



**EVALUATING THE EFFECTIVENESS OF ISO14001 – ENVIRONMENTAL
MANAGEMENT SYSTEM (EMS) IN IMPROVING KEY ENVIRONMENTAL
PERFORMANCE INDICATORS OF ESKOM DISTRIBUTION: A CASE STUDY OF
MPUMALANGA OPERATING UNIT**

By

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DECLARATION

I, Adeline Manake, declare that the thesis / dissertation, which I hereby submit for the degree Master of Science in Environmental Management at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.



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DATE: 21 January 2019

ABSTRACT

Evaluating the Effectiveness of ISO14001 – Environmental Management System (EMS) in Improving Key Environmental Performance Indicators of Eskom Distribution: A Case study of Mpumalanga Operating Unit

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Abstract

The purpose of this research is to evaluate the effectiveness of Environmental Management System (EMS) (based on ISO 14001 Standard) in improving environmental Key Performance Indicators (KPIs). The identified KPIs are waste management, environmental training and environmental incidents. In order to achieve the aim, the methodology employed was mixed research methodology, which included quantitative approach in terms of survey questionnaires and qualitative approach in terms of interviews and observations at identified sites. The key findings reveal that ISO 14001 is effective in identifying the environmental aspects associated with waste management, environmental goals are achieved and key personnel dealing with waste management have been trained.

The key contribution of this research is by creating an increased knowledge in literature with regard to EMS as a tool for improving environmental performance. Practically this research provides organisations planning to develop and implement EMS with knowledge on the critical areas to assess, in order to ensure effective implementation of EMS.

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Contents

DECLARATION.....	ii
ABSTRACT iii	
ACKNOWLEDGEMENTS.....	iv
CHAPTER 1: Introduction	1
1.1. BACKGROUND	1
1.2. DESCRIPTION OF THE STUDY AREA	4
1.3. PROBLEM STATEMENT	9
1.4. AIM AND OBJECTIVES OF THE STUDY.....	10
1.4.1 OBJECTIVES OF THE STUDY.....	10
1.5. RESEARCH QUESTIONS	10
1.6. CONTEXT, SCOPE AND METHODOLOGY OF THE STUDY	11
1.7. LIMITATIONS OF THE STUDY.....	11
1.8. ORGANISATION OF THE STUDY	11
CHAPTER 2: Literature Study.....	13
2.1. INTRODUCTION	13
2.2. DEFINING ISO 14001 AND ENVIRONMENTAL MANAGEMENT SYSTEM (EMS).....	13
2.3. THE KEY ELEMENTS OF ISO 14001 STANDARD.....	14
2.3.1 ENVIRONMENTAL POLICY.....	16
2.3.2 ENVIRONMENTAL IMPACT EVALUATION	16
2.3.3 ENVIRONMENTAL OBJECTIVES AND TARGETS.....	16
2.3.4 RESPONSIBILITIES AND TRAINING	16
2.3.5 REVIEW AND CONTINUAL IMPROVEMENT.....	16
2.4. REVISION OF ISO 14001 STANDARD	16
2.5. RATIONALE FOR SEEKING ISO 14001 IMPLEMENTATION AND CERTIFICATION	18
2.6. BENEFITS OF ADOPTING ISO14001	20
2.7. ISO 14001 AND ENVIRONMENTAL PERFORMANCE	21
2.8. CRITICAL FACTORS FOR SUCCESSFUL IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) BASED ON ISO 14001 STANDARD	23
2.9. PROCESS OF ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) IMPLEMENTATION IN TERMS OF ISO 14001 STANDARD	24
2.10. CHALLENGES AND BARRIERS ASSOCIATED WITH ENVIRONMENTAL MANAGEMENT SYSTEM BASED ON ISO 14001 IMPLEMENTATION	26
CHAPTER 3: Research Methodology	27
3.1. INTRODUCTION	27
3.2. JUSTIFICATION FOR RESEARCH METHODS	27
3.3. ETHICAL CONSIDERATION.....	27
3.4. RESEARCH DESIGN	29
3.4.1 Sampling	32

3.4.2	<i>Data collection methods</i>	32
3.5.	DESIGN OF RESEARCH INSTRUMENTS	36
3.5.1.	<i>Questionnaire design</i>	36
3.5.2.	<i>Interview design</i>	36
3.6.	DATA EDITING, CODING, CAPTURING AND STORING	37
CHAPTER 4: Research results and findings		40
4.1.	INTRODUCTION	40
4.2.	RESULTS: QUANTITATIVE STUDY.....	40
4.2.1.	<i>Demographic Profile of the Respondents</i>	41
4.2.2.	<i>Elements of Mpumalanga Operating Unit (MOU)'s Environmental Management System (EMS)</i>	43
4.2.3.	<i>Benefits of EMS</i>	44
4.2.4.	<i>Environmental Training</i>	45
4.2.5.	<i>Waste Management</i>	46
4.3.	FINDINGS: QUALITATIVE STUDY	48
4.3.1	<i>Demographic profile of the respondents</i>	48
4.3.2	<i>Interviews</i>	49
4.3.3.	<i>OBSERVATIONS</i>	57
4.3.4	<i>Access to and identification of Legislative requirements</i>	64
CHAPTER 5: Conclusions and Recommendations		66
5.1.	INTRODUCTION	66
5.2.	SUMMARY OF FINDINGS.....	66
5.3.	CONCLUSION.....	68
5.4.	RECOMMENDATIONS	69
5.4.1	<i>Recommendations for ESKOM</i>	70
5.4.2	<i>Recommendations for further research</i>	70
Reference List		71
APPENDIX A: PERMISSION LETTER FOR RESEARCH STUDY		78
APPENDIX B: EXAMPLES OF INFORMED CONSENT FORMS		79
APPENDIX C: INTERVIEW GUIDE.....		80
APPENDIX D: COVER LETTER FOR QUESTIONNAIRE.....		81
APPENDIX E : RESEARCH QUESTIONNAIRE		82

LIST OF FIGURES

Figure 1.1: Map of Mpumalanga Operating Unit.....	6
Figure 2.1: Plan, Do, Check, Act cycle	15
Figure 2.2: PDCA cycle in terms of ISO14001:2015 Standard.....	17
Figure 4.1: Power Plant Maintenance Workshop (PPM), Witbank – Maintenance area indicating transformers in an oil tray, to contain oil leaks from the transformer.	57
Figure 4.2: Drain Bay to contain the drained oil from the transformers for recycling – PPM Workshop - Witbank	58
Figure 4.3: Used Thinners and Paint containers for disposal – PPM Workshop, Witbank	58
Figure 4.4: Used Oil rags contained in a waste Skip. Site: PPM workshop, Witbank	59
Figure 4.5: Rotten wooden poles, Ermelo CNC – Ermelo Zone	60
Figure 4.6: Scrap conductors placed in a waste skip, Ermelo CNC – Ermelo Zone .	60
Figure 4.7 Boxes, plastics and metals (red circle) placed in a waste skip, Ermelo CNC – Ermelo Zone	61
Figure 4.8: Boxes and plastic bottles (red circle) scattered, bottles mixed with boxes, Ermelo CNC – Ermelo Zone	61
Figure 4.9: Insulators, scrap conductors & defective transformers placed on the ground, Kwaggafontein CNC – Emalahleni Zone	62
Figure 4.10: Scrap conductors, Kwaggafontein CNC – Emalahleni Zone	62
Figure 4.11: Scrap metre boxes with plastics, Kwaggafontein CNC – Emalahleni Zone.....	63
Figure 4.12: Wooden poles with creosote wearing off the poles, Kwaggafontein CNC – Emalahleni Zone	63

LIST OF TABLES

Table 1.1: MOU Customer Network Centres (CNC)	7
Table 3.1: Research Design: Quantitative and Qualitative Stages.....	30
Table 3.2: Quantitative vs qualitative Design.....	31
Table 3.3: Coding – Demographic Background.....	38
Table 3.4: Coding for qualitative data	39
Table 4.1: Demographic profile the respondents - Gender	41
Table 4.2: Demographic profile the respondents – Level of Education	41
Table 4.3: Demographic profile the respondents - Position.....	42
Table 4.4: Demographic profile the respondents – Job Grading	43
Table 4.5: Elements of MOU's Environmental Management System (EMS).....	44
Table 4.6: Benefits of EMS.....	45
Table 4.7: Environmental Training.....	45
Table 4.8: Waste Management	47
Table 4.9: Demographic characteristics of the participants.....	49
Table 4.10: Responses to Closed - ended questions.....	50

LIST OF ACRONYMS

Dx	:	Eskom Distribution
EMS	:	Environmental Management System
KPI	:	Key Performance Indicators
ISO	:	International Organisation for Standardization
MOU	:	Mpumalanga Operating Unit
PDCA	:	Plan-Do-Check-Act
SHEQ	:	Safety Health Environment and Quality

CHAPTER 1: INTRODUCTION

1.1. BACKGROUND

ISO 14001 Standard is recognized as one of the voluntary tools to effectively manage the activities of an organisation as well as to measure, evaluate, and improve its environmental performance (Salim & Padfield 2017:254). It assists organizations to identify environmental impacts resulting from their operational activities and to improve their environmental performance. Da Forsenca (2015:37) states that, ISO 14001 is an international standard, based on the concept that better environmental performance can be achieved when environmental aspects are systematically identified and managed, through pollution prevention, and improved environmental performance as well as complying with applicable laws.

