt Responsible Care and ISO 14001.2004 in South Africa.

ISO 14001.2004 is an international standard and Responsible Care is a standard that was developed by the Canadian Chemical Producer's Association and is used in numerous countries around the world. This study was undertaken to determine whether implementing and running two EMSs in organisations is necessary and if both standards add value. The reason for the study is that both EMSs have similar requirements and the same objective in ensuring environmental legal compliance and reducing the environmental impacts of the industry.

The study was conducted via a questionnaire which surveyed organisations that had implemented both EMSs. Various questions were asked on the benefits and challenges of the EMSs implemented and results were analysed via SPSS (Statistical Packages for the Social Sciences).

Both EMSs had similar objectives in increasing legal compliance and ensuring that the environmental objectives of the organisation were met. From the results it could be concluded that ISO 14001 was a preferred standard in the South African chemical industry due to its recognisability, ease of implementation, ability to be exported and flexibility although it was an EMS that was more expensive to implement. Industries however, agreed that both systems did add value and the time, money and resources invested in having two EMSs were justified. This could be attributed to the fact that Responsible Care covered Product Stewardship, Community Interaction, Process

Safety and Health and Safety. The recommendation is that the South African chemical industry could look at adopting an integrated Responsible Care 14001 which is an amalgamation of the two EMSs.

Attestation

I understand the nature of plagiarism, and I am aware of the University's policy on this. I certify that this dissertation reports original work undertaken by me during my University project, except for the Literature Review where work not written by myself has been referenced.

Acknowledgements

I would like to express my gratitude to my supervisor Mr. Johnny Lutchmiah for his guidance and valuable insight which allowed me to complete my studies. Appreciation to Protea Chemicals KZN-the company I am employed by-who provided a bursary for my studies. Thanks to my husband, Sanjay for the continuous support and my son Ayush to whom I hope to be an inspiration.

Glossary

ACC-American Chemistry Council

AECI-African Explosives and Chemical Industry

AFNOR-Association Francaise de Normalisation

BS-British Standard

CAIA-Chemical and Allied Industries Association

CCPS-Canadian Chemical Producer's Association

CEFIC-European Chemical Industry Council

CEO-Chief Executive Officer

EMAS-Eco-management and Audit Scheme

EMS-Environmental Management System

GATT-General Agreement of Trade and Tariffs

ICCA-International Council of Chemical Associations

ISO-International Organisation of Standards

NEMA-National Environmental Management Act

QIP-Quantitative Indicators of Performance

REACH-Registration, Evaluation, Authorisation of Chemicals

SABS-South African Bureau of Standards

SAGE-Strategic Advisory Group on the Environment

SANS-South African National Standards

SASOL-South African Synthetic Oil Liquid

SA-South Africa

SHE-Safety, Health and Environment

SMME-Small, Medium and Micro Enterprises

SPSS-Statistical Packages for the Social Sciences

SQAS-Safety and Quality Assessment System

TREC-Transport Emergency Cards

UK-United Kingdom

UNCED-United Nations Conference on Environment and Development

US-United States

Vs.-Versus

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CHAPTER ONE: Introduction and Contextualisation of Problem

1.1 Preamble

Chemical manufacturing industries, globally, have been in existence for many centuries. Dyes, fragrances, flavourings and medicines were originally extracted from plants while fats from animals served as the primary ingredient in soap making and leather preservation. The post-industrial revolution period witnessed an unprecedented demand for the stated products and industries as a result, were required to increase production on scales of economies. Concomitant, with population growth and urbanisation, was the growing need for housing, clothing, food and transport by communities the world over. This, subsequently, gave rise to a greater need for the manufacture of chemicals. The chemical industry began in South Africa (SA) in 1896 due to the mining industry's need for explosives Available from www.caia.co.za. (Accessed on 28 March 2013). The following is an adapted history of the chemical industry in South Africa from Booth, 2010 cited from the Chemical and Allied Industries Association (2010).

- The major chemical companies to emerge in SA, at a very early stage, included AECI (African Explosives and Chemical Industry), Sasol (South African Synthetic Oil Liquid) and Dow Sentrachem. AECI was formed to manufacture explosives for the mining industry, with subsequent diversification into fertilizers, paints, insecticides and the manufacture of various other chemicals. The latter, once again, was due to the demand from the various sectors of the economy.
- AECI currently is composed of African Explosives Limited (Ltd.) and Chemical Services, the speciality chemicals arm with a portfolio of twenty independent businesses focussed on specific markets.
- Sasol began in 1950, erecting the first plant in Sasolburg, producing petrol, liquefied petroleum gas, waxes, oils and diesel. Due to the elevated need for more oil the second Sasol plant was commissioned in 1980.
- The Dow Sentrachem company started in 1967. This company focussed on the manufacture of alcohols, ketones, acids, esters, carbon dioxide gas, mining froth-flotation reagents, phthalate plasticisers, synthetic resins and animal feed

supplements. Over the years, Dow Sentrachem's profitability was affected by competition. This company, subsequently, has been reduced to a single company called Dow Agrosience.

The chemical industry's 100 year existence in SA has been influenced by the demand for explosives by the mining industry, the abundance of relatively cheap coal and the political and regulatory climate which shaped the industry between 1944 and 1994. This resulted in numerous small scale plants being commissioned in order to meet the local demands for the major petrochemical and synthetic-fuel organisations. Post 1994 with South Africa however, now being able to compete in the global markets, the demand for compliance and corporate governance became a priority for many of the major chemical industries in the country (Booth, 2010).

1.2 Contextualisation of Problem

The chemical industry, globally, is an industry that is a one extremely high risk and accidents can have catastrophic consequences. The following incidents, reported by Brice (2008) which occurred globally over the decades have necessitated the need for companies to have formal systems in place to mitigate these risks:

- *Oppau, Germany-September 21, 1921*

Workers at the BASF (Baden and Aniline Soda Factory) plant in Oppau decided to use explosives to break up ammonium nitrate and ammonium sulphate that had solidified. This caused the death of more than 500 people and resulted in a massive 125 metre crater.

- *Texas, United States (US)-April 16, 1947*

A French ship was being loaded with ammonium nitrate fertiliser when it caught alight. The steam, used to extinguish the fire, caused the ship to explode killing 576 people and injuring 3500 people.

- *Texas, United States-March 23, 2005*

A series of explosions occurred when a hydrocarbon isomerization unit was restarted and a distillation tower became flooded with hydrocarbons. 15 people were killed and 180 injured.

- *Jilin City, China-November 13, 2005*

A nitrobenzene tower had reached high temperatures causing an explosion that killed 5 and injured 70. The local water supply was contaminated together with rivers that lead to Russia.

- *Flixborough, UK-June 1, 1974*

A cyclohexane vapour explosion resulted in deaths of 28 people causing 36 injuries. This led to the creation of new legislation viz. the Health and Safety Act in the UK.

- *Seveso, Italy-July 10, 1976*

At a company called ICMESA, a reactor overheated and exploded causing a toxic cloud of 2, 4, 5-trichlorophenol to spread to the densely populated town of Seveso. This resulted in the compilation of the “Seveso 2 Directive” which called on companies to mitigate their safety, health and environmental risks.

- *Toulouse, France-September 21, 2001*

An ammonium nitrate explosion in 2001 resulted in the death of 30 people and caused 10000 injuries at the Antoine’s Grande Paroisse fertilizer plant.

- *Schweizerhalle, Switzerland, November 1, 1986*

Water, used to fight a chemical fire at Sandoz, caused severe pollution of the river Rhine and killing an estimated 500 000 fish. This highlighted the need for anti-pollution legislation.

Incidents such as those above, and several others over the years in the chemical industry, forced the chemical industry to devise formal and structured measures to prevent fatalities and protect the environment from pollution. The most catastrophic incident, however that forced the chemical industry to formulate and implement systems to mitigate their risks was the Bhopal tragedy of India in 1984. “A gas leak at US-based Union Carbide’s pesticide plant in Bhopal, India, is cited as one of the chemical industry’s greatest tragedies. On December 3, 1984, methyl iso-cyanate gas leaked from the facility during the early hours of the morning while local residents slept. This disaster led to the death of an estimated two thousand people with numerous unborn children suffering severe birth defects” (Brice, 2008:1).

1.2.1 Developmental of environmental legislation

Environmental legislation and formal systems to manage environmental impacts were well established in most first world countries long before 1994. Prior to the advent of democracy in South Africa in 1994, environmental legislation had been fragmented by

the different laws and statutes in the former homelands, provinces and various municipalities of the Apartheid State (Brauteseth, 2010).

The Constitution of the Republic of South Africa (1996) has, since its promulgation, become one of the primary sources of environmental law in South Africa. Following the promulgation of the National Environmental Management Act (NEMA) 107 of 1998, amended in 2009, in South Africa and the entrance of South Africa into the global market, compliance with environmental laws has become imperative. The 1980's and 1990's witnessed the emergence of environmental legislation, environmental codes of practice and International Standards Organisation (ISO) standards. Environmental legislation both in South Africa and internationally, has become overwhelming. In order to ensure a method of continuously complying with legislation and in order to avoid fines and penalties, many organisations in the chemical industry now seek, adapt and implement an effective Environmental Management System (EMS).

1.3 The Need for Environmental Management Systems

1.3.1 The emergence of ISO 14001

“An EMS is a set of management tools and principles that is intended to help organisations integrate environmental issues into the conduct of their daily business. An EMS is designed to guide an organisation in allocating resources, assigning responsibilities and continually evaluating its practices, procedures and processes in order to enhance environmental management” (Gibson, 2005:25). An EMS allows an organisation to manage its environmental programme in a systematic, planned and documented method. An EMS for a chemical organisation allows the organisation to deal with its environmental issues in a holistic manner by ensuring regulatory compliance and sustainability. The benefits of an effective environmental system as outlined by Staib (2005) are summarised as follows:

- It provides a structured and systematic approach to compliance with legislation;
- It provides legal protection against prosecution;
- An Environmental Management System is a tool to identify future environmental changes;

- An environmental management system enhances a better corporate image of the organisation. This is valuable for its employees and neighbouring communities;
- There are lower insurance premiums;
- There are lower operating costs due to reduced pollution and waste minimisation; and
- There is improved data management and proper record keeping which allows for ease of information retrieval for external reporting.

An EMS, in the context of the above, can therefore be viewed as a basis for taking the organisation to a performance beyond compliance and perhaps towards sustainability.

As American and European companies began to formalize their approach to pollution prevention, the EMS movement emerged (Watson *et al.*, 2004). In 1992, at the United Nations Conference on Environment and Development (UNCED), Agenda 21 and the Rio Declaration articulated the need for EMSs. There are numerous EMSs that have been developed worldwide such as the Responsible Care Programme which was initiated by the Canadian Chemical Producers Association (CCPS); Charter, the requirements of the International Chamber of Commerce; the International Organisation for Standardization's ISO 14000 series and the Environmental Protection Agency's Merit programme (Germain *et al.*, 2011). An EMS has a pro-active approach that assists a chemical company to prevent non-compliance and improve the health and safety of the workplace for the employees and the public. One of the earliest EMSs was Responsible Care which began in 1988, followed in 1990 by the Strategies for Today's Environmental Partnership programme that was started by the American Petroleum Institute (Watson *et al.*, 2004). The French had developed the AFNOR (Association Francaise de Normalisation) X30-200 and the British had developed the BS 7750 EMS. In 1993 the European Union developed the Eco-Management and Audit Scheme (EMAS) which was used at various companies (Watson *et al.*, 2004). This resulted in the need for an EMS that would be standardized globally resulting in the development of the International Organisation of Standardisation (ISO) 14001.

At present, the two most recognised standards used internationally are the ISO 14001 and Responsible Care. In South Africa the Responsible Care programme is managed

by the Chemical and Allied Industries Association (CAIA) whilst the ISO 14001 series is under the jurisdiction of the South African Bureau of Standards (SABS). In 1987, the United Nations World Commission on Environment and Development published, „Our Common Future“, a report which first used the term „sustainable development“ and called on the industry to develop effective EMSs (Watson *et al.*, 2004). The United Nations Conference on Environment and Development (UNCED) was convened in Rio de Janeiro in 1992. Two major documents emerged from this conference, Agenda 21 and the Rio Declaration, which put forth a set of 27 principles for achieving sustainable development. Article 30.10 of Agenda 21 states that “business and industry, including transnational corporations, should be encouraged:

- a) to report annually on their environmental records as well as their use of energy resources; and
- b) to adopt and report on the implementation of codes of conduct promoting best environmental practice, such as the International Chamber of Commerce’s business charter on sustainable development and the chemical industry’s Responsible Care initiative” (Watson *et al.*, 2004).

In 1991, during the preparation for the Earth Summit, the International Standards Organisation formally established the Strategic Advisory Group on the Environment (SAGE) to develop recommendations regarding international standards for environmental management (Watson *et al.*, 2004). The members of SAGE called for the development of an EMS. In 1996, the ISO 14001 EMS was developed and published globally (Watson *et al.*, 2004). On 19 November 1996 the SABS formally launched the ISO 14001 standard in South Africa. This standard has been embraced by chemical companies in South Africa and to date approximately over 300 companies have been certified against the ISO 14001 standard. “ISO 14001 represents a new approach to environmental protection. It challenges each organisation to take stock of its environmental aspects, establish its own objectives and targets, commit itself to effective and reliable processes and continual improvement, and bring all employees and managers into a system of joint and enlightened awareness and personal responsibility for the environmental performance of the organisation. In an attempt to avoid the adoption of punitive measures a new model that relied on positive motivation was developed. Over the long term, it promises to establish a solid base for dependable, consistent management of environmental obligations. ISO 14001 provides a framework to direct the use

of organisational resources to the full breadth of real environmental impacts through reliable management processes and a base of educated and committed employees” (Gibson, 2005:26).

“ISO 14001 is designed to facilitate trade. The standard is voluntary and will accommodate any organisation regardless of size, type or location” (van der Veldt, 1997). It is organised in such a way as to afford organisations with EMS elements that can be incorporated into other management requirements to help attain environmental and financial goals (van der Veldt, 1997). “Clearly, some companies have implemented EMSs at the request of major clients” (Gibson, 2005:27). Subsidiary companies, for example that supply the automobile manufacturers with certain products have had to implement environmental management systems as a condition to sell to carmakers (Gibson, 2005). Other companies have chosen to implement ISO 14001 because they were impressed with the results achieved from the adoption and implementation of ISO 9001, the internal quality standard. ISO 14001 improves environmental performance at the facility level because that is where the compliance requirements are most evident and the facility is required to ensure compliance (Gibson, 2005). It is an international standard that permits organisations to focus on environmental issues in terms of internationally recognized criteria. Companies, apart from being able to meet with legal compliance, can also compete in the global market (Belleli *et al.*, 2005). Increasingly, in the international market, a company needs to be capable of demonstrating sound business acumen. An EMS, such as ISO 14001, when properly implemented provides a flexible tool that has the potential to improve environmental performance for organisations of various sizes, particularly in countries where enforcement of legislation is weak (Belleli *et al.*, 2005).

1.3.2 The Emergence of Responsible Care

Numerous catastrophes, across the world, from the 1920s to the 1970s resulted in the chemical industry being portrayed as a major risk to human lives. The Union Carbide incident occurred in 1984, killing thousands of civilians in India. This placed the Canadian chemical industry in a dilemma as companies stood to lose operational licenses due the Union Carbide incident which received international media attention. At this point in time there were no EMSs in place to mitigate safety, health and environmental risks. This dilemma foreshadowed a dramatic change in operations as safety, health and environmental issues assumed paramount importance (Prakash and Potoski,

2006). The industry decided to adopt a sustainable and progressive resolution to the problem which culminated in the form of an environmental management system *viz.*, Responsible Care (Belanger *et al.*, 2009).