ISO 14001 Standard provides the basic framework for organisations to establish an Environmental Management System (EMS) (Murmura *et al.* 2018:692). Ivanova *et al.* (2014:1271) explains the difference between a “standard” and a “system”. The term “standard” refers to a management standard, in this case, an ISO 14001 Standard. The term “system” refers to the company’s management system, in this case, EMS Ivanova *et al.* (2014:1271). EMS is a set of management tools and principles that are intended to assist organisations to integrate environmental issues into their daily operations. An EMS is designed to guide an organisation in allocating resources, assigning roles and responsibilities and continually evaluating its practices, procedures and processes in order to enhance environmental management (Dwarika 2015:5). In addition, EMS allows an organization to devise its policy and objectives while considering the legal requirements and information concerning significant environmental impacts (Campos *et al.* 2015:287).

Many companies around the world have been implementing EMS by adopting ISO 14001 Standard, and have undergone its certification. According to the ISO survey undertaken in 2016, 346189 ISO 14001:2004 certificates have been issued worldwide (ISO 2017:1). 323023 certificates were issued based on the ISO 14001:2004 Standard and 23167 certificates were issued based on the ISO 14001:2015 Standard. ISO 14001 Standard is intended to apply to organizations of

all types and sizes around the world (ISO 2004:v). According to Searcy *et al.* (2012:279), the overall aim of the ISO 14001 Standard is to support environmental protection and prevention of pollution. Companies adopt ISO 14001 Standard for various reasons. Massoud *et al.* (2012:110) believe that, the driving forces for ISO 14001 adoption vary according to the type of industry and country. In the Italian metal companies, Arena *et al.* (2012:5) found that, the motivation for ISO 14001 implementation was to achieve improvement of the environmental performance, the improvement of corporate image, the improvement in the relationship with the regulators, the improvement in the relationship with local communities, and the improvement of product quality. Whilst in the Germany's Energy and Gas organizations, the rationale for adopting ISO 14001, was to ensure regulatory compliance, increase operational efficiencies, and improve documentation (Massoud *et al.* 2012:110).

The primary motivation for Macao region in China, to adopt ISO 14001 Standard, was to promote employees' environmental awareness, improve efficiency, integrate with other management systems, ensure compliance to environmental regulations, reducing environmental-related costs and to meet supplier-chain requirements (To and Tang 2014:250). In Spain, Heras-Saizarbitoria *et al.* (2014:3) propose three types of motives, the ethical, competitive and relational motives that lead companies to adopt ISO 14001 and implement an Environmental Management System (EMS). Ethical motives are a response to feelings related to environmental responsibility. Competitive motives arise from the search for competitive advantage. Relational motives emerge from the desire on the part of a company to become legitimized and to improve the relationships between the different interest groups in the company stakeholders Heras-Saizarbitoria *et al.* (2014:3).

According to Tyira (2012:11), the decision to adopt ISO 14001 and implement EMS in some underground platinum mines in South Africa, was based on the need to minimise harm to the environment by designing, operating and closing all operations in an environmentally responsible manner. Chauke *et al.* (2017:63) indicated that a number of South African companies have implemented ISO 14001 as a result of their response to the demands from the customers and market, for higher environmental reliability.

Heras-Saizarbitoria *et al.* (2014:3) draws a distinction between the internal and external motivating factors for adopting ISO 14001. The internal motives relates to

efficiency issues such as improvement in performance, productivity and profitability. The external or institutional motives relates to the social pressure exerted by different agents to persuade company managers to adopt ISO 14001. Daughtry (2014:30) expressed that the need for organizations to address environmental issues has increased due to either external or internal pressure. External pressure may be in the form of regulatory requirements from authorities and internal pressure may be in the form of the organization's Environmental policy. Simpson and Sroufe (2014:830) believe that, firms that seek stakeholder recognition of their practices, or face stakeholder pressure for evidence of improvement, implement ISO 14001 Standard.

Deepak *et al.* (2015:161), believes that the rationale for companies to adopt ISO 14001 Standard is based on the need to gain a competitive edge. Further on, Deepak *et al.* (2015:162), pointed to a survey that found that, 61% of executives at 115 large North American businesses, expected ISO 14001 to bring potential competitive advantages such as the attraction of new business and customers, image and reputation enhancement as well as ability to enter the international market. Ferron-Vílchez (2016:883) pointed some examples of competitive advantages associated with ISO 14001 adoption, which include international trade for firms, preferential access to foreign markets allowing reductions in information asymmetries. Furthermore, Hojnik and Ruzzier (2017:584) described competitive advantage associated with ISO 14001 Standard, in terms of cost reduction, stronger reputation among customers, and increased competitiveness in international markets, which eventually improves the organisation's financial performance.

ISO 14001 is based on a key concept of implementing a systematic approach in order to reduce the environmental impacts, control the significant environmental aspects, with an ongoing commitment to improving the overall environmental performance (Mazzi *et al.* 2016:874). Furthermore, Arimura *et al.* (2016:557) indicates that ISO 14001 requires that facilities establish an environmental policy, create quantifiable goals to reduce their environmental impacts, and monitor their environmental progress through systematic auditing and management review. Additionally, ISO 14001 Standard is based on a continuous-improvement model that expects firms to periodically update their environmental improvement goals to ensure that negative environmental impacts are minimized (Arimura *et al.* 2016:557).

Fei-Baffoe *et al.* (2013:1) indicates that EMS is one of the tools available for making organizations more environmentally proactive and efficient and aims to encourage an

organisation to control its environmental impacts and reduce such impacts continuously. In addition, the companies set objectives and targets for managing their environmental issues. They monitor, measure, and evaluate their progress in environmental performance (Fei-Baffoe *et al.* 2013:1). Arimura *et al.*, (2016:556) pointed to various studies where ISO 14001 adopters have revealed improved environmental performance. For example, ISO 14001 adopters operating in the United States, Japan and Mexico have shown improved environmental performance (Arimura *et al.* 2016:556). Fonseca and Domingues (2018:2) indicate that many companies aimed to improve the environmental performance of their processes by implementing an EMS, based on ISO 14001 Standard.

According to da Forsenca (2015:39), better environmental performance can be achieved when environmental aspects are systematically identified and managed through pollution prevention, improved environmental performance and complying with applicable laws. In addition, Fonseca and Domingues (2018:2) indicate that the ability to manage the environmental aspects more effectively and continually improve the environmental performance is some of the benefits associated with EMS.

Despite evidence of improved environmental performance after implementing ISO 14001, Maletič *et al.* (2015:875) argued that, it does not confirm that the improvement in environmental performance can be entirely attributed to ISO 14001 implementation. In addition, Maletic *et al.* (2015:875) pointed to some empirical studies that revealed a negative relationship between environmental performance and ISO 14001 adoption. Similarly, Nguyen and Hens (2015:362) indicate that uncertainty exists as to whether or not, ISO 14001 Standard improves environmental performance. In order to address the uncertainty regarding the benefit of ISO 14001 in improving environmental performance, this research is undertaken in Eskom – Distribution (Dx), Mpumalanga Operating Unit (MOU).

1.2. DESCRIPTION OF THE STUDY AREA

Mpumalanga Operating Unit (MOU) is one of the Eskom Distribution (Dx) Operating Units (OU). An OU refers to a geographical province, therefore MOU refers to Mpumalanga province. It is divided into three zones namely, Emalahleni, Ermelo and Mbombela zones, as colour coded in Figure 1.1. MOU is responsible for managing

and distributing electricity distribution assets and for providing reliable electricity by building, operating and maintaining distribution infrastructure (MOU 2018:15). As indicated in the MOU operational plan (MOU 2018:12), MOU operates 278 substations, 451 High Voltage (HV) lines of 5 019 km and 849 Medium Voltage (MV) feeders of 28 683 km. The Zones are responsible for managing and operating the indicated infrastructure. Within the zones, there are about 43 Customer Network Centres (CNCs) and 2 electrical workshops. Refer to Figure 1.1 and Table 1.1. The CNCs and workshops undertake maintenance of the infrastructure at different levels. The CNC's are responsible for operating, building, maintaining and repairing the electrical network in order to promote safety, satisfy customers and to achieve business and statutory requirements (Hlonwana 2014:8). There are also other departments such as Network engineering, Land Development and Project execution which provide support services in infrastructure related acquisition projects (MOU 2018:18).

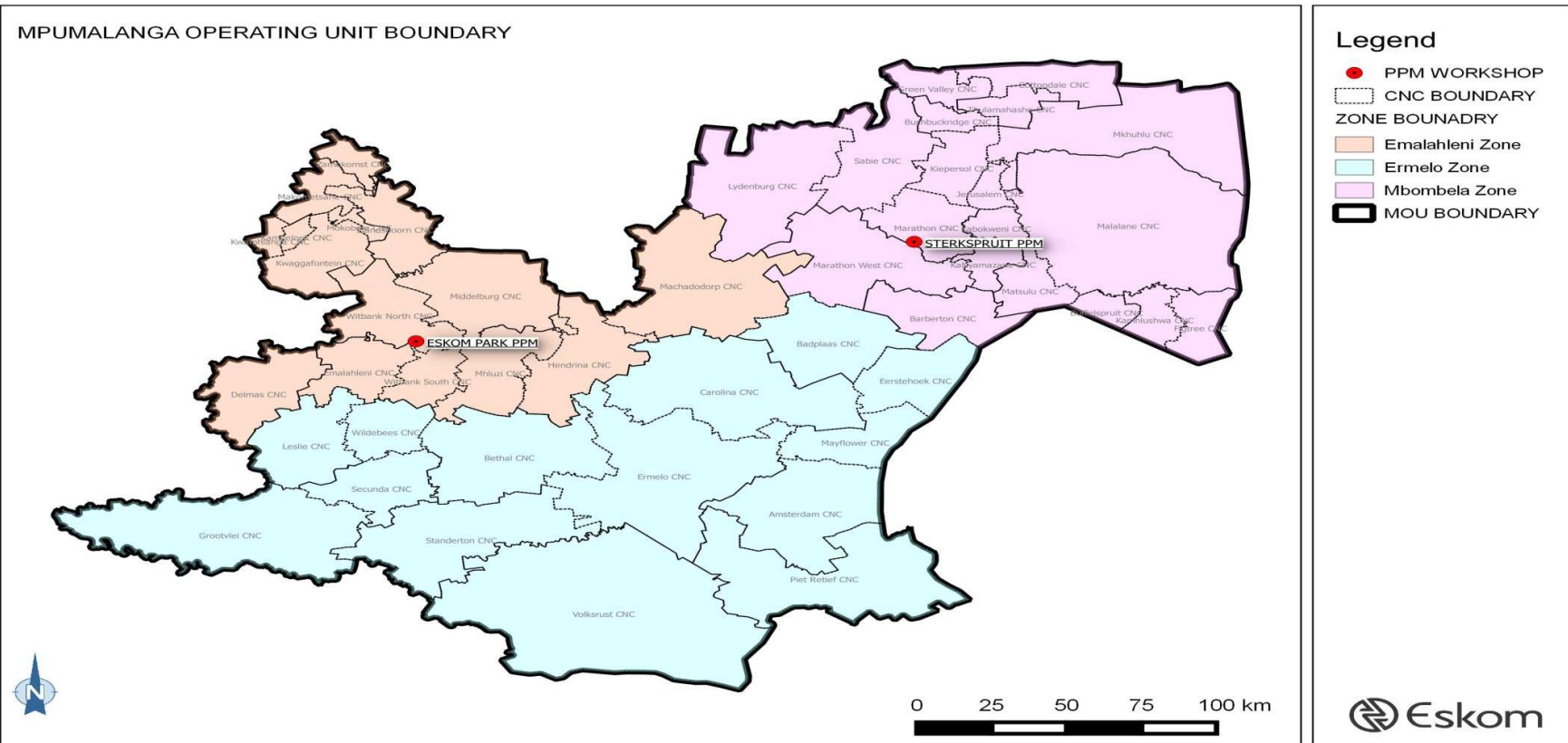


Figure 1.1: Map of Mpumalanga Operating Unit
(Source: Eskom GIS)

Table 1.1: MOU Customer Network Centres (CNC)

MOU Zone	CNC
Emalahleni Zone	Elandsdoorn
	Kwaggafontein
	KwaMhlanga
	Zamekomst
	Kameelnek
	Delmas
	Witbank North
	Witbank South
	Emalahleni
	Hendrina
	Machadodorp
	Middleburg
Ermelo Zone	Grootvlei
	Standerton
	Leslie
	Wildebees
	Ermelo
	Piet Retief
	Volksrust
	Bethal
	Badplaas
	Carolina
	Eesrtehoek
	Mayflower
Mbombela Zone	Barberton
	Marathon
	Marathon West
	Kanyamazane
	Kabokweni
	Buffelspruit
	Figtree
	Kamhlushwa
	Malelane
	Matsulu

Mbomela Zone	Jerusalem
	Lydenburg
	Sabie
	Kiepersol
	Mkhuhlu
	Greenvalley
	Bushbuckridge
	Cottendale
	Thulamahashe

(Source: Authors' own)

MOU activities are associated with some environmental impacts, on account of transformer oil spillages, waste generation and tree cutting due to clearing of servitudes (Chuma 2018:6). In taking efforts to address the environmental impacts, MOU has adopted ISO 14001 by developing, implementing and maintaining its EMS based on the ISO 14001 requirements. EMS implementation started formally in 2013, with a process of environmental aspects and impacts identification, inclusion of significant aspects in the MOU environmental objectives and targets. MOU was compelled to implement and certify its EMS (based on ISO 14001 Standard) through Eskom's SHEQ policy 32-727. As part of the SHEQ policy, Eskom has developed overarching objectives, which MOU has to achieve. Some of the strategic objectives include the following: (Eskom 2014:6)

- Achieve legal compliance to environmental legislation as a minimum requirement in all activities through effective management systems, monitoring, reporting and research.
- Enhance efficiency of waste management through reduction, reuse and recycling practices.

Implementing and maintaining Environmental Management System (EMS) aimed at obtaining ISO 14001 certificate is one of the key mechanisms to achieve the above mentioned strategic objectives (Eskom 2014:23). The objective of this study is to evaluate the effectiveness of ISO 14001 in improving key environmental parameters related to MOU's environmental performance. Some of the parameters include waste management, environmental training and environmentally related incidents.

The current study will be the first of its kind to be conducted in Eskom Distribution Mpumalanga Operating Unit (MOU). Considering the research work undertaken, and outcome of data analysis, value will be derived from this study in the following manner:

- Provide information which will enable drawing conclusion regarding the effectiveness of ISO 14001 adoption.
- Assist in justifying the amount of effort and expenses associated with ISO 14001 registration.
- The findings of this research will be used to improve the environmental culture in MOU.

1.3. PROBLEM STATEMENT

Fei-Baffoe *et al.* (2013:1) suggests that, ISO 14001 prescribes controls for activities that have a negative impact on the environment. The handling and treatment of waste is one of the activities that have an effect on the environment (Fei-Baffoe *et al.* 2013:1). In Eskom, Mpumalanga Operating Unit (MOU), the waste streams that are handled, include transformer oil, silica gel, oil rags, saw dust and scrap metal (Ndou 2018:3). The generation, handling and management of waste were identified as a significant environmental aspect with an impact on the environment, if not well managed (Chuma 2018:3). Hence, waste management, together with environmental training and environmental incidents have been included as some of the Dx environmental Key Performance Indicators (KPI) (October 2017:40). MOU is required to meet the Dx environmental KPIs as part of the strategic environmental objectives. A KPI embeds performance targets that indicate how an organization is performing relative to a specific objective (Sahai and Sahni 2016:17).

MOU has implemented EMS and has certified it in terms of ISO 14001:2004. However, it is not known whether EMS implementation and ISO 14001 certification is justified in terms of assisting MOU to improve its environmental performance. According to McGuire (2014:255), an ISO 14001 compliant EMS must enable firms to:

- Identify and control their environmental impact;
- Continually improve their environmental performance; and
- Implement a systematic approach to achieving environmental goals.

Additionally, according to ISO 14001 Standard (ISO 2015:9), organisations wishing to adopt ISO 14001 and implement EMS, must determine and have access to legal requirements related to its environmental aspects. Based on McGuire (2014:255)'s view and on ISO 14001 Standard (ISO 2015:9), the aim of this research is stated below.

1.4. AIM AND OBJECTIVES OF THE STUDY

The overall aim of this study is to evaluate the effectiveness of Environmental Management System (EMS) (based on ISO14001 Standard) in improving environmental performance, particularly with relevance to waste management.

1.4.1 OBJECTIVES OF THE STUDY

In line with the aim, the following research objectives will be addressed:

- Determine if ISO 14001 is effective in identifying environmental impacts associated with waste management.
- Determine if there is adequate access to legal requirements pertaining to waste management and if all applicable legislative requirements relevant to waste management are identified.
- Determine if there are measurable and documented environmental objectives, targets and management programmes related to waste management.
- Determine if key personnel whose activities result in poor waste management practices trained.

1.5. RESEARCH QUESTIONS

In an attempt to address the specific objectives indicated above, the research questions are stated as follows:

- Research Question 1 (RQ1): Is ISO 14001 effective in identifying environmental impacts associated with waste management?
- Research Question 2 (RQ2): Is there adequate access to legal requirements pertaining to waste management and are all applicable legislative requirements relevant to waste management identified?
- Research Question 3 (RQ3): Are there measurable and documented environmental objectives, targets and management programmes related to waste management?
- Research Question 4 (RQ4): Are environmental objectives, targets and management programmes achieved?

- Research Question 5 (RQ5): Are key personnel whose activities result in poor waste management practices trained?

1.6. CONTEXT, SCOPE AND METHODOLOGY OF THE STUDY

This study will be conducted in Mpumalanga Operating Unit (MOU) of Eskom Distribution. It is conducted within the context of Environmental Management System (EMS) effectiveness, based on ISO 14001 Standard and its effectiveness in environmental performance improvement.

The scope of this study covers the holistic implementation of ISO 14001:2004 Standard by MOU, the benefits that EMS, environmental training hold for MOU and the different waste management approaches that are followed by MOU.