In 1988 the Canadian Chemical Producer's Association (CCPA) presented the Responsible Care programme to the United States Chemical Manufacturers Association (now the American Chemistry Council) and it was adopted by that association. The International Council of Chemical Associations (ICCA) was formed soon after and became the custodian of Responsible Care globally (Belanger *et al.*, 2009). In 1994 CAIA launched Responsible Care in South Africa. This was in response to public concerns about the manufacture, storage, transport, use and disposal of chemicals. CAIA currently has 162 company members, 149 of which are signatories to Responsible Care. Fifty-five of these companies have both EMSs, ISO 14001 and Responsible Care (CAIA). Chief executives of member companies are invited to sign a set of guiding principles pledging their company to make health, safety and environmental performance an integral part of overall business policy. Adherence to the principles and objectives of Responsible Care is a condition of membership to the Chemical and Allied Industries Association. „The guiding principles of Responsible Care, as outlined by (Prakash and Potoski, 2006:85) require companies to:

- “Conform to statutory regulations;
- Operate to the best practices of the industry;
- Assess the actual and potential health, safety and environmental impacts of their activities and products;
- Work closely with the authorities and the community towards achieving the required levels of performance; and
- Be open about activities and give relevant information to interested parties”.

Responsible Care started off in the early 1980s as a one page statement of principle it has now “evolved into a set of codes, verification processes, visible performance measurement and a deeper understanding of the principles first stated” (Belanger *et al.*, 2009). EMSs, such as ISO 14001 and Responsible Care, are voluntary systems and environmental legislation does not mandate these standards. EMSs are tools that enhance environmental performance and environmental legal compliance.

1.4 Rationale for the study

Responsible Care and ISO 14001 were introduced in the mid-1990s; in the wake of the 1994 democratic elections in South Africa. Numerous organisations in the chemical and allied industry have subsequently adopted these two EMSs. The mid 1990s was a time of radical change and the focus on better environmental practices made chemical companies in South Africa realise the need for management of their environmental impacts. There seems to be duplication of environmental management systems in this industry as some of these industries implement two environmental management systems *viz.*, ISO 14001 and Responsible Care. There are similarities between the two standards and there are differences. This study is a comparison of both standards and highlights the benefits and differences of the standards in the South African chemical industry. The study also focusses on the necessity of an amalgamation of the two standards. The focus, *inter alia*, will be on effectiveness, simplicity and popularity within (chemical manufacturing industries) and outside organisations (major clients).

1.5 Aim and Objectives

1.5.1 Aim of the Study

The aim of this study is to undertake a comparative assessment of the operational characteristics and efficacy of the two EMSs, ISO 14001 and Responsible Care currently used in the chemical and allied industry in South Africa.

1.5.2 Objectives of the Study

- *To study the characteristics of the two main EMSs used in the chemical industry of South Africa: the ISO 14001 and the Responsible Care Management Systems;*
- *To assess the relative levels of efficacy of the Responsible Care and ISO 14001 standard in achieving environmental objectives and compliance to environmental legislation;*
- *To determine which of the two standards is more popular within the chemical industry and which has received greater acceptance;*
- *To determine whether ISO 14001 or Responsible Care adds value to the business as a whole;*

- *To determine the benefits and challenges of implementing ISO 14001 and Responsible Care.*

1.6 Chapter Sequence

The introductory chapter of this investigation contextualises the problem to be researched with a rationale for such a study as well. The overall aim, objectives and rationale for the study are also highlighted. Chapter two will provide the reader with a comprehensive literature review of the two EMSs *viz.* ISO14001 and Responsible Care. Strengths, weaknesses and cases studies will feature prominently in this part of the study. A detailed description of study area and research methodology to be implemented will serve as primary area of focus in chapter three. The emphasis, in the penultimate chapter, will focus on results obtained from the implementation of the methodology described in chapter three and the subsequent analysis of the data. Tabulations and graphs will be employed to depict the results. The fifth and final chapter of this investigation will constitute a discussion of the results, recommendations and an overall conclusion to the study.

1.7 Conclusion

This first chapter focusses on the history of EMSs and the reason for the emergence of EMSs. As industrialisation grew, the chemical industry began to emerge to meet the ever increasing demands of urbanisation. With the emergence of the chemical industry, there were various catastrophic incidents around the world as the industry focussed on production instead of engineering controls that addressed safety, health and environment issues which were not commissioned into these facilities. As the impact of lives and the environment became of paramount importance in the chemical industry, formal EMSs began to emerge in order to address these incidents. Numerous EMSs had emerged across the world and first world countries were quick to adopt these standards. With South Africa being isolated from the global markets, the promulgation and gazetting of environmental laws took prominence after 1994 which then saw the introduction of ISO 14001 and Responsible Care in the South African chemical industry. These EMSs were implemented to ensure legal compliance, compete in global markets, to ensure sustainability and promote a better corporate image.

CHAPTER TWO: Environmental Management Systems-A Theoretical Review

2.1 Introduction

EMSs, historically, date back to the eighteenth and nineteenth century industrial revolution. The formulation and implementation of environmental laws and regulations commenced in the 1970s. This was a consequence of “widespread concern for environmental protection emerging dramatically with the advent of the industrial revolution. Public outcries over smoke pouring from the stacks of coal burning factories, along with the eventual expansion of the petroleum industry, led to an early foothold for the environmental movement” (Culley, 1998:13).

Voluntary codes of practice were the first type of EMSs in the industry. The enforcement of regulations compelled companies to adopt EMSs in the early 1970’s. During this period, industries were experiencing a very high frequency of industrial accidents and, public pressure as a result escalated with calls for the industries to create an accident free environment for their employees as well as the environment at large. As both European and American companies began to review their approach to environmental control, the emergence of environmental systems was born. In Europe there was the emergence of the British Standard BS 7750 and the Eco-Management and Audit Scheme (EMAS). The objective was to have a common set of guidelines for voluntary EMSs. The early 1990’s also saw the emergence of the two international EMSs, ISO 14001 and Responsible Care. The implementation of ISO 14001 around the world continues today with over 111 162 companies, worldwide, being certified against the ISO 14001 standards (Cascio, 1996).

2.2 The Need for an Environmental Management System in South Africa

South Africa’s political ideology of apartheid, a system of government elected by the white minority, impacted significantly on the biophysical environment. Reference in this regard can be made to land degradation in the former homelands, soil erosion due to farming methods, stripping of forests due to the need for fuel wood, over population in homelands, lack of sanitation in rural areas and reckless mining, these were all fac-

tors, as a result of apartheid, that contributed to the land's ecological degradation (Durning, 1995). Following the discovery of gold in 1886 in South Africa, the mining industry played a fundamental role in the country's economic, political and social environment (Adler *et al.*, 2007).

South Africa is one the major mineral producers in the world. It is first among countries in the production of gold, chromite and platinum. Mining, a source of income for South Africa, is a significant source of pollution. Some one hundred tons of waste is generated in the process of producing one ton of metal (Durning, 1995). The extraction of minerals involves blasting, digging and hauling thousands of tons of ore from several metres underground to the surface. This is followed by a process of crushing and grinding the ore into a fine powder form. Chemical substances that include cyanide, mercury and sulphuric acid are used to access the required metals from the powder. The remaining impurities, together with the said chemical substances, are thereafter released as unwanted effluent into waterways. Acidification of surface water and groundwater was a direct result of the discharge of effluents from mining activity. Sand dumps and sludge dams, resultant features from mining activities comprising of mining waste, can also be detrimental to the environment. Mining waste left in a heap topside, blows away with winds causing air pollution and run off into rivers causes pollution of waterways (Durning, 1995).

A study conducted by Adler *et al.*, (2007) indicated the pollution caused by the mining industry. A mine-waste site *viz.* Robinson Lake has been sold by a mining company to create residences and shopping complexes. Acid mine drainage has also contaminated the Cradle of Humankind, a world heritage site. Rivers around the Vaal region have shown significant levels of heavy metal pollution (Adler *et al.*, 2007). Non-compliance and lack of enforcement of environmental legislation was not unique to the mining sector. Manufacturing industries, very often, discharge untreated effluents into streams. Reference, in this regard, can be made to the discovery of toxic industrial solvents and effluents in a mud hut in a neighbourhood situated along the Mngeni River. The source of the waste products was a paint manufacturing company. Analysis of water samples, from the said river, revealed concentrations of mercury to be beyond that of acceptable levels. The "guilty party", in this particular instance, was a mercury waste processing company (Durning, 1995). Research conducted on water quality, with particular reference to Mercury levels in Inanda Dam, highlighted the gap

between theory and reality when it came to environmental legislation and practice. The results of the research indicate that two decades after the polluting incident involving Thor Chemicals the mercury levels in the dam still remain high (Papu-Zamxaka, 2010).

Municipalities, throughout South Africa, are experiencing problems relating to the demand for water-borne sewage systems for some eight million people living in informal communities. Defecation in shallow pit toilets, on banks of rivers and open spaces is a common feature in these communities. Raw sewage especially, after rainfall events, is transported into rivers resulting in a significant decline in water quality. Most of these communities, in their quest for survival, destroy the very resource that sustains them. These communities are also dependent on water from streams for drinking, cooking, washing and bathing. Water, containing unacceptable levels of raw sewage, can lead to a breakout of waterborne diseases that include cholera, typhoid and gastroenteritis. At least 50000 people, world-wide, die each day due to waterborne diseases. There is little information on water-borne diseases in South Africa but it does not mean the situation is different (Grabow, 2007).

There are various industrial polluters in South Africa. In the South Durban Basin region there are refineries and various chemical companies that contribute to air pollution. Chemicals such as sulphur dioxide, hydrogen sulphide, benzene, toluene and xylene are emitted from the various industries. There have been numerous studies over the years showing the adverse health effects on the residents near these areas (Guastella and Knudsen, 2007). The South Durban Basin is the main manufacturing and industrial zone of the city of Durban, contributing to 30% of the Durban's gross domestic product and 10% to the manufacturing jobs in South Africa (Ethekewini Municipality Online 2010). This area was created during the pre-democracy period and affected disadvantaged racial groups located in close proximity to industries engaged in the production of hazardous products and the discharge effluents and gases. These gases are detrimental to the health of communities as well as to the atmosphere (air pollution), soil (soil toxicity) and water (water pollution). (Adebayo *et al.*, 2012). The main pollutant in the South Durban Basin is sulphur dioxide which is emitted from the refineries. In addition to sulphur dioxide pollution, there is noise pollution, frequent leaks from oil pipes, pollution from vehicles, flaring of refineries and contam-

inated soil and water (Adebayo *et al.*, 2012). Communities, as a result living in the South Durban Basin region have been diagnosed with health problems which, *inter alia*, include cancer and asthma. After the adoption of the new constitution in 1994 which gave all South Africans environmental rights, the South Durban Basin Community Forum has actively protested against environmental pollution in the region, forcing the industry to comply with environmental legislation (Adebayo *et al.*, 2012). The mining industry in Mpumalanga has caused severe heavy metal pollution of the Olifants River which is detrimental to the marine life (Kotze, 1997).

Coal-burning power stations, in South Africa and large metal working plants are the principal air polluters. Acid rain, sulphur dioxide and vehicle emissions are a problem for South Africa. Marine pollution is also an area of concern with off-shore drilling, shipping activities and land factors such as storm-water run-off. The total amount of industrial waste discharged into the sea is 780 000 tons annually. Individual South African households generate one ton of waste annually. With the shortage of hazardous and legal waste disposal sites, together with lack of enforcement in South Africa, pollution continues to increase. Most waste is not treated effectively when disposed of in a landfill and a large proportion of hazardous waste is disposed of on land.

The above is an indication that environmental degradation, despite the presence of environmental legislation comparable to the best in the world, is still prevalent in South Africa. With the above mentioned examples of pollution resulting in severe environmental impacts the need for companies to control their environmental impacts in South Africa has become pertinent. “Demand for innovative and new solutions is varied but it will take a lot of time, money and effort to convince the authorities of the advantages of these alternative systems.” Available from <http://www.remburssi.org> (Accessed on 20 February 2012). “It is common knowledge today that the chemical industry contributes significantly to the high level of environmental pollution and health and safety hazards to employees and communities arising from either day-to-day operations or unexpected accidents” (Evangelinos *et al.*, 2010:823). Gupta *et al.* (2002: 271-281) for instance argues that chemical accidents cause devastating impacts to the natural environment. “Chemical accidents depreciate the financial performance of the chemical industry, both directly on the stock value of the company responsible after an accident or indirectly, from the negative impact on the image and consequent-

ly the stock value of the whole industry” (Patten, 2003:83-94). To mitigate such risks, the chemical industry today chooses from a variety of EMSs.

Since the removal of sanctions, due to the demise of apartheid in South Africa, environmental aspects have become more important in all projects related to industrial development in South Africa. With the opening of the global market to South Africa, most companies are forced to pay more attention to environmental issues and when exporting to European countries, trading partners expect their counterparts to subject themselves to their stringent standards. Environmental compliance in South Africa, however is still at an early stage of development due to the lack of enforcement by the authorities and the reality that it is mainly the large corporates that implement EMSs, with small, medium enterprises still not being able to implement EMSs due to exorbitant costs and the lack of resources.

South Africa, consequently is still far behind first world countries when it comes to environmental compliance and technology. With stricter environmental legislation, companies are gearing towards improving environmental performance, enforcement in South Africa, however is slow. With the promulgation of environmental laws such as NEMA in 1994 chemical companies sought the adoption of EMSs to ensure compliance to South African legislation. The two EMSs that were introduced in South Africa have been Responsible Care and ISO 14001, designed in order to assist chemical companies to ensure legal environmental compliance.

2.3 Responsible Care

2.3.1 The History of Responsible Care

“In 1983, the Canadian federal government congregated to determine the future direction of the Canadian chemical industry (Belanger *et al.*, 2009:5). Twelve industry leaders, together with two major trade unions got together to determine the economic feasibility of the Canadian chemical industry. Some of the CEOs also questioned the public perception of the chemical industry. This perception from respondents resulted in the documentation of the guiding principles of Responsible Care. In December 1984, the catastrophic Bhopal incident resulted in an emergency CCPA convention. All members of the CCPA agreed that Responsible Care would be mandatory for their

chemical companies. (Belanger *et al.*, 2009:5). “At the time of the draft, legal counsel expressed fears that such a statement could lead to increased liabilities; however, eventually the draft statement was revised and approved by the Board of Directors of the CCPA” (Belanger *et al.*, 2009:6). The committee’s report was published in February 1984 and signed by all project members. It declared that the industry was a key and responsible industry and published for the first time the Statement of Guiding Principles, citing the Transportation Emergency Assistance Programme as a palpable example of the CCPA’s commitment to applying Responsible Care. The report stated that formal acceptance of the Guiding Principles, by all members of the CCPA, would be aggressively sought. (Belanger *et al.*, 2009).

Over the last 25 years, the American Chemistry Council (ACC), an organisation that represents over 90% of the chemical manufacturing industry in the US, has helped the chemical industry implement the Responsible Care Environmental Management System. Examples of the programme’s success include reductions of releases to air, water, land and major enhancements in the workplace and better community relations (Yosie, 2003).

2.3.2 Merits and Demerits of Implementing Responsible Care

Responsible Care is an international chemical industry initiative which calls on companies to demonstrate their commitment to improve all aspects of performance which relate to protection of health, safety and the environment. Demonstrating both commitment and improved performance is the key to obtaining and retaining public acceptance of the chemical industry (CAIA, 2010). The Responsible Care initiative began in Canada in 1985, and was later introduced in the U.S. to 1988. CAIA introduced Responsible Care to South Africa in 1994 (CAIA, 2010).