A mixed method research approach, in which both quantitative and qualitative research methods are combined, will be followed in order to achieve the research objectives. The data collection methods that will be used include a survey questionnaire using structured questionnaires (quantitative approach) supported by in-depth interviews and field observations (qualitative approach).

1.7. LIMITATIONS OF THE STUDY

This study is limited to Eskom Distribution Mpumalanga Operating Unit (MOU) and focus on specific MOU zones of Emalahleni, Ermelo and Mbombela zones. However, the lessons can be learnt and implemented in other Eskom Distribution Operating Units (OU).

1.8. ORGANISATION OF THE STUDY

This report is structured in five chapters as follows:

Chapter 1 provides introduction, background of the study, in terms of rationale and benefits of adopting ISO 14001, scepticism surrounding ISO 14001, aims, and objectives of the study, research problem, context, scope and methodology employed as well as description of the study area.

Chapter 2: Literature study, reviews the existing literature on ISO 14001 and Environmental Management System (EMS), benefits and shortfalls of EMS, process for EMS development and implementation, ISO 14001 and environmental performance.

Chapter 3: Research design and methodology – chapter 3 details the research design and methodology of the study. It provides justification of the research methods, ethical consideration, and the methods used to collect data.

Chapter 4: Data analysis and discussions of results, presents the data collected from the research methods used.

Chapter 5: Conclusions and Recommendations, presents the conclusion and recommendations based on the results of the analysis.

CHAPTER 2: LITERATURE STUDY

2.1. INTRODUCTION

This literature survey is organized into nine sections, addressing the overview of ISO 14001 standard and Environmental Management System (EMS), key requirements of ISO 14001 Standard, the recent revision of ISO 14001 Standard, rationale for seeking ISO 14001 certification, benefits of adopting ISO 14001 Standard, ISO 14001 vs environmental performance, critical factors for successful implementation of EMS, process for EMS development and finally the challenges, barriers and pitfalls associated with EMS.

2.2. DEFINING ISO 14001 AND ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

ISO 14001 Standard was developed in 1996 by the International Standards Organization (ISO) (Segarra-Ona *et al.*, 2014:7). ISO 14001 Standard was first approved in 1996, revised in 2004, and again in September 2015 (Mazzi *et al.* 2016:873). According to Mazzi *et al.* (2016:873), it is an international standard with requirements and guidelines to develop and maintain an effective Environmental Management System (EMS). Additionally, ISO 14001 Standard offers a format for developing a management system (such as EMS) to promote continuous improvement of environmental performance consistent with the Deming cycle of plan-do-check-act (Mazzi *et al.* 2016:873).

Prajogo *et al.* (2014:567) indicate that, ISO 14001 Standard sets out the criteria for an EMS and to which an organisation can be certified. It can provide assurance to top management, employees, and stakeholders of an enterprise including suppliers and customers that its environmental impact is being measured, monitored, controlled, and improved (Prajogo *et al.* 2014:567). ISO 14001 Standard provides organisations with a framework to protect the environment and respond to the changing environmental conditions (ISO 2015: vi). In addition, it (ISO 14001) enables organizations to develop and implement their environmental policies, identify their significant environmental aspects and to develop their objectives and targets as well as management programmes (ISO 2015:1).

To and Tang (2014:246) defines EMS, as a management system that enables an organization to identify and control the environmental impact of its activities, products, and services, improve the organization's environmental performance continually, and implement a systematic approach to setting environmental objectives and targets, to achieving the set targets and to demonstrating that they have been achieved. According to Campos *et al.* (2015:287), EMS refers to a part of the management system of an organization that aims to manage the environmental aspects related to its activities, products and services. Yang and Zhang (2017:1317) describes EMS as a system that integrates procedures and processes for training of personnel, monitoring, summarizing and reporting of specialized environmental performance information to internal and external stakeholders.

The definitions presented above, are characterised by the managing and controlling of environmental aspects and impacts as well as following a systematic approach. Arimura *et al.* (2016:557) points out examples of such systematically related activities, which include reviewing and documenting the organization activities having a negative impact on the environment, developing an environmental policy statement, creating quantifiable environmental goals to reduce the environmental impacts, monitor progress by means of systematic environmental audits and management reviews. Once the organization has established and implemented EMS compliant to ISO 14001 Standard, it can seek to be certified to ISO 14001 Standard, by undertaking third party audits, by a party external to the organisation (Walcott 2015:6). According to Walcott (2015:6), an organisation that performs third party audits, has an option to register their EMS externally. Registration with an external party requires annual third party surveillance audits and third party re-registration audits every three years.

2.3. THE KEY ELEMENTS OF ISO 14001 STANDARD

Adopting a systematic approach in terms of Environmental Management system (EMS), is centered on implementing the key elements of ISO 14001 standard. The key elements are based on the Plan-Do-Check-Act (PDCA) methodology (Deepak *et al.* 2015:163). Refer to Figure 2.1.

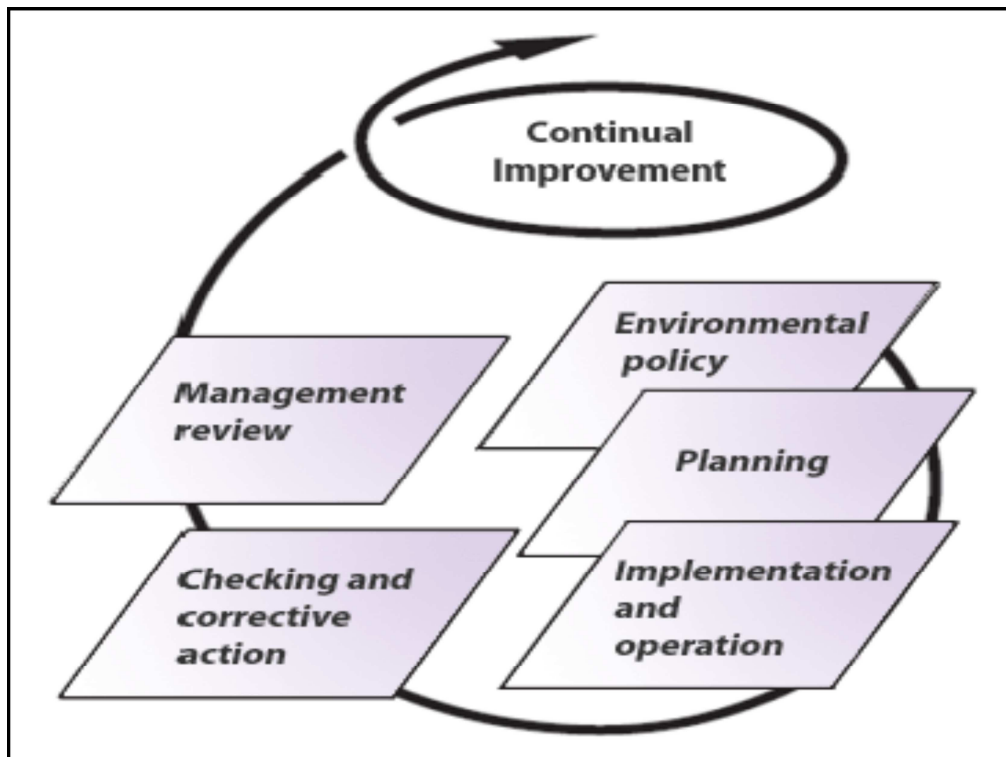


Figure 2.1: Plan, Do, Check, Act cycle

(Source: ISO 14001 2004:vi)

The P-D-C-A cycle is described as follows in the ISO 14001 Standard (ISO 2015:vii).

- Plan, during the plan stage, the objectives and processes necessary for delivering results in accordance to the organization's environmental policy are established.
- Do, requires implementation of the processes as initially planned during the plan stage.
- Check, requires the monitoring and measuring of processes against the environmental policy, objectives and targets, legal and other requirements as well as reporting on the results.
- Act, requires that actions be taken in order to continually improve performance of the EMS.

Yang and Zhang (2017:1318) describe the main elements of EMS as follows:

2.3.1 Environmental policy

The environmental policy is the foundation of an EMS. It is a statement of what an organization aims to achieve and ensures that all activities are consistent with the organization's environmental objectives.

2.3.2 Environmental impact evaluation

An organization identifies and documents the actual and potential impacts of its operations on the environment. This can be achieved through environmental auditing.

2.3.3 Environmental objectives and targets

An objective refers to an overall environmental goal, while a target refers to a detailed, quantified requirement that arises from the objectives. Environmental targets need to be quantifiable and regularly reviewed to minimize environmental harm. All operational procedures should comply with the environmental objectives and targets.

2.3.4 Responsibilities and training

Responsibilities should be allocated to staff and management in order to ensure that EMS is implemented effectively. Training should be provided to staff to familiarize them with the environmental policy as well as to provide them with the necessary skills and expertise for EMS implementation.

2.3.5 Review and continual improvement

Review audits and top management review of EMS must be undertaken regularly to monitor whether EMS is well functioned. The procedures set in place to meet environmental objectives should be constantly examined in order to determine the need for improvement aimed at optimizing the effectiveness of the EMS. The review stage creates a loop of continuous improvement for a firm.

2.4. REVISION OF ISO 14001 STANDARD

According to Da Fonseca (2015:43), all ISO standards require to be revised every five years, in order to ensure that they are updated and relevant for the marketplace. After the review of ISO 14001:2004 Standard, the new Standard was published in 2015 (ISO

14001:2015). When compared to ISO 14001:2004 Standard, the 2015 Standard has major changes in terms of the clauses, as noted by Da Fonseca (2015:44). The new clauses are context of the organization, leadership, planning, support, operation, performance evaluation and improvement (Da Fonseca, 2015:44). Because the P-D-C-A is an integral part of EMS, it (P-D-C-A) is also the basis for ISO 14001:2015. Refer to Figure 2.2. According to Da Fonseca (2015:44), context of the organisation clause, requires organizations to determine the issues and requirements that can affect the planning of the Environmental Management System (EMS). Such issues may amongst other things, include the need for organizations to commit to proactive initiatives to protect the environment from harm and degradation (Da Fonseca 2015:44).

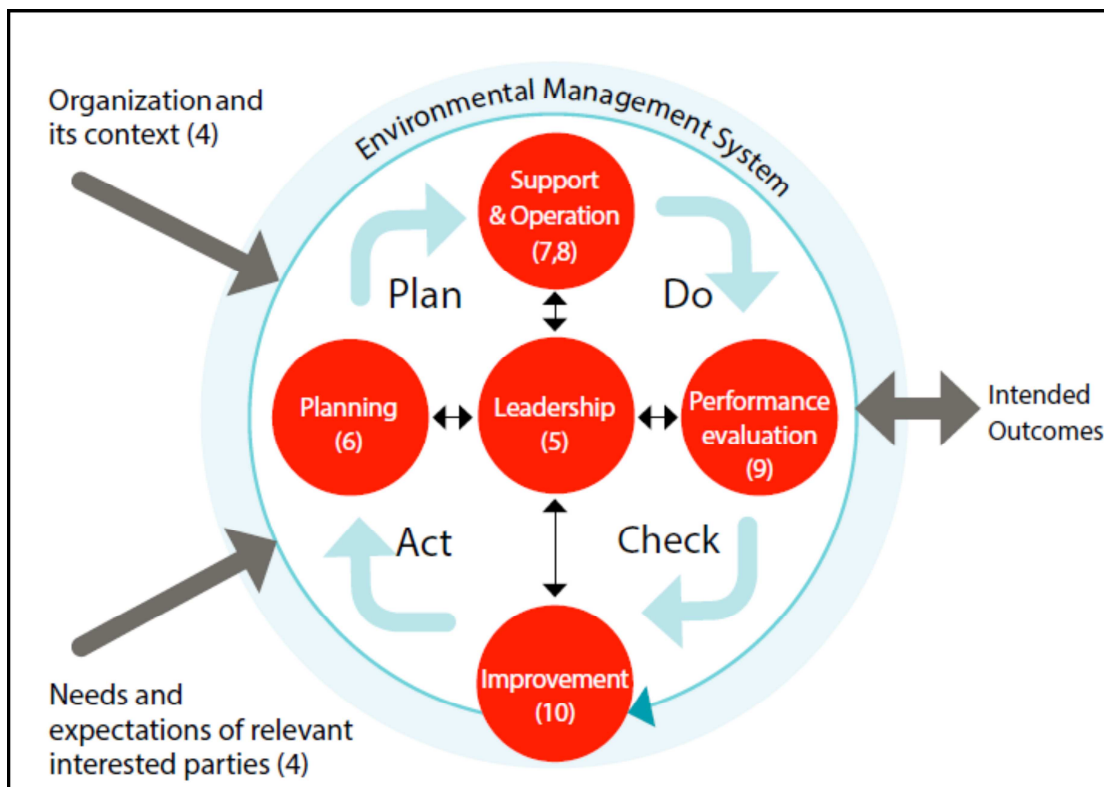


Figure 2.2: PDCA cycle in terms of ISO14001:2015 Standard

(Source ISO 14001 2015: vii)

According to Walcott, (2015:30) ISO 14001 Standard can be used as a tool for organizations to improve their environmental performance, prevent pollution and meet compliance obligations. ISO 14001:2015 Standard, (ISO 2015:6) indicates that environmental performance relates to the management of environmental aspects. Environmental aspects refer to elements of an organization's activities, products or services that can interact with the environment (ISO 2015:2). Managing the environmental aspects associated with negative environmental impacts can lead to improved

environmental performance, which can be monitored through Environmental Performance Evaluation (EPE) (ISO 2013: v). According to ISO (2013:4) EPE, follows a P-D-C-A cycle as described below:

- **Planning** the EPE, the EPE must be based on the organisation's significant aspects, the organization's own criteria for evaluation of environmental performance as well as the requirements of interested parties. The organization's activities, products and services as well as context of the organisation should be taken into consideration. Environmental Performance Indicators must be selected.
- **Do**, during the doing phase, data on the selected environmental indicators must be collected, analysed and transformed into information that describes the effectiveness of environmental protection. Measurement results of the Environmental Performance Indicators (EPI) must be compared against the defined criteria. Such environmental performance information should be communicated to management, to ensure that necessary actions are taken towards the improvement of the organisation's environmental performance.
- **Check and Act**, during the check and act phase, the EPE and the associated results must be reviewed periodically in order to identify opportunities for improvement. Various aspects to be reviewed may include actions implemented for effectiveness of environmental protection, appropriateness of criteria for environmental protection, appropriateness of selected environmental performance indicators, sources of data, methods of collection as well as the quality of data.

The implications of the new standard (ISO 14001:2015), is that organisations that are certified in terms of ISO 14001:2004 Standard have to transition to the 2015 Standard (Walcott 2015:10). According to Susanto and Mulyono (2017:48), the transition period from ISO 14001:2004 to ISO 14001:2015 is three years, from the date of publication of the ISO 14001 2015 Standard, so the end of the transition period is 15 September 2018.

2.5. RATIONALE FOR SEEKING ISO 14001 IMPLEMENTATION AND CERTIFICATION

There are many reasons why organisations implement Environmental Management System (EMS) and seek ISO 14001 certification. Kola-Lawal *et al.* (2014:409) indicate that factors influencing EMS adoption stems from within and external to the organisation. The factors considered to be strong internal drivers of ISO 14001 adoption are corporate awareness of the finiteness of natural resources, the need for maintaining a sense of

environmental stewardship and responsibility (Kola-Lawal *et al.* 2014:409). According to Kola-Lawal *et al.*, (2014:409), the external factors influencing the adoption of ISO 14001 are market opportunities, government or regulatory influences, institutional, and community pressures. Walcott (2015:27) indicates that the motivating factors for adopting ISO 14001 Standard can be coercive in nature. Coercive motivating factors include pressure from regulators, customers and suppliers (Walcott 2015:27).

Deepak *et al.* (2015:161) indicate that, the major motive for organisations to implement EMS and seek ISO 14001 certification is to improve the organisation's corporate image. According to Adeniji *et al.* (2015:2), corporate image includes information and inferences about the company as an employee, employer, customer, community, supplier and as a corporate citizen. Organisations strive to develop and manage their corporate image for many reasons such as enhancement of the corporate competitive advantage leading to higher profitability, promoting good relationship with the government and various interest groups, stimulating sales which influence customer loyalty, influencing investors and financial institutions and promoting a favourable relationship with the community within which the organisation operates (Adeniji *et al.* 2015:2). In supporting Adeniji *et al.* (2015:2), Prasad and Mishra (2017:44) indicate that compliance with ISO 14001 is associated with large market share that contributes to the financial performance in China.

Based on the findings from the study by Campos *et al.* (2016:6), motivations for ISO 14001 adoption and certification, include better adaptation to environmental legislation, image enhancement, improving environmental performance, as well as increased environmental awareness among employees and meeting the market demand. Mazzi *et al.* (2016:874) indicate that an organization seeks the environmental certification in order to show its capacity and competencies to identify and decrease its environmental issues with a proactive approach. According to Prasad and Mishra (2017:44), some organisations adopt ISO 14001 for reasons such as market pressure, particularly export market, to assist them to address environmental issues and for enhanced image amongst regulators, customers and public. Murmura *et al.* (2018:693) distinguished between the three types of motives that lead companies to adopt ISO 14001. The ethical motives relate to a response to the feeling related to environmental responsibility, competitive motives linked to the search for a competitive advantage, and the relational motives, which emerge from the desire for companies to become legitimized and to improve the relationship existing between the company stakeholders (Murmura *et al.* 2018:693).

2.6. BENEFITS OF ADOPTING ISO14001

Seagra *et al.* (2014:7) believes that ISO 14001 provides an assurance to organisations, as well as external stakeholders, that environmental impact is being measured and improved. Martín-Peña *et al.* (2014:222) states that the most commonly analysed benefits of ISO 14001 adoption, are the reduction in costs and improvement in productivity efficiency, improvement in the competitive position, market acceptance and consumer satisfaction, better access to sources of finance, improvement in the relationship with the environmental regulators and improvement in environmental performance in terms of a reduction in air emissions, waste and the use of resources. According to Martín-Peña *et al.*, (2014:222) market acceptance relates to attraction of new markets and customers, as well as satisfy customer. If consumers perceive that, the organisation respects the environment, its sales and market share can grow (Martín-Peña *et al.* 2014:222). Additionally, ISO 14001 is an internationally recognised symbol, which favours the creation of good image and reputation as a green and sustainable organisation (Martín-Peña *et al.* 2014:22).