The objectives of introducing Responsible Care to South Africa were:

- To develop optimum and practicable goals for improvement in all aspects of the operation of the South African chemical industry which have the potential to impact adversely on the community and the environment;
- Increase communications and build credibility with all sectors of the community;
- Increase the relations amongst chemical companies by compliance with agreed management practice standards. (CAIA).

Under the custodianship of CAIA, and the guidance of the International Council of Chemical Associations (ICCA), Responsible Care is distinguished worldwide as a credible initiative that promotes maintainable development amongst its members (Booth *et al.*, 2010). “Responsible Care contains six codes with more than 100 specific management practices for tackling environmental problems in manufacturing, distribution and transportation and involves ten underlying principles developed for members of chemical associations” (Evangelinos *et al.*, 2010:823). The codes include community interaction, emergency response, pollution prevention, ensuring safety in the production process, guaranteeing safe distribution, reducing health and safety for employees and providing high quality of product stewardship (Evangelinos *et al.*, 2010). In addition to providing the necessary infrastructure to promote Responsible Care, CAIA has established a good affiliation with the national environmental and labour departments of South Africa and is therefore able to address the chemical industry’s needs. CAIA’s support efforts are channelled through Business Unity South Africa and the National Economic Development and Labour Council (Booth *et al.*, 2010).

The following list of advantages is outlined by Booth *et al.*, (2012):

- Membership of CAIA: This carries a number of benefits and gains in itself, through representing the industry at the strategy and governing level;
- Access to resources: Substantial resources are made available to signatories for training and development. This benefits small organisations;
- Improved efficiency: Signatories realise significant cost-savings through implementing efficient systems that, for example, save water and electricity;
- Keeping up with industry’s developments: Responsible Care keeps members up-to-date with new legislature and regulations-helping companies to ensure compliance with the law as a minimum standard, as well as new expertise and processes that improve throughput;
- Obeying international standards: In terms of international trade, Responsible Care is a strategy for growth and survival, making it possible for companies to attain world-class standards and comply with international requirements;
- Improved operations and cost savings: Implementing Responsible Care practice standards yields significant cost-savings and extra benefits by reducing

down-time and damage to plant and equipment due to safety incidents and absenteeism due to ill-health;

- Networking and knowledge exchange: Responsible Care provides for peer support, networking and the exchange of knowledge and information amongst companies through various workshops and forums, including those at an international level;
- Industry expansion and brand building: Responsible Care receives substantial publicity across the broadcast, electronic and print media, boosting public and stakeholder perception of the industry and its member companies;
- Risk minimisation and mitigation: The Responsible Care system of management practice standards, third-party verification and audit guidance acts as an early warning system to help prevent and mitigate incidents;
- Peace of mind: Responsible Care gives members of management teams peace of mind that they are doing everything possible to ensure that the chemicals they manufacture will be produced, stored, transported and used in a responsible and sustainable manner to minimise the risk of adverse consequences.

South African companies, which implement Responsible Care, benefit by remaining at the forefront of environmental technology as the membership to CAIA exposes these companies to the latest regulations of first world companies. They are also able to communicate *via*, CAIA, with the government regarding new regulations and standards. They have access to a network of companies from which they can learn best practices. They are also able to attend Responsible Care workshops and are exposed to topics from experts, nationally and internationally on topics that are pertinent to their industry (CAIA, 2010).

Business has taken a closer look at the role Responsible Care should play in advocacy efforts, with rising public pressure on the sector to take substantial steps to further reduce its environmental footprint and increase plant and product safety (Sissell, 2011).

Industry associations in the U.S., Europe and Canada have launched major reviews of Responsible Care and the outcomes, thus far, reflect a wide divide in regional challenges and solutions (Sissell, 2011). Some of the findings include creating a process safety performance indicator, security vulnerability assessments, and enhanced re-

source efficiency. The U.S. programme's biggest task is shoring up product stewardship as companies struggle to address downstream uses, exposure trends, and highlight other potential hazards. By contrast, the European Chemical Industry Council (Cefic), which represents more than 25 national federations indicates that product stewardship is among the least of its challenges, due largely to the European Union's Registration, Evaluation and Authorisation of Chemicals (Reach) law which in effect puts a government stamp of approval on industry's products-a process that poses significant challenges for industry (Sissell, 2011).

2.3.3 Features of Responsible Care

Responsible Care is designed to have a measurable impact on safety, health and environmental performance and the programme therefore binds members to implement a rigorous system that includes:

- Signing a voluntary Responsible Care public commitment at the highest level of the company;
- Implementing world-class management practice standards on an incremental level;
- Regular auditing of compliance with Responsible Care Management practice standards, allowing for continuous progress;
- Third-party verification of systems to ensure transparency and accountability;
- Measuring, monitoring and publicly reporting on performance indicators to benchmark the industry against global standards (Lindeque and Booth, 2011).

One of the key objectives of Responsible Care is to improve the public understanding of chemistry and public perception of the industry. The chemical industry is sometimes not well understood or well regarded due to its technical nature and associated hazards. For this reason, Responsible Care emphasises the importance of transparent and credible communication with the public and other stakeholders. The Responsible Care global charter was launched in 2006 by the International Council of Chemical Associations (ICCA), of which CAIA is a member. The charter has strengthened the initiative through a more harmonised approach to implementation of Responsible Care's guiding principle and core principles. The Charter has been signed by a number of international chemical companies, including those in SA, and is also supported by

CAIA. Companies must be members of CAIA in order to become Responsible Care signatories. The practical implementation of Responsible Care starts with a public signing ceremony where the CEO of the company makes a commitment to the guiding principles of Responsible Care (Lindeque and Booth, 2011). According to the latter authors, practical implementation of Responsible Care at site level takes place with the guidance of Management Practice standards documents which are discussed in detail below. The following discussion is a summary from the Responsible Care management practice standards.

2.3.3.1 Community Interaction

The purpose of the community interaction management practice standard is to build a good company image among the community. Companies which use Responsible Care as an EMS are required to provide non-confidential information pertaining to the company's environmental impacts on the neighbouring communities. Communities are engaged and are allowed to express their concerns around any environmental impacts that may have an adverse health effect on the community. The implementation of these management practice standards involves establishing active channels of communication with employees, the public and other stakeholders. The company will be required to establish a community interaction programme with objectives, targets and management programmes. Training on the community interaction programmes is required with monitoring after each public process and records are to be kept of each meeting (Responsible Care Management Practice Standard-CAIA, 2010).

2.3.3.2 Health and Safety

The purpose of this management practice standard is to protect the health and safety of employees, contractors and visitors on site. The organisation is required to have a full occupational health and safety programme. A full security system is needed to control entry and exit of all people at the work site. Risk assessments are needed to identify hazards and mitigation controls are put in place. Participation of workers is required when compiling risk assessments. Safe work procedures must be documented and all workers must be trained on these safe operating procedures. Health assessments are to be conducted based on job specifications. Emergency medical assistance must be provided for people at work sites for example first aid facilities. Occupational health and safety records are to be maintained and compliance is required with occupational

health and safety laws (Responsible Care Management Practice Standard –CAIA, 2010).

2.3.3.3 Pollution and Resource Efficiency

The purpose of this management practice standard is to prevent air, water and land pollution, waste minimisation and cleaner production. The standard promotes eco-efficiency and strives towards sustainability. A site environmental plan will be established to include identification of role players, scope, responsibilities and accountabilities, legislative requirements, environmental policy, training, communication, technology, equipment, air quality, waste resource management, resource efficiency and biodiversity. Pollution must be prevented and there must be measures in place for early detection of releases. There must also be compliance with environmental legislation. Emergency plans must be put into place to deal with environmental incidents. Waste management programmes must be in place. The use of raw materials and energy consumption and means of energy conservation and reduction of resource materials must be determined (Responsible Care Management Practice Standard-CAIA, 2010).

2.3.3.4 Emergency Response

An emergency response plan must be implemented to protect employees and the neighbouring communities. The employees and the community must be made aware of the hazards of the company operations which could have an impact on them. Risk must be assessed on an on-going basis to ensure continuous improvements to the emergency response plan. The names of responsible people for emergencies must be recorded in the plan. Risks, associated with the transportation of chemicals, must be assessed and specific risks surrounding incompatibility of products must be taken into consideration. The emergency response plan must also include all the risks on the transport routes. The emergency response plan must be tested for its effectiveness. Provision for participation of the community in the emergency plan must be included. All emergency response activities must be documented (Responsible Care Management Practice Standard-CAIA, 2010).

2.3.3.5 Management commitments

Responsible Care must be included as a key component of the business strategy. Responsible Care must be included in the key performance indicators of each employee. Employees must participate in the development and implementation of Responsible Care. Resources required for the implementation of Responsible Care must be provided by top management. A management review must be conducted to review the performance of Responsible Care as an EMS. Responsibilities for Responsible Care must be clearly defined. All employees must receive training on Responsible Care and there must be awareness of Responsible Care amongst all stakeholders (Responsible Care Management-CAIA, 2010).

2.3.3.6 Process Safety

The purpose of the code is designed to prevent fires, explosions and environmental incidents. Process Safety encompasses the design stage, operations, maintenance and training. The Process Safety Management system needs to be formally documented. The Process Safety code is divided into four elements that include:

Systems and Procedures and Technology

When designing new facilities, the concerns of employees and the public are taken into consideration. Proper incident investigation is required for all process safety related incidents. The Process Safety system needs to be audited. Safety needs to be incorporated into new designs. Documents such as diagrams and operating procedures for Process Safety equipment needs to be documented.

Facilities and Operations

Design, construction and maintenance of equipment must occur against recognised standards. Process Safety reviews must take place prior to commissioning. Documented maintenance programmes are essential. Procedures dictating the control of processes and equipment during emergencies must be put into place.

Personnel

Process Safety skills for employees must be determined and employees must be deemed competent. All employees must be trained on Process Safety (Responsible Care Management Practice Standard-CAIA, 2010).

2.3.3.7 Storage and transportation of chemicals

The objectives of the above management practice standards are to minimise and prevent incidents involving the storage and transportation of chemicals. Storage of chemicals must be in accordance with the relevant SANS codes. Responsible Care members use the CEFIC system Safety and Quality Assessment System (SQAS) in order to ensure compliance of their fleet. Documentation and labelling is a prerequisite for hazardous chemicals and this management practice advocates this. Compatibility of products during storage must be addressed. The community is entitled to storage and distribution information surrounding hazardous chemicals (Responsible Care Management Practice Standard-CAIA, 2010).

2.3.3.8 Product Stewardship

As a product moves from seller to buyer, the product becomes more remote from the producer. Product stewardship is the responsible management of risks and improvements of the performance of a product in the fields of safety, health and environment, during its entire life cycle. Product stewardship includes procuring, designing, manufacturing, marketing, distributing, storing, using, recycling and disposing of the product. Safety, health and environmental data on products such as material safety data sheets, transport emergency cards (TREC) and labels need to be maintained. During research and development of products, the safety, health and environmental aspects need to be taken into consideration. During plant design, construction and commissioning, the hazards associated with the risks and the mitigation processes need to be adequately assessed. The formal product stewardship programme needs to be monitored and improved via the management review process (Responsible Care Management Practice Standard-CAIA, 2010).

Assessment of compliance with Responsible Care procedures and progress in implementation is a thorough, on-going process, that takes place at several levels and includes:

- Self-assessment questionnaires: These are completed during the first two years of membership as a means of self-evaluation;

- Quantitative indicators of performance (QIPs): These are a set of measurable indices to be completed and submitted to CAIA annually for inclusion in the Responsible Care Annual Performance Report;
- Third-party verification: Verification of compliance is conducted every three years by trained Responsible Care auditors using the Responsible Care Audit Guidance documents; and
- Responsible Care Award: An annual award recognises and rewards companies for exceptional performance and is based on year-on-year improvements in QIPs with site visits to shortlisted entrants; (Lindeque and Booth, 2011).

Execution of Responsible Care is managed by national chemical industry associations. The associations, through the participation of their members in work groups, determine their priorities for their own Responsible Care programmes, development of guidance and of indicators of performance which are published through the national associations (Tapper, 1997).

Responsible Care is flexible in the way it can be adapted to the conditions facing the chemicals industry or its component companies. It outlines a set of principles that represent the core of the programme. It is however, up to national industry associations to agree on their priorities for implementing these principles, and then for each participating company to determine its priorities within the overall national framework (Tapper, 1997). The flexibility of Responsible Care allows businesses to work on the issues that they see as priorities, either because of the activities of the company, local circumstances, or other factors. It provides a structure within which to arrange management practices that, for the most part, are already established in any chemical company but which are often poorly documented (Tapper, 1997). Most companies, pledging to Responsible Care will already have documentation systems from which the performance and other information required for Responsible Care can be readily extracted. This means that there is little or no added administrative requirement to participate in the programme (Tapper, 1997). Where documentation systems however, at corporate level for all aspects of management need further development and implementation, Responsible Care may require added effort until effective management systems are fully applied across a company. There should be no added costs in implementing Responsible Care since it is built on prevailing systems. The programme has good

compatibility with many other management tools and standards which all require documentation. Meeting the requirements of Responsible Care is therefore a matter of creating corporate documentation so that the relevant information can be retrieved easily to meet the information requirements of Responsible Care (Tapper, 1997).

A vital issue for Responsible Care is the problem of the integrity of the chemical industries in relation to the public. The sector is approaching this problem from two related aspects:

- Raising its prominence and communication with the public on the performance of the chemicals sector and on its commitment to constant improvement through Responsible Care; and
- Credibility within the communities. (Tapper, 1997).

Chemical corporations have found that their use of Responsible Care places them in a solid position to participate in voluntary schemes and to obtain accreditation to new management standards. As corporate customers increasingly examine the environmental performance of their suppliers and look to certification under voluntary schemes for their evidence, companies may well find that a sector-based initiative will bring rewards individually and to the sector as a whole. The Responsible Care programme grew up in an industry with high and visible environmental effects and one that is continually in the spotlight of public concern. Responsible Care is now demonstrating that it has the ability to evolve, as new demands are made of it, and build on the network of associations in the chemicals sector to continue to promote performance improvements in combination with new regulatory approaches and international standards (Tapper, 1997).

2.3.4 Case Studies of Responsible Care in International Companies

According to Tapper (1997), one of the key benefits was the flexibility of Responsible Care. Companies are allowed to work on management practices they deem a priority in their organisation. Responsible Care allows companies to build on other EMS such as ISO 14001 and to plug in gaps that may exist. This minimises the administrative workload and lowers the cost of implementation. This flexibility also prevents duplication of systems. Very few case studies have been done on companies that implement Responsible Care.

Evangelinos *et al.*, (2010) highlight the challenges faced by the Greek chemical industry in their implementation of Responsible Care. A questionnaire was sent out to twenty four chemical companies by email and sixteen questionnaires were returned which constituted 60% of the population. The companies were asked to rate Responsible Care topics in order of importance. The topics were listed as follows in order of priority: the safety process; the safe storage and transportation of chemical products; the management of hazardous materials; the health and safety of employees; the controlling of pollution and emergency preparedness.

The Table below ranks the challenges faced by Greek chemical companies in adopting Responsible Care:

Table 2.1 Challenges faced by Greek Companies in their implementation of Responsible Care (Evangelinos *et al.*, 2010)

Challenges	No. of companies	%	Ranking
Legitimacy to community	9	56.25	1
Good citizenship	6	37.5	2
Collective identity	5	31.25	3
Growing cooperation amongst companies of the chemical sector	4	25	4
Improved environmental performance of the overall chemical sector	6	37.5	2
Improved communication of Responsible Care issues	3	18.75	5
Ensure compliance with regulations	2	12.5	6
Cost savings	1	6.25	7

According to the data presented in Table 2.1 from the Greek study conducted by Evangelinos et al., (2010), the most challenges relating to the adoption of Responsible Care, in order of priority, is to gain legitimacy from the company, to be a good citizen, to gain a collective identity, to have good co-operation within the chemical sector, to improve the environmental performance of the overall chemical sector, to improve communication and to improve compliance with regulations and cost savings. The study also identified barriers in adopting Responsible Care. The barriers were the lack of knowledge about Responsible Care, the administration when adopting Responsible Care, the lack of awareness of Responsible Care by the community, the duplication of requirements covered by other EMSs and the high level of requirements.

2.4 ISO 14001

2.4.1 History of ISO 14001

The ISO 14000 series arose primarily as a result of the Uruguayan round of the GATT (General Agreement on Trade and Tariffs) negotiations and the Rio Summit on the environment held in 1992. While GATT focused on the need to decrease non-tariff barriers to trade, the Rio Summit generated a commitment to protection of the environment across the world. After the rapid acceptance of ISO 9000, and the growth of environmental standards around the world, ISO assessed the need for international environmental management standards. They formed the Strategic Advisory Group on the Environment (SAGE) in 1991, to consider whether such standards could serve to encourage a shared approach to environmental management, improve the organisation's ability to attain and measure improvements in environmental performance and facilitate trade and eliminate trade barriers (Available from <http://www.quality.co.uk>) (Accessed on 19 February 2012).

The ISO 14001 standards apply to all types and sizes of organisations and are designed to encompass diverse geographical, cultural and social conditions. The standard can cover the entire scope of the organisation such as its products, services, activities, operations, facilities and transportation. ISO 14001 gives South African companies the added advantage of exporting its products overseas and accessing compliance to legislation. Adherence to ISO 14001 standards help to ensure compliance with international norms, legislation and regulations.

Constructing and registering an EMS to the ISO 14001 standard, benefits companies by:

- Providing the company with guarantee that they will continue to meet their EMS commitments and commercial policy requirements;
- Providing fewer surveillance visits from regulatory authorities;
- Showing business associates, regulatory authorities and communities that the organisation is environmentally responsible;
- Increasing competitiveness;
- Increasing profits through possible process improvements and energy safeguarding;
- Reducing environmental liability;
- Reducing costs, as a result of potentially lower insurance rates;
- Verifying systems for recognizing and complying with environmental laws and regulations;
- Restructuring operations-organisations often realize monetary savings as a result of greater operational efficiency and energy conservation, reduction in the use of hazardous materials and generation of hazardous waste; and
- Safety benefits-by revising the procedures for controlling significant operations, including a review of emergency readiness and response procedures, organisations are able to identify and implement significant safety improvements (White paper: The value of ISO 14001 requirements and registration, www.smithersregistrar.com). (Accessed on 31 August 2010).

2.4.2 The Features of ISO 14001

The ISO 14001 standard, according to van der Veldt (1997:1-2), includes the following requirements:

- a) Environmental Policy states top management's commitment to complying with applicable legislation, preventing pollution and fulfilling the company's environmental objectives and targets.
- b) Environmental planning that ensures environmental aspects are identified and its impacts evaluated. Environmental objectives and targets should align with

the organisation's environmental policy and programmes will include tasks, timelines, responsibilities and resources to meet the environmental objectives and targets.

- c) Implementation and operation of the EMS: Human, physical and financial resources, necessary to achieve environmental objectives and targets, should be made available. Employees should be trained on the environmental aspects of their job. Internal and external communication procedures should be documented for reporting of environmental issues.
- d) Internal audits must be conducted on the EMS and legal compliance audits need to be conducted.
- e) Management reviews-reviews the effectiveness of the EMS.

The above requirements are summarised from SANS ISO 14001.2008.

2.4.2.1 General requirements

The organisation shall implement and document an EMS and define the scope of its EMS (SANS ISO 14001.2008).

2.4.2.2 Environmental Policy

The policy shall be defined and shall be appropriate to the nature and scale of its environmental impacts. The policy shall commit to continual improvement and shall prevent pollution. The policy shall commit to legal compliance and the setting of objectives and targets. The policy shall be communicated to all including the public (SANS ISO 14001.2008).

2.4.2.3 Planning

2.4.2.3.1 Environmental Aspects

The organisation shall establish, maintain and implement a procedure to identify its environmental aspects and determine the impact of these significant aspects (SANS ISO 14001.2008).

2.4.2.3.2 Legal and Other Requirements

The organisation shall establish a procedure to identify the legal requirements pertaining to the EMS and have access to these legal requirements. The legal requirements shall be linked to the aspects (SANS ISO 14001.2008).

2.4.2.3.3 Objectives, Targets and Programmes

The organisations shall implement, document and maintain objectives and targets which shall be consistent with the environmental policy. A formal programme to implement and maintain the objectives and targets shall be put in place. The objectives and targets shall take into consideration the legal obligations of the organisation (SANS ISO 14001.2008).

2.4.2.4 Implementation and Operation

2.4.2.4. Resources, Roles, Responsibility and Authority

Management shall ensure the availability of resources for efficient running of the EMS. Resources include financial resources, human resources, infrastructural and technological resources. Management shall appoint a specific person to ensure that the EMS is implemented, maintained and reviewed (SANS ISO 14001.2008).

2.4.2.4.2 Competence, Training and Awareness

The organisation shall identify training needs related to the EMS and shall ensure that employees whose tasks impact on the environmental aspects are adequately trained and are deemed competent in these tasks (SANS ISO 14001.2008).

2.4.2.4.3 Communication

The organisation shall implement and maintain a procedure for internal communication regarding its environmental aspects. The procedure should also cover external communication from interested parties and the authorities. Records of communication shall be retained. The company can choose to communicate its environmental aspects to the public and this decision needs to be documented (SANS ISO 14001.2008).

2.4.2.4.4 Documentation

Documentation for the EMS shall include the environmental policy, objectives, targets, scope, records and description of the EMS and their interaction and reference to related documents (SANS ISO 14001.2008).

2.4.2.4.5 Control of Documents

All documents of the EMS shall be controlled. A procedure shall be implemented to include the approval of documents prior to issue, review and update of documents, ensure current versions are in use and prevent use of obsolete documents. Documents of external origin shall also be controlled (SANS ISO 14001.2008).

2.4.2.4.6 Operational Control

The organisation shall identify and plan those operations that are associated with the identified significant environmental aspects consistent with its environmental policy, objectives and targets. The organisation shall establish, implement and maintain procedures related to the significant environmental aspects (SANS ISO 14001.2008).

2.4.2.4.7 Emergency Preparedness and Response

The organisation shall establish, implement and maintain a procedure to identify potential emergency situations and potential accidents that can have an effect on the environment. The organisation shall respond to actual emergency situations and prevent adverse environmental impacts. The organisation shall periodically review its emergency procedure and periodically test the emergency procedure (SANS ISO 14001.2008).

2.4.2.5 Checking

2.4.2.5.1 Monitoring and Measurement

The organisation shall establish, implement and maintain a procedure to monitor and measure the operations that can have a significant environmental impact. The procedure shall indicate how this information is recorded. The equipment that is used to monitor and measure shall be calibrated (SANS ISO 14001.2008).

2.4.2.6 Evaluation of Compliance

The organisation shall have a procedure for evaluation of its legal requirements and its other requirements. Records of these evaluations shall be kept (SANS ISO 14001.2008).

2.4.2.7 Non-conformity, Corrective Action and Preventive action

The organisation shall implement a procedure for dealing with actual and potential non-conformities and their corrective and preventative actions. The root causes of non-conformities shall be determined, together with preventative actions which shall be reviewed for effectiveness. Records of non-conformities, corrective actions and preventative actions shall be kept (SANS ISO 14001.2008).

2.4.2.8 Control of Records

The organisation shall establish and implement a procedure for the identification, storage, protection, retrieval, retention and disposal of records (SANS ISO 14001.2008).

2.4.2.9 Internal Audit

The organisation shall ensure that internal audits are carried out periodically against ISO 14001 requirements and the auditors are competent and impartial (SANS ISO 14001.2008).

2.4.2.10 Management Review

Top management shall review the EMS regularly against the environmental policy, objectives and targets. Records of the management review shall be maintained. The management review needs to include results of internal audit, legal compliance evaluations, communication with external parties, the environmental performance of the organisation, the objectives and targets, the status of corrective and preventative actions, recommendations for improvements and actions from previous management reviews (SANS ISO 14001.2008).

To achieve ISO 14001 accreditation the organisation must demonstrate the following: Documentation of the system; implementation of the system and effectiveness of the system. The standard also requires a procedure on how to deal with emergencies

which addresses the very need for which environmental management systems were created for. (SANS ISO 14001:2008).

Certification to ISO 14001 involves 2 stages:

This first stage is to confirm the readiness of the organisation for full assessment. The assessor will confirm that the EMS conforms to the requirements of the standard, including the identification of impacts and aspects, confirm its implementation status, confirm the scope of certification, checks legislative compliance, produces a report that identifies any non-compliance or potential for non-compliance and agrees to corrective action plan if required, produces an assessment plan and confirms a date for stage 2 assessment.

The second stage is to confirm that the system conforms fully to ISO 14001 requirements. The assessor will undertake sample audits of the processes and activities defined in the scope of assessment, report any non-compliance, and produce a surveillance plan. If there is a major non-conformance, the organisation cannot be certified until corrective action is taken and verified (SANS ISO 14001:2008).

2.4.3 The Merits and Demerits of ISO 14001

Holt (1998) has recognized the perceived benefits of accreditation to an environmental management standard in thirteen UK companies. The benefits include reduced risk, lower insurance premiums, cost savings and regaining old customers. In addition, ISO 14001 would help the firm to address all of the legal, commercial and other challenges related to the environment, material and energy inputs, and to reduce waste, thus refining process efficiency. For example, a number of ISO 14001 adoption companies in Singapore have reported a substantial amount of cost savings. Darnall *et al.*, (2000), however, found that other non-environmental considerations such as upholding a competitive advantage, enhancing public relations, meeting customer demands, and decreasing overall costs seemed to prevail in a company's decision to seek certification. Economics and institutional pressures also play an important role in determining acceptance of ISO 14001 (Bansal and Bogner, 2002). Possible benefits for ISO 14001 adoption comprised of: reduced costs of waste management, savings in consumption of energy and materials, enhancing corporate image, regulatory cost savings, more effective supply chain management, improved customer relationships, and increased market competitiveness. Advocates of ISO 14001 claimed that the implementation of

ISO 14001 substantially improved the organisation's operational and managerial systems (Rondinelli and Vastag, 2000). In Malaysia, Maliah and Nazli (2002) stated that ISO 14001 improves fiscal and ecological performance. Some businesses market the certification of their EMSs to increase market share and to gain competitive advantage.

Veldt (1997) looked at six case studies in the United States where companies that had implemented ISO 14001 in the chemical, electronics and plastic industries. The case studies contain the reasons, steps taken, costs, benefits, problems and future trends of ISO 14001 implementation and certification. The following lists of advantages and disadvantages are outlined by van der Veldt, (1997: 3-6) in this study:

- Compliance with environmental laws and continuous improvement of environmental performance: ISO 14001 brings environmental awareness to both management and employees in an organisation, allowing them to work in a manner that will reduce environmental impacts;
- Operational efficiency improvement: An organisation can achieve operational efficiency by saving material, energy, water and reducing waste;
- Environmental risk reduction: ISO 14001 allows environmental aspects to be identified so that corrective and preventative actions are taken against the environmental impacts;
- Reducing liability expenses: Organisations that implement ISO 14001 ensure compliance to environmental legislation thus reducing fines and punitive damages with potentially devastating financial consequences;
- Reducing environmental insurance costs and interest rates: Insurance companies are likely to reduce insurance premiums for organisations that lower their environmental risks;
- ISO 14001 as a requirement to stay in business: Customers and the community prefer companies that show good environmental practices; and
- ISO 14001 as a marketing tool: Being green improves an organisation's image and lends credibility to the organisation's commitment to sustainable environmental stewardship.

The disadvantages of ISO 14001 were found to be:

- ISO 14001 is an expensive system to implement and involves a cost to the company as employees have to be trained, courses have to be undertaken, management time allocated for and sometimes, consultants have to be hired.
- A concern regarding the implementation of ISO 14001 in the United States has arisen over the fact that registration of environmental incidents is practically a request for legal discovery and prosecution. This concern however, should not be a barrier as the system does not force disclosure of environmental non-compliances to the authorities (van der Veldt, 1997).

2.4.4 The characteristics of ISO 14001

The ISO 14001 standard is made up of the following requirements:

- General requirements
- Environmental Policy
- Planning (environmental aspects, legal and other requirements, objectives, targets and programmes)
- Implementation (resources, roles, responsibility and authority, competence, training and awareness, communication, documentation, control of documents, operational control, emergency preparedness and response, checking, evaluation of compliance, non-conformity, corrective and preventative action, control of records, internal audit)
- Management Review

2.5 Case studies of ISO 14001 in International Companies

Psomas *et al.*, (2011) carried out a study involving the motives, difficulties and benefits with regard to implementing ISO 14001 in fifty three Greek companies. Exploratory Factor Analyses was used to determine the latent constructs of the ISO 14001 motives, benefits and difficulties. The study was done using the questionnaire method. The statistical package SPSS was used to analyse the data collected. Exploratory factor analyses were applied to the motives for ISO 14001. Cronbach's coefficients were used to determine the most significant motives. Values higher than 0,5 were deemed to be more significant. In descending order environmentally-friendly

policy was the strongest motive. Second was competitive advantage and the last motive was social requirement. Similar analysis was applied to the difficulties in implementing ISO 14001. Determining issues of environmental performance showed greater difficulty in implementing ISO 14001 than the requirements of ISO 14001. The study showed that the most significant benefits were improved waste management, better corporate image with the community and lastly, sustainability of the business.

The companies surveyed were small, medium and large enterprises, indicating that ISO 14001 can be implemented in organisations of all sizes (Rondinelli *et al.*, 2000). Morrow and Rondinelli (2002) looked at German companies in the energy and gas industries that had implemented ISO 14001 and the benefits derived thereof. The study used questionnaires and interviews to determine the motivations and benefits of ISO 14001. The three primary reasons for the companies implementing ISO 14001 were: to enhance environmental performance, improve their corporate image and ensure legal compliance. Some of the benefits were that companies found that, prior to ISO 14001 certification, they did not know which environmental laws were applicable to them and the level of compliance and furthermore, companies saw an improvement in environmental documentation. Other benefits noted, were increased environmental awareness amongst employees, improvements in recycling, air and waste reduction emissions, materials re-use, energy and water conservation and environmental and safety incidence reduction (Morrow *et al.*, 2002).

Six case studies of American companies were described by van der Veldt (1997), outlining the benefits, costs, problems, reasons and steps taken for ISO 14001 implementation and certification in the following companies, *viz.*, Formosa, Motorola, Texas Instruments, Monsanto, Philips and Lucent Technology.

Formosa indicated that the reason for ISO 14001 certification was to enhance corporate image, environmental compliance to protect their assets and to ensure profitability by ensuring operational efficiency. Formosa had ISO 9001 certification prior to ISO 14001 certification. The actual benefits of ISO 14001 implementation for Formosa was a reduction of environmental releases. Hazardous waste generation had decreased and the recordable injury rate had reduced from five to two.