To and Tang (2014:251) categorized the benefits related to implementing ISO 14001 into three categories, namely managerial benefits, environmental benefits and cost related benefits. The managerial benefits include, enhancing organizational image, assisting management to deal with environmental issues, enhancing communication on environmental matters within the organizations, reducing disputes with public on environmental pollution, enhancing employee's awareness on pertinent environmental regulations and enhancing employee's awareness on environmental issues (To and Tang 2014:251). According to To and Tang (2014:251), the environmental benefits include improving energy conservation, noise pollution, water conservation, management of air pollution, environmental health of organization, management of soil waste, management of liquid waste, management of solid contamination, management of toxic chemicals and reducing greenhouse gas emission. The cost related benefits include reducing costs due to environmental pollution and improving productivity (To and Tang 2014:251).

Mazzi *et al.* (2016:875) indicate that compliance with environmental standards assures the improvement of environmental performance, in terms of environmental impacts reduction. In addition, Mazzi *et al.* (2016:875) state that an important internal benefit of organizations to adopt ISO 14001 is the contribution to human resource management in terms of knowledge, competence and awareness improvement. The main external benefits for ISO 14001 adoption and certification are the increase in market share as well as competitiveness (Mazzi *et al.*, 2016:875). Murmura *et al.* (2018:698) found that the

major perceived benefits of ISO 14001 adoption are increased possibility to manage environmental costs and liabilities that bring to cost saving, improvement of corporate image, improvement of the company performance management, greater compliance with legal requirements, decreased risk of environmental accidents and better relationships with suppliers and customers.

2.7. ISO 14001 AND ENVIRONMENTAL PERFORMANCE

According to ISO, (2013:2) environmental performance refers to the measurable results of an organisation's management of its environmental aspects. Similarly, Shetty and Kumar (2017:664) indicate that environmental performance is the outcome of the firm's effort in managing and controlling its environmental aspect during production process. In their study, Maletic *et al.* (2015:880) found that environmental performance can be achieved by setting clear and real objectives, measuring indicators to determine if the pre-defined objectives are being met, followed by suitable and timely actions. According to Turki *et al.* (2017:423) an organization's environmental performance criteria are evaluated based on the environmental aspects and impacts intended to meet the objectives of EMS. In light of this, Kumara and Weerasinghe (2017:242) indicates that environmental performance should be measured against the organisation's control of its operation and how they are tied into and comply with any relevant environmental legislation. Additionally, the recorded reduction and minimisation of the overall environmental impact to enhance environmental performance while applying mitigation measures are to be used as a measure of environmental performance (Kumara and Weerasinghe 2017:242).

ISO 14001 Standard is a process standard for Environmental Management System (EMS) that does not emphasise the actual environmental performance outcomes, but emphasizes the processes that facilities should undertake to manage their environmental impacts (Arimura *et al.*, 2016:557). Moreover, ISO 14001 Standard provides an EMS for managing and improving performance regarding all environmental regulatory requirements, pollution prevention and continuous improvement through effective management of an organization's environmental impacts (Turki *et al.* 2017:480). According to Turki *et al.* (2017:490), implementing EMS, based on ISO 14001 Standard involves identifying common environmental performance indicator (EPI) to reach EMS effectiveness, adopting proactive environmental performance management and strategies, ensuring the presence of regulatory framework for compliance as well as redefining policy, smarter objectives and targets.

According to Maletič *et al.* (2015:875), a vast majority of studies have reported a positive impact of ISO 14001 on environmental performance indicators. Maletič *et al.* (2015:875) indicate that ISO 14001 contributes to improved environmental performance, mainly by ensuring a systematic way of supporting the organizations to manage the short and long-term impacts of their products, services and processes on the environment. According to Turki *et al.* (2017:483) the measure of environmental performance depends on aspects and their significance. From the study of Turki *et al.* (2017:483), it was found that, waste management was the most important environmental aspect. A distinction was made in terms of the qualitative and quantitative indicators. The qualitative indicators included the severity, probability of occurrence and control level of environmental aspects as well as the legal requirements and the quantitative indicators included the volume of water consumed, the acoustic noise, the amount of gases emitted, the risks on the environment as well as the solid and liquid wastes (Turki *et al.* 2017:483). According to Turki *et al.*, (2017:483) the ratio in percentage of environmental aspects' significance provides the real state of the effectiveness of EMS.

Arimura *et al.* (2016:557), indicate that by virtue of undergoing ISO 14001 certification, facilities are likely to commit to achieving legitimate environmental performance goals. According to Ferron-Vílchez (2016:884) most of the researches have demonstrated a positive relationship between the adoption of ISO 14001 and improvements in environmental performance. Shetty and Kumar (2017:661) pointed to a study that found that, the facility that integrated ISO 14001 into their day-to-day operation reported better environmental performance after the implementation of the ISO 14001. In a study of the Tunisian food industry, Turki *et al.* (2017:430) identified water and energy consumptions, noise problem, hazardous wastes, and chemicals concentrations as environmental aspects to assess environmental performance. The results revealed a 6.67% water consumption reduction per year, 7.14% reduction of energy consumption, 5% reduction in noise reduction, good management of solid wastes, which included 100% waste sorting, 100% hazardous waste management, that included the efficient control of chemical concentrations and other effluents' parameters.

In a study of the Sri Lankan food manufacturing company, Kumara and Weerasinghe, (2017:241) identified waste management and water consumption as environmental aspects on which environmental performance was based on. The study revealed that EMS implementation based on ISO 14001 Standard had a positive impact on the identified environmental performance Indicators Kumara and Weerasinghe, (2017:241). In

the study of the American continent, analysing EMS based on ISO 14001, Neves *et al.* (2017:251) pointed to a lot of studies indicating that ISO 14001 has the ability to manage the reduction of emissions of various pollutants. For example, according to Neves *et al.* (2017:251), ISO 14001 certification reduced the amount of SO₂ in approximately 160 countries. In the coating industries, there has been a significant decrease in the amount of pollutants emitted due to ISO 14001 certification and in Italy, the implementation of EMS based on ISO 14001, had a clear positive impact on CO₂ emissions in the short and long term (Neves *et al.*, 2017:251).

Although some studies indicate a positive effect of ISO 14001 on environmental performance, the review of other literature studies reveal the mixed findings. For example, Nguyen and Hens (2015:362) indicate that uncertainty exists as to whether or not ISO 14001 certification improves environmental performance. Ferron-Vílchez (2017:34) pointed to a study, which indicates that, the adoption of ISO 14001 is not necessarily associated with organizational capabilities that enable the firm to achieve significant reductions in their negative environmental impacts.

2.8. CRITICAL FACTORS FOR SUCCESSFUL IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) BASED ON ISO 14001 STANDARD

Successful implementation of Environmental Management System (EMS) based on ISO 14001 Standard is dependent on a number of factors. According to Lars *et al.* (2013:127) top management commitment and budget allocations for environmental activities, are some of the resources that facilitate adoption of ISO 14001. Top management commitment is critical in order to increase the consciousness about environmental issues among line managers and employees, and top management can explain why businesses undertake voluntary environmental management practices (Lars *et al.* 2013:127). In addition, Lars *et al.* (2013:127) indicate that environmental budget allocations enable the organisations to commit voluntarily to environmental practices more easily than organisations without such budgets. Lars *et al.* (2013:131) also indicate that resources and their capability drive successful EMS implementation. Organizations, which have a management person in charge of environmental issues, are mostly associated with a higher probability of implementing EMS elements.

The findings by Ivanova *et al.* (2014:1286) revealed that the key factors affecting effective implementation of EMS (based on ISO 14001 Standard) include, having a high focus on

internal improvement, top management support, design of the system around existing processes, use of information technology, positive employees' attitude, and employees' usage of the system. Top management's support and involvement in the EMS implementation process is critical, also, top management must provide the time and the resources for the implementation process (Ivanova *et al.* 2014:1286). From the findings Ivanova *et al.* (2014:1286), found that the extent to which the EMS is designed around existing processes is rated high if the EMS documentation was integrated within the existing processes. In addition, the use of information technology was rated high based on the use of proprietary computerized systems in the implementation processes, employees' attitudes were rated as positive based on the employee's support towards EMS implementation and employees' involvement was rated high based on the employee's usage of the system on an everyday basis (Ivanova *et al.* 2014:1286). The inter-departmental communication and the use of cross-functional teams were found to have a positive impact on the adoption of ISO 14001 and EMS implementation process.

2.9. PROCESS OF ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) IMPLEMENTATION IN TERMS OF ISO 14001 STANDARD

According to Daughtry (2014:7), implementing EMS in terms of ISO 14001 Standard is based on five key principles of environmental policy, planning, implementation and operation, checking and management review. As outlined by Daughtry (2014:7), the process for EMS implementation in terms ISO 14001 Standard consists of the following steps:

- **Environmental policy**

The first step is to create and environmental policy, which must be defined by top management.

- **Planning**

In terms of Planning, organizations are required to determine the impacts on the environment, resulting from activities, products and services associated with the company's operations. The environmental impacts are then assessed to determine which environmental aspects are significant. Determining the legal statutes and ordinances that affect the business or organisation and keeping up-to-date on any new statutes and requirements is also a requirement during the planning stage. Therefore, Legal and other requirements must be identified and assessed on a regular basis to ensure continued

compliance. Another requirement during planning is to develop objectives, targets and programme(s). The significant environmental aspects identified are used to create measurable and relevant improvement objectives and targets with fixed periods. In order to ensure that the objectives and targets are achieved, the organisation must implement and maintain one or more environmental programmes based on the environmental objectives and targets as well as the significant environmental aspects. The programmes should determine responsibilities, methods, and a time-frame by which the targets and objectives are to be achieved.