Motorola did not implement ISO 14001 as it already had an EMS in place that overlapped with the ISO 14001 requirements so the need for ISO 14001 was not great. ISO

14001, in Motorola's European branches, was implemented due to the demand from customers. The German and Taiwanese sites implemented ISO 14001; this was due to government subsidies for the costs of implementation. Monsanto's American plants already had an effective EMS that combined health and safety standards and did not therefore implement ISO 14001 (van der Veldt, 1997).

All Philips sites, worldwide, implement ISO 9001 prior to ISO 14001. ISO 14001 is the preferred EMS for Philips sites. The benefit of implementing of ISO 14001 for Philips has been increased operational efficiency and reduction of waste. Lucent has implemented ISO 14001 in England due to customer demand. Formosa incurred costs of \$500 000 in order to obtain ISO 14001 certification and it took 3 years to implement. Two Texas sites, in Germany and Taiwan, incurred costs of \$50 000 for ISO 14001 certification and it took 6 months to implement the standard. The discrepancy in costs is due to the fact that the Germany site was already registered to another EMS which reduced the cost of ISO 14001 implementation.

Although Formosa was ISO 9001 certified, many elements of ISO 14001 such as documentation, training and the setting up of the aspects/impacts register still needed to be put into place. Monsanto, Motorola, Lucent and Texas all believe that the implementation of an EMS results in cost savings. Lucent has taken a decision to ensure that ISO 14001 certification is in place at all its sites due to customer demand. Philips implements ISO 14001 at all its sites to ensure environmental excellence and not merely for corporate image. There is a marked distinction between ISO 14001 certification in the U.S. and Europe as European companies demand this as a pre-requisite for doing business. (Van der Veldt, 1997).

The findings from the Lopez-Rodriguez (2009) study on ISO 14001 Spanish companies indicate that the two major reasons for implementation of the standard were the financial benefits and the environmental improvements of the process. Pan (2003) did a similar study on Taiwanese and Korean firms and found that the primary motives for implementation were external pressure and better corporate image. A study by Turk (2009) on Turkish companies revealed that access to export was the most significant reason for adopting the ISO 14001 standard (Psomas *et al.*, 2011).

Poksinska *et al.*, (2003) found that in Swedish companies one of the difficulties experienced, when implementing ISO 14001, was the identification of the environmental

aspects. Turk (2009) found that Turkish companies experienced poor top management commitment when implementing the standard (Psomas *et al.*, 2011).

From the above studies mentioned, it was found that ISO 9001 is implemented in tandem with ISO 14001. The motives for implementing ISO 14001 were: competitive advantage, better corporate image, improved environmental performance and the environmental legal compliance. ISO 9001 may have decreased the difficulties in implementing ISO 14001 as some of the ISO 14001 requirements are similar to ISO 9001 (Psomas *et al.*, 2011).

2.6 ISO 14001 and Responsible Care in South Africa

With the abolishment of apartheid in 1994, South Africa could once again compete in the global market. European companies require ISO 14001 and South African companies started to obtain ISO 14001 in order to compete in the international market. Huge multinationals and international companies in South Africa sought ISO 14001 as compared to the small, medium and micro enterprises (SMMEs) which found the cost of implementing ISO 14001 too high, together with insufficient resources dedicated to the environmental issues. With the emergence of environmental bodies and environmental legislation in recent times, chemical companies, both large and small, are now seeing the benefits of ISO 14001 and have started to implement the system. Fifty five chemical organisations have adopted both EMSs *viz.* Responsible Care and ISO 14001.

2.7 Similarities and Differences between ISO 14001 and Responsible Care

Table 2.2 Similarities between ISO 14001 and Responsible Care

Responsible Care	ISO 14001
<i>Management Commitment</i>	<i>Environmental Policy</i>
Leadership and Commitment	Legal and other Requirements
Policy	Objectives and Targets
Legislative Requirements	Structure and Responsibility
Organisational Responsibility	Communication
Personnel	Environmental Management System Audit
Communication	Management Review

Records	
<i>Community Interaction</i> Procedures and Systems Training Monitoring Records	<i>Planning</i> Environmental Policy Environmental Aspects Emergency Preparedness and Response Monitoring and Measurement
<i>Pollution Prevention and Resource Efficiency</i> General Approach Technology and Equipment Facilities and Operation Procedures and Systems Pollution and Prevention Resource Efficiency	<i>Environmental Management Programs</i> Aspects Training, Awareness and Competence Document Control Operational Control Monitoring and Measurement Non-conformance, corrective and preventative action Environmental Audit
<i>Health and Safety</i> Organisation, Recruitment and Skills development Employee and Contractor Health and Safety	<i>Legal and other requirements</i> Training, Awareness and Competence Operational Control Emergency Preparedness and Response
<i>Product Stewardship</i> Product Information Research and Development Suppliers Marketing and Sales Planning Realization and Implementation Monitoring and Corrective Measures Management review	<i>Communication</i> Environmental Aspects Legal and other Requirements Objectives and Targets Environmental Management Programme Operational Control Emergency Preparedness and Response Monitoring and Measurement Non-conformance, Corrective and Preventative action Management Review

<i>Storage and Transport</i>	<i>Operational Control</i>
Procedures and Systems Communication Transportation Monitoring Records	Training, Awareness and Competence Communication Document Control Emergency Preparedness and Response Monitoring and Measurement Non-conformance, Corrective and preventative action
<i>Process Safety</i>	-

The above Table shows the similarities between the two EMSs. The big differences are that ISO 14001 does not advocate community interaction involving open days on the chemical site, whereas Responsible Care does. ISO 14001 gives the company an option as to whether or not to report on significant impacts to the neighbouring communities. The other difference is that Responsible Care focusses on a specific management practice standard for Process Safety which is not featured in ISO 14001.

ISO 14001 subject to stage 1 and stage 2 audit by external auditors before certification, whereas Responsible Care only requires a self-assessment. ISO 14001 also has an annual surveillance audit by an external body as compared to Responsible Care which has an audit every three years by an external body. The above similarities and differences between the two EMSs is what constitutes this and its results will highlight the extent to which one is preferred over the other.

CHAPTER THREE: Study Area and Methodology

3.1 Introduction

The focus in this chapter is on a description of the study area where the investigation was undertaken and the methodology implemented to undertake the research. In any research, a study area is required to conduct the investigation. A description of the study area will indicate to the reader, as well as to other researchers, where the study was undertaken. The researcher will, *via* this part of the dissertation, inform readers of the rationale for choosing a particular area to carry out the investigation. All investigations require some form of research methodology to obtain data. There are several methods or techniques that researchers can employ to undertake their research. The type of research will, ultimately, determine the method required to access the data. The researcher will, apart from highlighting the type of research being undertaken, also provide a rationale for choosing the technique appropriate for the study. Researchers are also required to be familiar with the different types of sampling techniques so that they can choose the one most suitable to their study.

3.2 Study Area

ISO 14001 and Responsible Care are the two predominant EMSs in South Africa. The companies that adopt these standards are chemical companies that are based throughout South Africa. It includes various industries such as chemical manufacturing (personal care products, explosives, biocides, fertilizers, agrochemicals); mining; waste management; warehouseing and distribution of chemicals; and laboratories making up a total number of fifty five organisations. There are in total fifty five organisations distributed throughout South Africa that implement the two EMSs. The regional distribution of the organisations is presented in Table 3.1 and their spatial distribution on Figures 3.1 and 3.2.



Figure 3.1 Map indicating provinces where chemical industries are situated (indicated in red) (Available from www.rainbownation.com) (Accessed on 21 January 2015).

Table 3.1 Distribution of organisations on a regional basis

Region	Number of Organisations	Broad Activities
Kwazulu-Natal	22	Gas, chemical manufacturing, manufacturing of speciality chemicals, refineries, manufacturing of mining chemicals, waste management services, testing and verification services.
Eastern Cape	2	Manufacturing of chemicals and speciality chemicals.
Western Cape	2	Chemical distributors.
North West Province	1	Manufacturing of chemicals.

Gauteng	19	Manufacturing of explosives, manufacturing of chemicals, manufacturing of speciality chemicals, waste management services, manufacturing of mining chemicals, retail of environmental equipment, manufacturing of water treatment chemicals, manufacturing of agrochemicals.
Free State	9	Manufacturing of chemicals, manufacturing of speciality chemicals, mining and manufacturing of fuel.

The chemical and associated industries *viz.*, the petroleum, rubber, chemical and plastic products contributed R318 million to the GDP in South Africa in 2011, which is about 23% in total manufacturing sales. The above industries employ about 200 000 people (Stats SA, 2012).

The fifty five organisations, as depicted in Figures 3.1 and 3.2, will serve as the study area for this investigation. In effect, the entire population *viz.*, the fifty five organisations will be investigated in accordance with the aims and objectives as outlined in chapter one. Consequently, the disadvantages pertaining to any sampling technique will not impact negatively on the integrity of the research, Figures 3.1 and 3.2 provide a representation of the distribution of the fifty five organisations on a national and regional level.

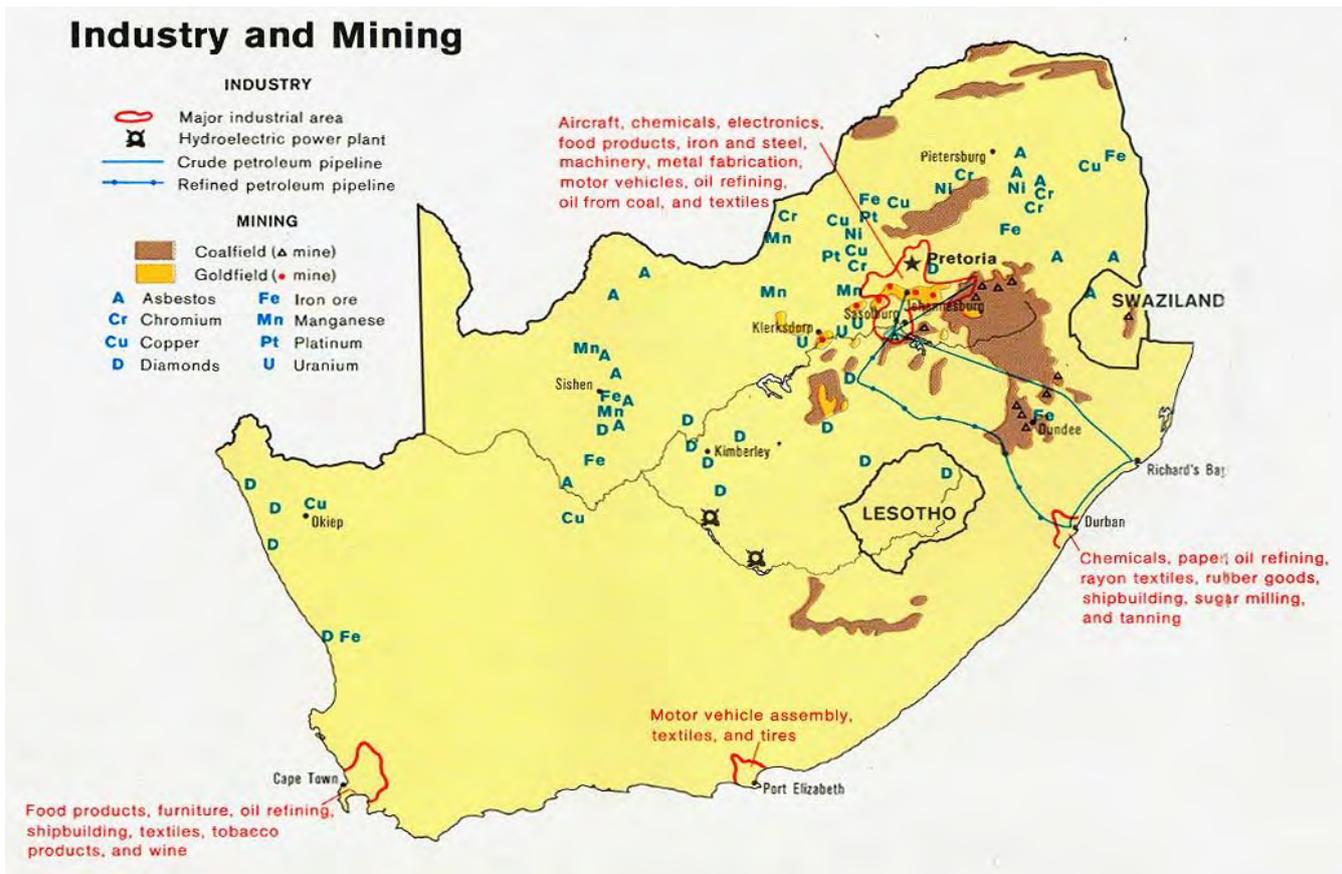


Figure 3.2 Distribution of the Organisations on a National Level Available from www.wondersof southafrica.weebly.com (Accessed on 17 January 2015).

3.3 Methodology

Research methodology is a way to methodically solve the research problem. It is a science of studying how research is done systematically. When we talk of research methodology, we not only talk of research methods but also consider the reasoning behind the methods we use in the context of our research study, we explain why we are using a particular method or technique instead of others so that research results are capable of being assessed either by the researcher himself or by others. The research process involves the formulation of the research problem, extensive literature search and subsequent review, developing the sample design, gathering the data and analysis of such data, implementation of the project, examination of data, generalisations and interpretations, preparation of the report and the formal write-up of conclusions reached (Kothari, 2004).

Research is the practice of gathering, examining and interpreting information to answer questions. In order to qualify as research, the process must have certain features: it must, as far as possible, be measurable, rigorous, methodical, valid and verifiable, experiential and critical. Research is a scientific and systematic search for pertinent information on a specific topic (Kothari, 2004). Research involves the use of various procedures and practices in order to create scientifically obtained knowledge by using unbiased methods and procedures. Different studies use different methods or techniques because they have different aims (Welman and Kruger, 2001). There are various types of research which, *inter alia*, include:

- *Descriptive vs. Analytical*: Descriptive research contains surveys and fact finding enquiries. In descriptive research, the problem is organised and well understood. Key characteristics of descriptive research are structure and exact rules and procedures (Ghuri *et al.*, 1995). Analytical research is where the researcher uses facts or information, already accessible, and analyses this to make a critical assessment of the material (Kothari, 2004).
- *Applied vs. Fundamental*: Applied research aims at finding a solution for an immediate problem facing society or industry. Fundamental research is mainly concerned with generalisations and with the formulation of a theory (Kothari, 2004). For instance, a particular product may not be selling well and the manager might want to find the reasons for this in order to take remedial action. Such research is called applied research. Fundamental research refers to the creation of a body of knowledge by trying to understand how certain problems, that occur in businesses, can be solved (Sekaran, 2003).
- *Quantitative vs. Qualitative*: Quantitative research is based on the measurement of quantity or amount. Qualitative on the other hand is concerned with qualitative phenomena relating to involving quality or kind (Kothari, 2004). “The main difference between qualitative and quantitative research is not quality but procedure. In qualitative research, findings are not arrived at by statistical methods or other procedures of quantification. The difference between quantitative and qualitative methods is not just a question of quantification, but

also a reflection of different perspectives on knowledge and research objectives” (Ghauri *et al.*, 1995:84).

Table 3.2 Differences between Qualitative and Quantitative Research Methods (Ghauri *et al.*, 1995:84)

<i>Quantitative methods</i>	<i>Qualitative methods</i>
Emphasis on testing and verification	Emphasis on understanding
Focus on facts and/or reasons for social events	Focus on understanding from respondent’s/informant’s point of view
Logical and critical approach	Interpretation and rational approach
Controlled measurement	Observations and measurements in natural settings
Objective outsider distant from data	Subjective insider view and closeness to data
Hypothetical-deductive; focus on hypothesis testing	Explorative orientation
Result oriented	Process oriented
Particularistic and analytical	Holistic perspective
Generalization by population membership	Generalization by comparison of properties and contexts of individual organism

- *Conceptual or Empirical*: Conceptual research is that, related to some intangible idea or theory. It is used by philosophers or thinkers. Empirical research relies on experience or observation alone. It is data-based research, revealing deductions which are capable of being verified by observation or experiment. There are two basic approaches to research: qualitative and quantitative (Kothari, 2004).

3.3.1 Survey Methodology

Data collection methods are an essential part of research. There are numerous data collection methods, each with its own advantages or disadvantages. Data can be collected in a variety of ways: in different settings-field or lab and from diverse sources. Data collection methods include interviews, face-to face interviews, telephonic interviews, computer-assisted interviews, interviews through the electronic media, questionnaires that are either personally controlled, sent through the mail, or electronically run, observation of individuals and events with or without videotaping or audio recording. Interviewing, administering questionnaires and observing people are the three main data-collection methods in survey research (Sekaran, 2003). Although interviewing has the advantage of flexibility in terms of adapting, adopting and changing the questions as the researcher proceeds with the interviews, questionnaires have the advantage of obtaining data more efficiently in terms of researcher time, energy and costs.

The choice of data collection methods depends on the facilities available, the degree of accuracy required, the knowledge of the researcher, the time span of the study, and other costs and resources associated with and available for data gathering (Sekaran, 2003). The observation method is the most common in the study of behavioural sciences. Under the observation method, the information is sought by way of investigator's own direct observation without interaction from the respondent. In this type of method, subjective bias is eliminated. This process is independent of the respondent's readiness to respond and, as such, is less demanding of active co-operation on the part of respondents, as happens to be the case in the interview or the questionnaire method. This method however is expensive. The information provided by this method is also very limited (Kothari, 2004).

The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. The personal interview method requires a person, known as the interviewer, asking questions in a face-to-face contact situation with the other person. The main advantages of the interview method are as follows: more information can be obtained, there is greater flexibility by restructuring questions, samples can be organized more effectively as non-responses are low and misunderstandings can be avoided. One of the disadvantages of the interview method

is that it can be expensive if it is a large geographical area as this method is time-consuming. In order for effective interviews to take place, the interviewer should be trained, honest and impartial to ensure that the data collected is non-biased and accurate (Kothari, 2004). There are two types of interview methods *viz.*

- *Structured Interviews*: These are interviews where a standard format of interview is used with an emphasis on fixed response categories and systematic sampling, and leading procedures combined with quantitative measures and statistical methods (Ghauri *et al.*, 1995).
- *Unstructured Interviews*: The interviewer does not enter the interview with a list of pre-determined questions. The respondent is given almost complete liberty to discuss reactions, opinions and behaviour on a specific issue. The questions and answers are unstructured and are not scientifically coded beforehand (Ghauri *et al.*, 1995).

The advantage of the interview method is that researcher can adjust the questions whenever necessary, clarify doubts and ensure that the responses are correctly understood by repeating or rearticulating the questions. The disadvantages are the geographical limitations that may be imposed on the surveys and the vast resources needed if such surveys need to be done nationally or internationally (Sekaran, 2003).

The questionnaire method was used in this study to collect the data. The benefit of this method is low cost and it is able to be conducted over a wide area, geographically. It is free from the prejudice of the interviewer. Respondents have adequate time to provide accurate answers. Large samples can be used and the results are more reliable and consistent. The disadvantages can be the low number of completed questionnaires. There is also possible bias due to no response from respondents. Furthermore, there is the possibility of confusing replies or omission of replies. This method is likely to be the slowest of them all (Kothari, 2004). Electronic questionnaires are easy to manage and can reach people globally. They are very economical, fast and respondents can reply at their convenience. The disadvantages are that computer literacy is essential, respondents must have access to the facility and the respondent must be prepared to complete the survey (Sekaran, 2003). For this particular investigation, the researcher formulated and implemented a structured questionnaire. A structured questionnaire has definite,

concrete and pre-determined questions. The questions were presented to all the respondents with the exact wording. Both closed and open-ended questions were used. A structured questionnaire was designed in relation to the motives, difficulties and benefits of implementing both the EMSs. The draft questionnaire was carefully reviewed by a social scientist, an environmental management specialist and an environmental scientist, prior to implementation. Based on their recommendations, minor adjustments were made to the wording and coding of the questionnaire to improve the final version. The questionnaire was divided into 4 sections *viz.* EMS, the costs of implementing EMS, Responsible Care vs. ISO 14001 and Logistics.

3.3.2 Sampling Techniques

Surveys are beneficial and powerful in order to discover answers to research questions through data collection and subsequent analyses. They can however do more harm than good if the population is not appropriately targeted. The process of selecting the right individuals, objects or events for study is known as sampling. Sampling is the process of choosing a sufficient number of elements from the population so that a study of the sample and an understanding of its properties or features would make it possible for us to generalize such properties or characteristics to the population elements (Sekaran, 2003). There are various sampling techniques. The first step is determining the sample size. The next step will be to determine the geographical area and then the names of the objects to be studied in that region. The sample size needs to take into consideration efficiency, representativity, reliability and flexibility. A representative sample is necessary as sampling an entire population is expensive and time consuming. There are two sampling methods *viz.*, probability and non-probability sampling (Kothari, 2004).

3.3.2.1 Probability Sampling

In probability sampling, the elements in the population have some known chance or probability of being selected as sample subjects. Probability sampling can be either unrestricted or restricted sampling. In the unrestricted sampling design, more frequently known as simple random sampling, every element in the population has a known and equal chance of being selected as a subject. This type of sampling has the minimum bias and offers the most generalizability. This sampling process, however could become cumbersome and costly. Restrictive probability sampling offers a practical and

more efficient alternative to the unrestricted design (Sekaran, 2003). Other types of probability samplings are systematic sampling and cluster sampling. Systematic sampling involves a cyclical pattern or regular pattern from the population. Cluster sampling is used in large scale surveys and involves breaking up a large population into smaller more manageable clusters (Welman and Kruger, 1999).

3.3.2.2 Non-probability Sampling

Non-probability takes place when the population does not have an equal chance of being selected. Non-probability sampling includes convenience sampling and purposive sampling. Convenience sampling refers to the collection of information from members of the population who are conveniently able to provide it. Purposive sampling is confined to specific types of people who provide the desired information, either because they are the only ones who have it, or conform to some criteria set by the researcher (Sekaran, 2003).

Other examples of non-probability sampling, are quota sampling and snowball sampling. In quota sampling, certain subgroups of units, like small, intermediate and large firms, are represented in the sample in approximately the same proportions as they are represented in the population (Ghauri *et al.*, 1995). Snowball sampling takes place when few individuals are approached from the population and then proceed to identify other individuals in the population. For this study, non-probability sampling specifically purposive sampling was utilised as the sample was known and it was critical that the entire sample be surveyed in order to get a representative sample (Welman and Kruger, 2001).

3.3.3 Method Chosen for this Investigation

The technique chosen for this investigation was the electronic distribution of questionnaires as this allowed the entire population to be sampled. It was also the most economical method of data collection as it did not involve costs. The respondents were also allowed adequate time to complete the survey.

Information from CAIA enabled this researcher to compile a list of the South African chemical companies that are currently implementing the two EMSs viz., ISO14001 and Responsible Care. According to CAIA fifty five South African chemical compa-

nies are implementing the two EMSs. In view of the population fifty five being of a manageable size, the researcher decided on accessing data from the entire population. Questionnaires were e- mailed to the authorities responsible for EMSs in the fifty five organisations. The researcher followed up the electronic distribution with telephonic conversations with those authorities that did not respond timeously. The confidentiality clauses of twelve companies restricted them from not participating in the survey. This reduced the number of potential participants from fifty five to forty three. Electronic and telephonic appeals and persuasions, over a five month period, resulted in collection of eighteen responses. This number of responses was further reduced to fifteen as three of the organisations were not implementing both the EMSs. The researcher, ultimately, had to settle for fifteen responses out of a potential of fifty two (discounting the three that were not certified for both EMSs) respondents that were certified for the two EMSs. .

3.4 Method of Data Analysis

The data was collated from all the questionnaires and captured in an Excel spreadsheet for ease of processing. The statistical package SPSS was used to analyse the data. Data was also represented, graphically, using charts. The next chapter looks at the results of the data processed.

3.5 Conclusion

After assessing the different types of methodologies, the most appropriate methodology was found to be the questionnaire method due to the fact that the data would be qualitative and the entire sample would be included by using this method. The questionnaire was then developed by reviewing each EMS requirement. Questions were both open-ended and closed ended and gave the respondent options in order to prevent bias. The questionnaires were sent electronically to the fifty five organisations. The number of respondents that eventually responded was eighteen of which three did not qualify in terms of being ISO14001 and Responsible Care certified. The researcher had to analyse data from the fifteen questionnaires out of a potential number of fifty two respondents. The analysis was executed via the SPSS programme.

CHAPTER FOUR: Results, Analysis and Discussion

4.1 Introduction

The data obtained from the application of the methodology, implemented in the previous chapter, will be presented in this chapter. Tabulations and graphs will represent the results of the investigation. These results will, subsequently, be analyzed and discussed in relation to the objectives and literature presented in the first and second chapters, respectively.

4.2 Results, Analysis and Discussion

4.2.1 EMSs

4.2.1.1 Year of accreditation for EMSs

Table 4.1: Year of ISO 14001 accreditation

Year of certification	No. of responses	Percentage
2000	1	6.7
2002	2	13.3
2004	2	13.3
2006	1	7.7
2007	2	13.3
2008	1	7.7
2009	3	20.0
2010	1	7.7
No response	2	13.3
Total	15	100.0

Table 4.2: Year of Responsible Care certification

Year of certification	No. of responses	Percent- age
2006	2	13.3
2007	2	13.3
2009	2	13.3
2011	4	26.7
2012	2	13.3
No response	3	20.0
Total	15	100.0

ISO 14001 was introduced to SA in 1996. The chemical industry, as per Table 4.1, commenced with the adoption of this standard in 2000. At the end of 2010, thirteen of the organisations representing 87% of the sample were implementing ISO 14001. The increase in the adoption and implementation of this standard was a relatively slow process. Reference, in this regard, can be made to the data reflected in Table 4.1 where the increase from 6.7% in year 2000 to 87.7% in year 2010 occurred over a period of eleven (11) years. The year 1994 witnessed the launch of Responsible Care in South Africa. Organisations, representing the sample in this research, commenced with adoption and implementation of this EMS in 2006. In the first year (2006), two organisations, representing 13.3% of the sample, adopted this standard. This number, however, increased to twelve (80%) by year 2012. The increase in adoption and implementation of both EMSs can be attributed to compliance and enforcement of legislation. From Tables 4.1 and 4.2, it is evident that five organisations representing 33.3% of the sample commenced with implementation prior to the adoption of Responsible Care. This is an indication that ISO 14001 can provide the necessary baseline information for adoption and implementation of Responsible Care. According to Tapper (1997), most companies implementing Responsible Care have documentation from other systems that eases the administrative burden.

According to Price (2007), the introduction of ISO 14001 in the United Kingdom in 1996 witnessed the certification of a significant number of organisations. His research indicates that in the next four years there was a progressive increase in certification

although not as significant as in the year of introduction. The years between 1999 and 2002 experienced the greatest number of certifications. During these four years, 95% of the participating organisations were certified with this EMS. The lag between initial introduction of the standard and actual certification, was attributed to time constraints as organisations required time to increase staff awareness, undertake training and implementation of the EMS.

4.2.1.2 Motivation for accreditation

Table 4.3: Motivation for EMS

Motivation	Frequency
Compliance with environmental legislation	12
Group or corporate requirement	7
Internal requirement	6
Customer requirement	6
Access to export	1
To be responsible	1

The above (Table 4.3) reflects multiple responses from organisations as to the motivation for implementing EMSs. Collectively, the responses totalled thirty three. Most of the responses (twelve) cited compliance with environmental legislation as the primary reason for the implementation of EMSs. This was followed by group and corporate requirement. An equal number of responses (six each) were obtained for internal requirement and customer requirement. Access to export and responsibility received the lowest number of responses (one each). From the above, it can be deduced that pressure from environmentalists and government authorities (compliance) serves as the motivating factors for adoption and implementation of EMSs. Evangelinos *et al.*, (2010) looked at the benefits of implementing Responsible Care. In this study, the benefits were legitimacy to community, good citizenship, collective identity, growing cooperation among companies of the chemical sector, improved environmental performance of the overall chemical sector, improved communication of Responsible Care issues, ensure compliance with regulations and cost savings. These findings do not differ significantly from the United Kingdom research. 92% of the organisations involved in the UK studies indicated shareholder pressure, internal company requirements and the need to enhance

the company's image as reasons for the adoption and implementation of ISO14001 (Price, 2007).

4.2.2 Costs of implementing an EMS

Table 4.4: Implementation of an EMS perceived as expensive

Responses from the organisations	Frequency	Percentage
Yes	5	33.3
No	10	66.7
Total	15	100.0

Table 4.5: The costs of implementing EMSs (Rands)

Cost (000)	Responsible Care	ISO 14001
0-50	6	3
51-100	6	4
101-500	2	5
501-1000	0	1
>1000	1	2

Means: Responsible Care = 163 633, ISO 14001 = 342 067

Table 4.6: Costs of implementing EMSs in Relation to Staff Complement

Cost (R000)	Employees		Total
	<50	>50	
0-50	5	1	6
51-100	0	6	6
101-500	0	2	2
>1000	0	1	1
Total	5	10	15

66.7 % of the organisations perceived the implementation of EMSs as not expensive. 33.3% stated that it was expensive to implement the EMS (Table 4.4). ISO 14001 was expensive to implement with the average cost being around R342067, as compared to Responsible Care which averaged R163633. This is probably due to the fact that most companies implement ISO 14001, first, which includes elements of Responsible Care so the cost of implementing Responsible Care is greatly reduced (Table 4.4 and Table 4.5). In his study, Tapper (1997) stated that there should be no additional costs in implementing Responsible Care since it is built on existing systems. That could be the reason that it is less expensive to implement Responsible Care than ISO 14001.

Implementation costs

- The majority of the companies in the survey (10 out of 15) did not perceive the implementation of Responsible Care and ISO 14001 as costly.
- The cost of implementing ISO 14001 is more than twice that of Responsible Care.
- The costs of implementing both EMSs are lower for organisations with staff complements of less than 50 than for those with staff compliments of more than 50 (Table 4.6).

There is strong evidence to suggest that the costs for companies with more than 50 employees are significantly greater than that for companies with less than 50 employees. “The costs of ISO 14001 certification are not trivial and the process is not always easy. Estimates of actual costs to producers vary widely and depend on several factors. These include the size of the company, the number of employees, the amount of sites to be certified, the level of preparation required to implement EMS and whether the company has been previously certified to ISO 9001” (Bellesi *et al.*, 2005). The upfront costs of implementing an EMS can be high. Internal costs include management time, training costs, setting up the aspects and impacts register and documentation. External costs involve the audit costs and certification (Van der Veldt, 1997). The initial set-up of an EMS therefore raises costs and subsequent systems, built on existing systems, would generate lower costs.