- **Implementation and operation**

During implementation, an organisation should determine, document and communicate roles, responsibility and authority in terms of EMS. In addition, all staff and personnel involved in the EMS should be trained on the requirements of EMS and on the impacts of the organisation's operational activities on the environment. Communication of environmental issues should be ensured. Control of documents and operational control are other requirements during implementation and operation phase. A document control system needs to be established to ensure that valid information is available to all relevant personnel for use, the information is up-to-date and understood and no relevant information is lost. Operational control procedures should be established in order to ensure that all activities and operations are managed in accordance with the requirements and objectives of the environmental policy. Organisations must also have emergency preparedness and response plans in place. Procedures to identify and respond to potential incidents must be developed and implemented in order to prevent any environmental impact associated with such incidents.

- **Checking and corrective action**

During checking, monitoring and measurement of activities with a significant impact on the environment must be undertaken. Compliance with relevant environmental legislation and regulations must also be evaluated, and procedures for compliance evaluation must be established and maintained. In addition, internal EMS audits must be conducted in order to ensure that EMS is working as intended and to ensure continuous improvement. Based on monitoring, measurement, compliance evaluation and internal audits, non-conformity and corrective action procedures must be documented and implemented. Any non-conformances, as well as basic causes of such non-conformances, must be identified and improvements should be implemented. Additionally, control of records procedure must be established to control EMS related records.

- **Management review**

During management review, top management must assess the suitability, adequacy and effectiveness of EMS to ascertain the achievement of environmental objectives, targets and programmes.

2.10. CHALLENGES AND BARRIERS ASSOCIATED WITH ENVIRONMENTAL MANAGEMENT SYSTEM BASED ON ISO 14001 IMPLEMENTATION

According to Martín-Peña *et al.*, (2014:220) adopting an Environmental Management System (EMS), based on ISO 14001 Standard can offer firms a number of benefits, but also runs up against some difficulties. Martín-Peña *et al.*, (2014:222) indicate that factors such as cost, excessive implementation time, complexity of EMS, and establishing objectives and calculating their outcomes are some of the difficulties in implementing EMS. Costs include the auditor's fees, the time taken to prepare the documentation, the efforts in complying with the specifications as well as the high cost of capital and of environmental investments (Martín-Peña *et al.* 2014:222). In addition, aspects relating to employees and top management's lack of commitment to the environment, inadequate organisational culture, as well as the low level of environmental communication, training and qualifications are some of the difficulties in implementing EMS (Martín-Peña *et al.* 2014:223). The findings of To and Tang (2014:253) revealed that resistance to change is one of the obstacles that organisations need to overcome in order to adopt ISO 14001 Standard.

Mazzi *et al.* (2016:876) indicate that the significant drawbacks of ISO 14001 adoption and EMS implementation include the costs of its implementation, the lack of institutional incentives to support or reward the EMS adoption, difficulties to integrate the EMS into the organizational management system. In addition, the lack of knowledge of environmental impacts identification, the need for training and the lack of access to technology are some of the main constraints to ISO 14001 adoption (Mazzi *et al.*, 2016:881). According to Murmura *et al.* (2018:692), the negative aspects associated with the adoption of ISO 14001 Standard are, the difficulty to measure the standard's efficiency, the difficulty in applying the standard, complexity of the procedures, the increase of bureaucratization and the firm's costs, the problem of increasing employee awareness on environmental themes and the vagueness of the standard.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter introduces the research methodology used for this study, in order to achieve the research objectives. It starts by addressing the justification of research methods, ethical consideration, research design, data collection methods, design of research instruments, data editing, coding, capturing and storing. In an attempt to ascertain the effectiveness of ISO 14001 implementation, a mixed research method combining both quantitative and qualitative approaches was used. In implementing the mixed research methods, the research instruments used include questionnaires, interviews and field observations.

3.2. JUSTIFICATION FOR RESEARCH METHODS

The mixed method approaches are advantageous because both qualitative and quantitative data can be simultaneously collected, analysed and interpreted (Zohrabi, 2013:254). Further on, Zohrabi, (2013:261) indicates that the mixed research approaches can increase the reliability and validity of data as well as enhancing the integrity of the findings. In addition, Ponto (2015:170) believes that mixed research methods are advantageous in reducing the potential for non-response errors. Non response error occurs when sampling units selected for a sample are not interviewed. Therefore, in addressing potential for non-response errors, both survey questionnaire and interview approaches were used. Because interviews are conducted telephonically, computer and face to face, Ponto (2015:170) believes that they offer the advantage of clarifying the intended question. Interviews are however costly, time consuming and impractical for large samples. Therefore in this study, the participants interviewed were chosen from a smaller but representative sample.

3.3. ETHICAL CONSIDERATION

When engaging in a research involving individuals and group of people, Mouton (2001:244) explains that, human subjects must be informed as to what will happen and their signed consent must be obtained. Mouton (2001:244) further provides the following detailed description of how informed consent is ensured:

- Approval for undertaking the research must be obtained.
- The institution represented must be clearly stated.
- The purpose of the research must be explained to the subjects, including the benefits as well as who stand to benefit.
- Obtain informed consent from the subjects.
- Subjects must be assured of the confidentiality of the research.
- Offer the subjects an opportunity to suggest in order to improve the research procedures.
- Thank the subjects for their participation and if possible offer a small reward.

Approval to undertake this study was obtained from Eskom Mpumalanga Operating Unit (MOU). See appendix A for the Eskom permission letter. This study will contribute to MOU in terms of providing the value of EMS implementation as well as addressing the potential gaps identified in the ISO 14001 implementation. Primary data collection methods involved the use of survey questionnaire, interviews and field visits, which required human participants. Therefore, the above-mentioned guidelines for ensuring adherence to the ethical requirements were fulfilled. A full consent was obtained from the participants prior to undertaking interviews. Examples of some of the consent letters are included in Appendix B. Before commencing with the interview, the purpose of the interview and the voluntary nature of the responses were explained. The participants were assured of the confidentiality and anonymity of their responses. At the end of the discussions, the interviewees signed a consent form. See Appendix C for the interview guide.

In addition, the rules and regulations of the University of Pretoria with regard to conducting research using human subjects were adhered to. A cover letter specifying the request for completion of the questionnaires, as well as the voluntary and confidential nature of questionnaire was availed to the participants. See Appendix D for a cover letter for the questionnaire and Appendix E for the research questionnaire. In addition to the ethical considerations indicated above, Mouton (2001:241) also points out an ethical principle of scientific publication, which requires acknowledgment of one's sources. That means one should reference any source that has been consulted either directly or indirectly and that has made a significant contribution to one's own work (Mouton 2001:244). The sources used in this study were acknowledged by means of the use of Abridged Harvard Method (AHM). Furthermore, the highest level of objectivity was ensured throughout the data collection, data analysis and data interpretation.

3.4. RESEARCH DESIGN

Research design is defined by Leedy and Ormrod (2005:85) as a plan for a study, providing the overall structure for the procedures to be followed, the data to be collected and the analysis to be conducted. A research design is a blueprint or detailed plan of how a research is to be completed, variables of measurement, selecting a sample, collecting data and analyzing the results (Mouton 2001:55). Furthermore, Mouton (2001:55) indicated that the research design is applied so that suitable research methods are used to ensure the attainment of the goals and objectives. This research is an empirical design employing the use of mixed research methods. Table 3.1 illustrates the phases in research design.

According to Tashakkori and Teddlie (2003:11), mixed research design involves the use of both qualitative and quantitative design in parallel or sequential phases. Mixed design is the best approach if the study requires both quantitative and qualitative designs to address the problem statement (Tashakkori and Teddlie 2003:11). Two widely stated reasons for integrating both quantitative and qualitative data in research include triangulation and complementarity (Lopez-Fernandez and Molina-Azorina 2011:7). According to Lopez-Fernandez and Molina-Azorina (2011:7), triangulation seeks to achieve a convergence of the results obtained through quantitative and qualitative approaches in order to ensure that they are more reliable. Whilst complementarity aims to clarify or illustrate the results obtained with one method by also applying the other (Fernandez and Molina-Azorina 2011:7). Table 3.2 illustrates the differences between quantitative and qualitative research approaches.

The most suitable type of qualitative research design chosen for this study is phenomenological study. According to Leedy and Ormrod (2005:141), phenomenological study, is a study that attempts to understand and recognize people's perceptions and perspectives of a particular problem or situation being studied. Furthermore, the researcher wants to gain a better understanding of the experiences of others. In this study, both quantitative and qualitative approaches are used and are useful for several reasons. The qualitative approach enables one to gain new insight about the problem that is being investigated as well as to discover problems that exist. Additionally, the qualitative approach allows for verification of the results obtained from the quantitative analysis.