4.2.3 ISO 14001 vs. Responsible Care

Table 4.7: ISO 14001 vs. Responsible Care (summary) (efficacy)

Aspect	ISO 14001	Responsible Care	Ratio
Environmental objectives met	14	1	14
Recognizable by international customers	14	1	14
Aspect	ISO 14001	Responsible Care	Ratio
Adds more value to organisation	13	2	6.5
More recognizable by local customers	13	2	6.5
Increase in legal compliance	10	5	2
Financial benefits	10	5	2
More flexible	9	6	1.5
More commitment from top management	10	5	2

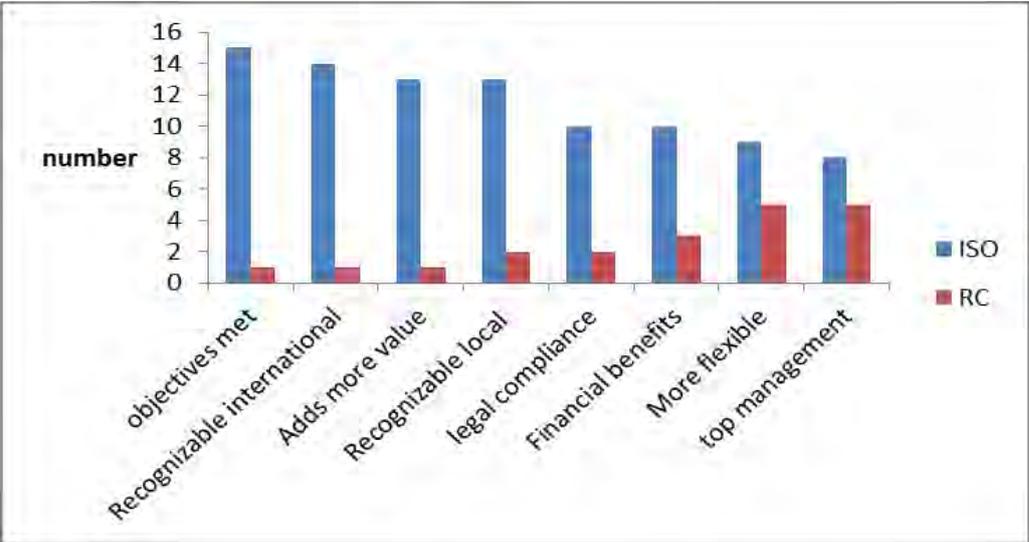


Figure 4.2.1: ISO 14001 vs. Responsible Care (summary) (efficacy)

Table 4.7 and Figure 4.1 represent responses from organisations, with respect to a comparison between the two EMSs, in terms of efficacy. The data from the Table and graph indicates that ISO 14001 is the preferred EMS. Fourteen organisations, representing 93.3% of the sample, stated that ISO 14001 was more efficient in meeting environmental objectives. Only one organisation, representing 6.7% of the sample, considered Responsible Care to be efficient in meeting environmental objectives. The response, for

variables relating to international recognition, was no different from that of meeting environmental objectives. A similar scenario, in terms of other variables, is not very different from the above. The following statements can serve as a summary of some the reasons for ISO 14001 being the preferred EMS with respect to efficacy.

- It meets the environmental objectives more effectively.
- It is an internationally recognized system. It is therefore more recognizable in the context of international and local customers.
- It has better financial benefits.
- It increases legal compliance.
- It is considered a good way of managing resources.

Research, with respect to the benefits associated with ISO 14001, undertaken in the United Kingdom (UK), Malaysia, The United States of America (USA), Greece, Singapore, Germany, Spain, Turkey, Sweden and Taiwan highlighted benefits that included reduced risk, cost savings, legal compliance, resource conservation, reduction in waste and meeting customer requirements (Puvanavarana *et al.*, 2010). The results of this investigation with reference to the benefits of ISO14001, are not very different from the above.

The majority of the customers also stated that ISO 14001 is more flexible and has more commitment from top management than Responsible Care. These majorities however are not significant. Responsible Care is considered to be a system that serves a good purpose when used in addition to ISO 14001, i.e., it adds more detail to environment management:

- It helps establish a community forum.
- It improves communication, audit, customer trust, handling, storage, health and safety.
- It provides access to government expertise via training and workshops (CAIA).

Very few case studies were done on Responsible Care that highlighted the benefits and challenges of this EMS.

Table 4.8: Data with Respect to the Acceptance of an EMS Illustrating the basis of Various Aspects.

Aspect	ISO 14001	Responsible Care
Recognizable by international customers	14	1
More recognizable by local customers	13	2
More applicable to SA	12	3
Environmental awareness	11	4
More commitment from top management	8	7
Easier to implement	7	8

- Fourteen of the organisations (93.3%) indicated that ISO 14001 enjoyed greater recognition by international customers. This could be attributed to ISO 14001 being an international standard, developed to facilitate trade across borders, and with most of the international clientele insisting on ISO14001 certification. The scenario at the local level is not very different from the international one. 86.7% of the companies are of the view that ISO14001 is the preferred EMS.
- The differences, between the two in perception of aspects that include commitment from top management and ease of implementation, are not significant between the two EMSs.

Table 4.9: ISO 14001 vs. Responsible Care (adding value to the business)

Aspect	ISO 14001	%	Responsible Care	%	Both EMSs (%)	None of the EMSs (%)
Environmental objectives met	14	93.3	1	6.7		
Adds more value to organisation	13	86.7	1	6.7	6.7	
Increase in legal compliance	10	66.7	2	13.3	20	
More applicable to SA	12	80	3	20		
Environmental awareness	11	73.3	3	20	6.7	
Financial benefits	10	66.7	3	20	13.3	
Requirements for export	8	53.3	1	6.7	20	20
Greater flexibility	9	60	5	33.3	6.7	
More commitment from top management	8	53.3	5	33.3	6.7	6.7
Easier implementation	7	46.7	8	53.3		
Environmental compliance (lifelong)	7	46.7	8	53.3		
Community interaction	4	26.6	10	66.7		6.7

The above Table (4.9) illustrates a comparison between ISO 14001 and Responsible Care with respect to adding value to business.

- Responses from the organisations indicate that ISO14001 is the preferred EMS, with respect to aspects that include meeting environmental objectives, adding value to the organisation, legal compliance and applicability in South Africa, environmental awareness, financial benefits and requirements for exporting ISO 14001. The differences, as per the above Table, is significant.
- On flexibility, commitment from top management, ease of implementation and lifelong environmental compliance, the difference between ISO 14001 and Responsible Care is negligible. The decision to implement an EMS comes from top management which is probably why top management's commitment was evident

for both the EMSs. EMSs provide guidelines on implementation procedures. The manner in which an EMS is implemented varies from organisation to organisation which ensures that both the EMSs remain flexible.

- On community interaction, the difference in views appears to be significant. More than 67% of the organisations opted for Responsible Care, as opposed to 26.6% choosing ISO14001. Responsible Care advocates community interaction by encouraging organisations to engage with the local community on the organisation's environment impacts and how the organisation mitigates these impacts.
- The majority (66.7%) of the organisations perceived ISO14001 as the EMS that contributed towards financial benefits. Holt (1998) had found that the implementation of ISO 14001 resulted in lower insurance premiums in thirteen UK companies. Darnall *et al.*, (2000) also found that organisations in Singapore experienced a reduction in capital outlay due to implementation of ISO 14001. Studies conducted in Malaysia and in the USA indicated similar trends in cost reduction. Effective waste management and a reduction in energy and materials contributed to financial benefits in the organisations studied in Malaysia and the USA. Evangelinos *et al.*, (2010), however, indicate that financial benefits can also accrue from the implementation of Responsible Care. According to these authors insurance premiums are reduced drastically as a result of low environmental risks and enhanced health and safety standards. EMSs, both ISO14001 and Responsible Care, can contribute to financial benefits for organisations by increasing the clientele base, injecting more revenue into the business and through the more efficient utilisation of resources.
- Ten organisations, representing 66.7% of the total number of organisations implementing both EMSs, stated that ISO14001 enhanced legal compliance within their organisations. Those that supported Responsible Care as the EMS that increased levels of legal compliance equated to 13.3%. Twenty percent of these organisations, however, were of the view that both EMSs contributed to an increase in environmental compliance within the organisations. This could be attributed to a greater focus on environmental impacts and the implementation of external audits.

- On the aspect of flexibility, majority of the companies (60%) indicated that they enjoyed greater flexibility with ISO 14001. Very few organisations (7%) were of the view that both EMSs afforded them equal degrees of flexibility. The balance (33%) stated that Responsible Care provided organisations with more flexibility than ISO14001. According to Tapper (1997) Responsible Care, in general, affords organisations a greater level of flexibility by allowing organisations to work on management practice standards they see as a priority. This EMS can adapt to changes within and outside of the organisation. The flexible nature of Responsible Care enables companies to determine their priorities within environments that experience uncertainties. “The flexibility also allows programmes to be structured to avoid duplication of other existing programmes, for example, emerging regional or international management standards, and to build on these as well as to plug any gaps” (Weiler *et al.*, 1997: 289).
- More than half (53.3%) of respondents stated that ISO 14001 enjoyed greater support from senior management. Five of the organisations were of the view that senior management offered more support to Responsible Care than ISO14001. The remaining two were divided in that while one believed that both EMSs received equal support, the other indicated that none of the EMSs enjoyed any support at all. Numerous studies indicate that effective implementation requires the participation of senior management. (Puvanasvaran *et al.*, 2010).
- Fourteen of the organisations, representing 93.3% of those involved in this research, were of the conviction that ISO 14001 allowed the EMS objectives to be achieved within given time frames. ISO 14001, specifically, requires environmental objectives and targets to be set together with management plans. These objectives and targets are reviewed by third parties annually *via* surveillance audits. This could also be attributed to the fact that ISO 14001 is subject to annual surveillance audits. Progress on objectives and targets are tracked whereas Responsible Care surveillance audits takes place every 3 years.
- More than half (53.3%) of the organisations are of the view that implementation of Responsible Care is less demanding than ISO 14001. This could be attributed to

the fact most of the practice guidelines pertaining to Responsible Care were already in practice, with respect to ISO 14001. Consequently, the knowledge obtained from the implementation of ISO14001 made it less difficult for the implementation of Responsible Care.

- A significant number (80%) of organisations indicated that ISO 14001 is more applicable in the South African context. Responsible Care, unlike ISO 14001, includes Process Safety and Community interaction. Process Safety, largely prevalent in multi – national organisations, is relatively new to the chemical industry in South Africa. The level of community interaction in the Responsible Care EMS is generally unsatisfactory. This can be attributed to the risks associated with community engagement. Organisations are very wary of disclosing information to the public with respect to environmental impacts, as such information could lead to legal battles between law enforcement agencies and these organisations.
- The majority (66.7%) is of the conviction that Responsible Care facilitated better community interaction than ISO 14001. Responsible Care stipulates a specific management practice standard on this, whereas ISO 14001 gives you an option to disclose your environmental impacts. Responsible Care encourages participation and interaction with neighbouring communities, with respect to environmental impacts.
- Eleven of the organisations are of the view that ISO 14001 enhanced environmental awareness amongst their employees due to ISO 14001. One organisation, representing 6.7 % of the total number of organisations participating in this research, indicated that both EMSs were responsible for increasing environmental awareness among its employees. Morrow *et al.*, (2002), also noted that one of the benefits of ISO 14001 was increased environmental awareness amongst employees. According to Rondinelli and Vastag (2010), ISO 14001 made employees more aware of environmental aspects, environmental legislation and environmental impacts. Employees gained a greater understanding and became more knowledgeable of the impacts of work processes, benefits of compliance with environmental procedures and the roles they played in ensuring good environmental practices.

- On the aspect of exportation, 53.3% of respondents are of the view that ISO 14001 serves as the primary EMS for international trade. Three respondents stated that none of the EMSs were necessary for exportation of their products. An equal number of organisations were adamant that both EMSs were required to export their products. One organisation, however, was of the view that Responsible Care is the essential EMS for exportation of its products. A survey by Bellesi, *et al.*, (2005) confirmed that while the international markets consider price and quality as the determining factors for selecting vendors, EMS certification is still taken into consideration. EMS certification implies that a supplier is showing ethical responsibility and is reliable. Europe is at the forefront of progressive environmental legislation and demands EMS certification from its suppliers.

4.2.4 Logistics of Implementation

Table 4.10: Availability of EMSs training

EMS	No. of responses	Percentage
Responsible Care	3	20.0
ISO 14001	11	73.3
Both	1	6.7
Total	15	100.0

From Table 4.10 it is evident that eleven of the organisations, representing a majority, indicated that training for ISO 14001 was readily available. 20% of these organisations were convinced that Responsible Care was more efficient in ensuring that training was readily available. The balance of the organisations believed that both EMSs were equally effective in terms of availability of training. This is due to the fact that the SABS, and many private training providers facilitate ISO 14001 training. Although CAIA had in-

roduced Responsible Care in 1994 no formal training on any of the management practice guidelines were offered. CAIA only started to offer Process Safety Training in 2012.

Table 4.11: Which EMS Required the Use of an External Consultant?

EMS	No. of responses	Percentage
None of the EMSs	2	13.3
Both of the EMSs	1	6.7
Responsible Care	4	26.7
ISO 14001	8	53.3
Total	15	100.0

More than half (53.3%) of the organisations indicated that external consultants were essential for ISO 14001. four of the organisations, representing 26.7% of total number of organisations, stated that Responsible Care required external consultation. One organisation hired an external consultant for both EMSs. The balance (13.3%) of companies did not see the need for external consultation for either of the EMSs Table 4.11). This is due to the fact that ISO 14001 involves the compilation of a legal register which would require the expertise of a legal expert. There are also numerous external consultants trained on ISO 14001 and the internal audit of the ISO 14001 system dictates that an auditor be objective so use of external auditors becomes common. Responsible Care has been isolated from the chemical industry in South Africa and due to limited opportunities, very few external consultants are trained on Responsible Care.

Table 4.12: Availability of External Auditors

EMS	Yes	No
Responsible Care	13	1
ISO 14001	14	1

In Table 4.12 thirteen companies stated that auditors were available for Responsible Care and fourteen companies stated that auditors were available for ISO 14001. One company stated that there were no auditors available for auditing of both the EMSs. “Third party audits help keep people more honest. People tend to give more attention to things they knew they were supposed to do by knowing that someone might expose their shortcomings if the let down. Third party auditors were far more effective at getting attention than internal auditors” (Rondinelli and Vastag, 2010).

Table 4.13: Problems associated with the implementation of EMSs

Problems during implementation of the EMSs	Frequency of responses
Lack of time	9
Lack of resources	8
Documentation of issues	7
Resistance from employees	4
None	2
Lack of finance	1

From the above Table 4.13, it is evident that most of the organisations indicated that time constraints, lack of resources and documentation issues were the major obstacles during the implementation of the EMSs. Evangelinos *et al.*, (2010) identified obstacles such as lack of knowledge, duplication of requirements (covered by other EMSs) and administrative burdens when implementing Responsible Care in Greek organisations. Veldt (1997) cited the costs of implementing ISO 14001 as a barrier when implementing the systems. Training of employees, management time and hiring of consultants contribute to the additional costs of implementation.

Table 4.14 Efficiency of Duplication of EMSs

Response	Yes	Percentage
Yes	14	93.3
No	1	6.7
Total	15	100.0

Fourteen of the organisations are of the conviction that there is no need for the organisations to implement two EMSs. Only one of the fifteen organisations believe that two EMSs can create an efficient environment within the organisations (Table 4.14).

4.3 Conclusion

This chapter was critical in its analysis of the results of the study in order to ascertain whether the chemical and allied industries had a preference of either Responsible Care or ISO 14001. The analysis of the results also highlighted the benefits and challenges of both EMSs. The results also revealed which EMS was more suited to the South African study. The results showed that organisations preferred ISO 14001 to Responsible Care when it came to meeting environmental objectives, increased environmental awareness and increased legal compliance, these organisations however, still indicated that the time, resources and money spent on 2 EMSs were justified.

CHAPTER FIVE: Conclusion and Recommendations

5.1 Introduction

This chapter, the final and ultimate component of this study, provides the reader with an overall conclusion, followed by recommendations. This research comprised of four objectives pertaining to the overall aim of the study. In concluding this investigation, the researcher will revisit the objectives to assess whether they were achieved. Thereafter, recommendations pertaining to the objectives will be focussed upon. The objectives together with their recommendations, ultimately determine if there is need for the implementation of two Environmental Management Systems (ISO 14001 and Responsible Care) in the South African chemical industry.

5.2 Summary of Objectives

5.2.1 Objective One: To assess the relative levels of efficacy of the Responsible Care and ISO 14001 standard in achieving environmental objectives and compliance to environmental legislation.

The actual data being discussed below is reflected in Tables 4.1, 4.2, 4.3 and 4.7. Organisations that are ISO14001 and/or Responsible Care certified are, in terms of their affiliation to the international organisation that monitors their activities, required to ensure that their EMS or EMSs are implemented such that environmental objectives materialize within set time frames and that they are in compliance to the country's legislation pertaining to the environment.

Responses to questions, relating to the above objective, yielded responses which suggested that the majority of organisations were of the conviction that ISO14001 is most suitable. It creates an atmosphere conducive for the achievement of organisational objectives, and more importantly, it enhances environmental compliance. The latter also enables employees to become more aware of environmentally related issues and, as such, these employees exercise the necessary care to protect the fragile biophysical environment. This, in general, is achieved by ensuring that concentrations of emissions and effluents, discharged from chemical industries, are in compliance with

government standards. The achievement of organisational objectives, within legal frameworks (compliance), has endowed these organisations with both local and international recognition. Consequently, these organisations enjoy excellent trade relations with industries and retail outlets within and outside South Africa. Preference for ISO 14001 by respondents with reference to meeting the stated objectives can, to a large extent, be attributed to this EMS being implemented prior to that of Responsible Care. The latter was formulated according to most of the principles underpinning ISO14001. One can therefore assume that the popularity of ISO14001 for achieving the above objectives is due to this EMS being in practice prior to implementation of Responsible Care. It is possible that if Responsible Care was implemented prior to ISO14001 then respondents would have chosen the former as being most suitable in achieving organisational objectives and being in compliant with environmental legislation.

5.2.2 Objective Two: To determine which of the two standards is more popular within the chemical industry and which has received greater acceptance.

The actual data being discussed is reflected in Tables 4.8, 4.7 and in Figure 4.1. The focus here on the second objective of the investigation, was to compare ISO 14001 with Responsible Care in terms of popularity and acceptance among the organisations affiliated to the chemical industry. An overwhelming response of 80% indicated that ISO 14001 enjoyed a greater level of popularity and acceptance than Responsible Care. The latter, originally developed in Canada and used extensively in the United States, emphasises community interaction and process safety. This aspect of an EMS requires certain skills and resources which are readily available in first world countries. The choice of ISO 14001 by respondents, in respect of popularity and acceptance, can be attributed to the lack of required resources and skills. South Africa, essentially a developing country, cannot provide the necessary resources and skills required for community interaction and process safety. Those charged with the function of implementing EMSs in the chemical industry would, therefore, favour the one that is much more convenient to implement.

5.2.3 Objective Three: To determine if ISO 14001 or Responsible Care adds value to the business as a whole.

Tables 4.7, 4.9 reflect the actual data being discussed below. The organisations involved in this investigation, ultimately, are business enterprises. Profit maximisation and cost minimisation are pivotal factors in capitalist-oriented industries that thrive on effectiveness, efficiency and economy. It is therefore of great significance that these industries opt for an EMS that serves their best interests. This researcher, taking cognisance of the business nature of the organisations, included “adding value to business” as one of the objectives in this investigation. Questions relating to this objective, *inter alia*, related to meeting of environmental objectives, enhancing environmental compliance and awareness, applicability to South Africa and overall benefits. The majority of the respondents were of the view that the EMS most suitable in a capitalist-oriented industry, in terms of adding value to business, was ISO 14001. South African business enterprises, to a large extent, are ISO certified with respect to EMSs. This affords the chemical industries much convenience to conduct business with other enterprises. Notwithstanding the latter, the choice of ISO14001 by the majority, as opposed to Responsible Care, can be attributed to it meeting the objectives of the organisation, increasing environmental awareness and compliance and, more importantly, rendering the organisation to be effective, efficient and economical.

5.2.4 Objective Four: To determine the benefits and challenges of implementing ISO 14001 and Responsible Care.

The actual data being discussed can be seen in Tables 4.10, 4.11, 4.12 and 4.13. The focus on this objective, the final one for this investigation, was to identify benefits and challenges pertaining to the implementation of the two EMSs, *viz.*, ISO 14001 and Responsible Care. Respondents, representing the chemical organisations which were subjected to questions relating to sustainability, legal compliance, environmental awareness, leverage and good corporate image. The majority of the respondents indicated that both EMSs increased legal compliance in their organisations. Further to this, they were convinced that ISO 14001 promoted sustainability and environmental awareness. Responsible Care enjoyed a higher response rate with respect to good corporate image and leverage. Lack of resources, time constraints and documentation

issues were cited as challenges by the organisations. These challenges were common to ISO 14001 and Responsible Care. The benefits and challenges, experienced by the chemical organisations are not unique to South Africa. Studies of the two EMSs in other parts of the world yielded results not significantly different from those in this investigation.

5.3 Recommendations

From the above it is evident that the majority of the responses from the organisations favoured ISO 14001 over Responsible Care. Notwithstanding the responses, the Responsible Care EMS does offer certain benefits that supersede ISO 14001. Reference, in this regard can be made to one particular variable *viz.* community interaction and process safety. The latter does not feature in ISO 14001. The popularity of Responsible Care in first world countries, is to a large extent attributed to this variable. Organisations in developed countries are under enormous pressure from civic bodies, non-governmental organisations and environmental legislation to adopt and implement measures relating to community interaction and process safety. A very thorough and comprehensive analysis of the two EMSs will reveal that, apart from the community interaction and process safety variable, the two EMSs are similar as highlighted by Table 2.2 in the literature review. Differences, however, can arise if implementation of the standards is not in accordance with the prescribed guidelines. It is therefore recommended that the organisations, on the basis of preference, retain a single EMS, *viz.* ISO14001, with the proviso that community interaction and process safety are incorporated into the standard. The chemical industry, profit maximisation and cost minimisation enterprise will enjoy greater financial benefits through the implementation of a single EMS. Personnel costs, in particular, will be significantly alleviated.

Responsible Care, despite enjoying a relatively low status in terms of the responses, should not be ignored in its entirety. It offers Process Safety, Health and Safety, Product Stewardship and Community Interaction. These elements of Responsible Care, together with ISO 14001 can add value to the chemical industry. In 2002, the American Chemistry Council (ACC) formulated an EMS through the combination of ISO 14001 and Responsible Care. This combined standard was referred to as Responsible Care 14001 (Gilbertsen and Kowalski, 2002). This new EMS is intended to help the chemical and allied industries continually improve their performance, standardize and

certify environmental improvement practices, expand their EMSs to promote health and safety and facilitate product stewardship and communication programs. This EMS has been implemented at BASF and Arch Chemicals in the U.S. (Gilbertsen and Kowalski, 2002). This combined standard has not been implemented anywhere else in the world. ISO 14001 is more recognisable locally, is used for export to Europe and is audited by external certification bodies. Responsible Care still has a low recognition value in South Africa, is not audited by a certification body but by external auditors and is not a requirement for export. South African companies would benefit from Responsible Care 14001 as ISO 14001 imposes no health and safety requirements, leaves the extent of product stewardship up to the organisation and requires no communication of environmental performance to the public. The Responsible Care initiative and ISO 14001, actually, have diverse strengths. ISO 14001 focusses narrowly on environmental management and accentuates strictness in certification. The Responsible Care initiative encompasses health, safety, community, customers and communication improvements. By combining the two EMSs, companies get a rigorous, broad standard that can yield outstanding performance. Under Responsible Care 14001, an organisation can build a single EMS that is reliable with regard to both standards. ACC created the Responsible Care 14001 Management System Technical Specification, which methodically reconciles each element of ISO 14001 with the corresponding specifications of the Responsible Care initiative. Responsible Care 14001 offers the following advantages over ISO 14001 alone:

- An extended aspect/impact assessment process;
- Required proactive outreach to the community;
- Environmental performance reporting to investors;
- Required importance on upstream supplier issues and downstream customers and
- Qualification, training and review of contractors, transporters and other service providers.

By combining Responsible Care and ISO 14001, an organisation is able to add depth, rigour and credibility to its existing systems. The South African chemical and allied industries needs to look at Responsible Care 14001 and determine whether implementing this EMS would be more efficient.

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Appendix 1

Management Practice Standards

Storage and Transportation

„The objectives of the Storage and Transportation Management Practice Standards are to minimise the probability and potential severity of storage and transportation related incidents posing a threat to persons or the environment or involving loss of product or equipment.“

Product Stewardship

„This set of Management Practice Standards recognises the need for member companies to take responsibility for all significant considerations concerned with safety and the protection of health and the environment during the entire lifecycle of their products.“

Process Safety

The Process Safety Code is intended to prevent fires, explosions and accidental chemical releases.

Management Commitments

The objective of this standard is to provide a guide to management of member companies, in terms of their responsibilities for the initiative.

Pollution Prevention and Resource Efficiency

„The achievement and demonstration of responsible pollution prevention and resource efficiency at worksites is a primary goal of these standards.

Health and Safety

The purpose of the Health and Safety Management Practice standard is to protect the health and safety of persons working at the member company’s worksite. This management practice standard identifies hazards, prevents unsafe acts and conditions, maintains employee health and fosters communication on health and safety issues.

Emergency Response and Community Interaction

The Emergency Response Management Practice standard ensures that each facility has appropriate emergency plans to protect the health and safety of the workers. It also builds confidence in the surrounding community as it creates awareness of the hazards and the mitigation procedures that are in place at the company. Available from <http://www.caia.co.za> (Accessed on 19 April 2012).

Appendix 2

UNIVERSITY OF KWAZULU NATAL
SCHOOL OF AGRICULTURAL, EARTH AND ENVIRONMENTAL
SCIENCES

Research Questionnaire:

ISO 14001 versus Responsible Care as an Effective Environmental Management-
System

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The information contained, herein, is private and confidential. A question requiring identity, is purely for internal referencing. Your input into this research project is greatly appreciated.

NB: In order to complete the questionnaire, your company must have both, Responsible Care and ISO 14001.2004 in place.

Company Details

Company Name: _____

Total no. of employees: _____

Briefly describe your company's core business: _____

Type of Business(eg. manufacturing, warehousing, distribution): _____

Name (Optional): _____

Tel.no. (Optional): _____

Email (Optional): _____

Date: _____

Questionnaire no.(for ref.purposes): _____

Environmental Management Systems (Tick the relevant answer).

1. Does your company have ISO 9001.2008 accreditation?

1. Yes	2. No
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2. Does your company have an Environmental Management System (EMS) in place?

1. Yes	2. No
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3. Does your company have ISO 14001.2004 accreditation and, if so, in which year did the company receive accreditation?

1. Yes	2. No	3. Year:
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4. Has your company been verified against Responsible Care and, if so, in which year did they receive verification?

1. Yes	2. No	3. Year:
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5. What was the motivation behind the implementation of Responsible Care and ISO 14001? Please choose the most appropriate answer.

1. An internal requirement.	
2. A group or corporate requirement.	
3. Access to export.	
4. To ensure compliance with environmental legislation.	
5. Customer requirement.	
6. Other (Specify).	

Costs of implementing an EMS

6. Was there a cost factor involved in the implementation of Responsible Care and ISO 14001?

1. Yes	2. No
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7. Did management perceive the cost of the implementation of Responsible Care and ISO 14001 as costly?

1. Yes	2. No
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8. What was the cost of implementing Responsible Care (estimated figures acceptable)?

1. R0-R50 000	
2. R51 000-R100 000	
3. R101 000-R 500 000	
4. R501 000-R1000 000	
5. >R1000 000	

9. What was the cost of implementing ISO 14001.2004 (estimated figures acceptable)?

1. R0-R50 000	
2. R51 000-R100 000	
3. R101 000-R 500 000	
4. R501 000-R1000 000	
5. >R1000 000	

Responsible Care vs ISO 14001

10. Does your company export products or goods and, if so, which of the two standards was a requirement for export purposes? Tick the relevant Environmental Management System(EMS).

1. Responsible Care	2. ISO 14001
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11. What was the benefits of implementing:

1. Responsible Care

2. ISO 14001

12. Which of the 2 EMSs, below, were easier to implement? (Tick the relevant EMS).

1. Responsible Care	2. ISO 14001
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13. Which of the two EMSs have resulted in financial benefits (eg. reduction in waste disposal costs, water and energy expenses)?

1. Responsible Care	2. ISO 14001
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14. Which of the two EMSs resulted in an increase in environmental legal compliance?

1. Responsible Care_____	2. ISO 14001_____
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15. Is Responsible Care or ISO 14001 more recognisable by your local customers?

1. Responsible Care	2. ISO 14001
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16. Is Responsible Care or ISO 14001 more recognisable by your international customers?

1. Responsible Care	2. ISO 14001
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17. Which of the two, below in your opinion, is more applicable as an Environmental Management System in the South African context?

1. Responsible Care	2. ISO 14001
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18. Which of the two EMSs, in your opinion is more flexible in allowing you to design your Environmental Management System your own way?

1. Responsible Care	2. ISO 14001
---------------------	--------------

19. Which of the two EMSs gets more commitment from top management?

1. Responsible Care	2. ISO 14001
---------------------	--------------

20. In your opinion which of the two EMSs, adds the most value to your organisation?

1. Responsible Care	2. ISO 14001
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21. From the EMS chosen above, how do you believe that EMS adds value to your organisation?

22. Which of the two EMSs have improved environmental performance by ensuring the company's environmental objectives are met?

1. Responsible Care	2. ISO 14001
---------------------	--------------

23. Which of the two EMSs have increased environmental awareness amongst employees?

1. Responsible Care	2. ISO 14001
---------------------	--------------

24. Which of the two EMSs facilitated better community interaction with your company, surrounding the company's environmental impacts?

1. Responsible Care	2. ISO 14001
---------------------	--------------

25. Which of the two EMSs ensures environmental compliance from „cradle to grave“?

1. Responsible Care	2. ISO 14001
---------------------	--------------

Logistics of Implementation

26. In order to implement the standard, training is required for implementation and auditing of the EMS. Which of the two EMSs was training readily available for?

1. Responsible Care	2. ISO 14001
---------------------	--------------

27. Which of the two EMSs required the use of an external specialist consultant?

1. Responsible Care	2. ISO 14001
---------------------	--------------

28. Were third party auditors readily available for certification of the EMSs below?
Answer Yes or No.

28.1) ISO 14001

1. Yes	2. No
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28.2) Responsible Care

1. Yes	2. No
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29. What were the problems experienced when implementing ISO 14001 and Responsible Care?

1. Lack of resources.	
2. Lack of finance.	
3. Lack of time.	
4. Resistance from employees.	
5. Documentation issues.	

30. Does having two EMSs warrant the resources, costs and time involved?

1. Yes	2. No
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Thank you for completing the questionnaire.

Rivana Dwarika