Table 3.1: Research Design: Quantitative and Qualitative Stages

Overview of the Research Design		
Research Idea (Context)	Defining the research problem Introduction & Background, Scope, Research objectives, Problem statement, Research questions ↓ Literature Study ↓	Chapter 1: Introduction and Background Chapter 2: Literature Study
Data Collection Method	Questionnaire Survey (Quantitative method) Interviews (Qualitative method) Observations (Qualitative method) Research Methodology ↓	Chapter 3: Research Methodology
Implementation : Survey research design and qualitative design	Study Population, sample selection, Research Instruments, Data entry, capturing and storing ↓	
Data Analysis	Quantitative (Statistical Analysis) and Qualitative Analysis (Identify pattern) ↓	Chapter 4: Research Findings
Recommendations and Conclusion	Recommendations and Conclusions	Chapter 5: Recommendations and Conclusion

(Source: Author's Own)

Table 3.2: Quantitative vs qualitative Design

Classifications	Quantitative	Qualitative
Purpose	To test hypothesis, look at cause and effect and make predictions.	To understand and interpret social interactions.
Group studied	Large and randomly selected.	Smaller and not randomly selected.
Variables	Specific variables studied.	Study of the whole, not variables.
Type of data collected	Numbers and statistics	Words, images or objects.
Form of data collected	Quantitative data based on precise measurements using structured and validated data-collection instrument.	Qualitative data such as open-ended responses, interviews, field notes, participant's observations and reflections.
Type of data Analysis	Identify statistical relationships	Identify patterns, features and themes.
Objectivity vs Subjectivity	Objectivity is critical.	Subjectivity is expected.
Role of Researcher	Researcher and their biases are not known to participants in the study. Participant's characteristics are deliberately hidden from the researcher.	Researcher and their biases may be known to participants in the study. Participant's characteristics may be known to the researcher.
Results	Generalized findings that can be applied to other populations.	Particular or specialized findings that are less generalized.
Scientific Method	Confirmatory or top-down, the researcher tests the hypothesis and theory with the data.	Exploratory or bottom-up, the researcher generates a new hypothesis and theory from the data collected.
Most Common Research Objectives	Explain, describe and Predict	Explore, discover and construct.
Final Report	Statistical report with correlations, comparisons of means and statistical significance of findings.	Narrative report with contextual description and direct quotations from research participants.

(Source: Mccrindle (2017:13))

3.4.1 SAMPLING

3.4.1.1 Defining the population of interest

A target population refers to all the members who meet a particular criterion specified for a research investigation (Alvi 2016:10). In this study, the population consisted of all Eskom, Distribution Mpumalanga Operating Unit (MOU) employees who are responsible for Environmental Management System (EMS) implementation. For the quantitative approach, about 136 employees from the three MOU zones of Mbombela, Emalahleni and Ermelo zones were included in the population and for the qualitative approach, the population consisted of 136 employees and 43 Customer Network Centres (CNC)'s and two Power Plant Maintenance (PPM) workshops.

3.4.1.2 Sampling size

Alvi (2016:11) defines a sample as a group of relatively smaller number of people selected from a population for investigation purposes. In quantitative research approach, when dealing with smaller populations, for example with a size (N) of 100, Leedy and Ormrod (2005:213) suggest that the entire population can be surveyed. In this study, the population size (N) was 136, therefore the entire population was included in the survey. For qualitative approach, 17 employees of Mpumalanga Operating Unit (MOU) employees with direct experience in Environmental Management System (EMS) implementation were chosen as participants, including two Customer Network Centres (CNC)'s and a Power Plant Maintenance (PPM) workshop. In choosing the participants for qualitative approach, the sampling was purposeful. In purposeful sampling, individuals or objects that can yield the most information about the problem or issue under investigation are selected (Leedy and Ormrod 2005:147).

3.4.2 DATA COLLECTION METHODS

Primary data to assess the effectiveness of Environmental Management System (EMS) based on ISO 14001:2004 Standard was collected using mixed research methods. According to Creswell (2014:3) mixed research methods involves the integration of quantitative and qualitative data. Quantitative data was collected through survey questionnaires and qualitative data was collected through interviews and observations.

3.4.2.1 Surveys

Survey research involves the collection of data from a sample of individuals through their responses to questionnaires with numerically rated items (Ponto 2015:168). According to Ponto (2015:170), questionnaires may be self-administered, administered by a professional, or may be administered individually or in a group. Using a combination of methods of survey administration can assist to ensure better sample coverage (Ponto 2015:170). In this study, the structured questionnaires in paper form (see Appendix E) were distributed and administered during various engagements within Mpumalanga Operating Unit (MOU) employees between June and November 2017. About 50 questionnaires were distributed in June 2017 during the MOU management forum. Also, 34 questionnaires were administered in group sessions during the sector meetings held in July and August 2017. The other questionnaires were distributed in an electronic format on an email to 52 respondents. A cover letter explaining the purpose and the background of the study, request for participation was discussed during the employee engagements. A total of 136 questionnaires were distributed, of which 90 responses were returned, representing a 66 percent response rate.

3.4.2.2 Semi Structured Interviews

According to Qu and Dumay (2011:246) the semi-structured interview involves prepared questions which is guided by the identified themes in a consistent and systematic manner designed to elicit more elaborate responses from the participants. The focus is therefore on the interview guide incorporating a series of broad themes to be covered during the interview, to help direct the conversation towards the topics and issues about which the interviewers want to learn (Qu and Dumay 2011:246).

Qu and Dumay (2011:246) believes that semi structured interviews are flexible, accessible and comprehensible, more importantly are capable of disclosing important information. In this study, 30 minutes interviews were conducted through face-to-face technique and telephonic technique where face-to-face was not possible. Interviews were conducted with a selected sample of participants from the three zones of Mpumalanga Operating Unit (MOU) who were identified to contribute significantly and yield the most information to the interview questions. A total of 17 employees consisting of senior supervisors and managers with direct experience in EMS implementation were interviewed, with 9 employees representing Emalahleni zone and 4 employees representing Ermelo and Mbombela zones.

An interview guide providing details for asking, questions and recording the answers was developed (see Appendix C). The participants were asked open-ended questions in the same order. Questions asked were firstly introductory questions in order to kick start the conversation and move to the main interview questions, followed by direct questions in order to elicit direct responses. Questions enquired about the role, experience and expectations of participants with regard to Environmental Management System (EMS). Respondents answered by supplying responses in a form of a short sentence. Answers were recorded in full by making hand-written notes.

3.4.2.3 Field Observations

According to Zohrabi (2013:257) observation is a pre-planned research tool which is carried out purposefully to serve research questions and objectives. In this study, some of the research objectives were to determine if Environmental Management System (EMS) based on ISO 14001 Standard is effective in identifying environmental impacts associated with waste management as well as to assess if all applicable legislative requirements relevant to waste management are identified. In an effort to achieve the research objective, field visits were conducted at the Customer Network Centres (CNC) and workshop in Mpumalanga Operating unit (MOU) in June 2017. Sites that were visited are Ermelo and Kwaggafontein CNCs as well as Power Plant Maintenance (PPM) workshop. The sites were selected purposefully, based on gaining more insight from the responsible supervisors of the selected sites, regarding the waste management practices. According to (Etikan 2016:2), purposive sampling is a deliberate choice of participant due to the qualities the participants possess. It is a non-random technique that does not require underlying theories or a set number of participants (Etikan 2016:2). The variables observed during the field visits included the following:

- Waste streams that are on site.
- Waste segregation, collection and recycling initiatives as well as waste bins.
- Oil-water separator to separate water with oil
- Any potential for negative impacts on the environment.
- Implementation of waste management hierarchy of Reduce, Reuse, Recycle, Recover, Treatment and Landfill as the last option.

In order to answer Research Question 2 (RQ2: Is there adequate access to legal requirements pertaining to waste management and are all applicable legislative requirements relevant to waste management identified), the handling and storage of

waste was assessed against the most relevant and applicable waste related legislative requirements discussed below:

National Environmental Management Waste Act No 59 of 2008

According to section 21 (a – e) of the National Environmental Management Waste Act 2008, Act 59 of 2008 (South Africa 2009:38) any person who stores waste must at least take steps, to ensure the following:

- The containers in which any waste is stored, are intact and not corroded or in any other way rendered unfit for the safe storage of waste;
- Adequate measures are taken to prevent accidental spillage or leaking;
- The waste cannot be blown away;
- Nuisances such as odour, visual impacts and breeding of vectors do not arise; and
- Pollution of the environment and harm to health are prevented.

National Environmental Management Waste Classification and Management Regulations 634 of 2013

The National Environmental Management Waste Classification and Management Regulations, 634 of 2013 (South Africa 2013:9) stipulates the following regulations regarding waste:

- Regulation 6(3): Any container or storage impoundment holding waste must be labelled.
- Regulation R6(4): Requires that waste generators must ensure that their waste is re-used, recycled, recovered, treated and/or disposed of within eighteen (18) months of generation.

National Norms and Standards for the Storage of Waste Regulation 926 of 2013

- Regulation R9(5): Liquid waste must be stored in leak resistant containers which must be inspected weekly for early detection of leaks.

Creswell (2015:239) indicates that observations are open-ended in that the researcher asks general questions about the issue being observed. That also allows the participants to freely provide their views. During the observations conducted in MOU sites, the researcher engaged with supervisors and store persons responsible for waste management. Open-ended questions enquiring about the waste management practices implemented at the sites were asked including the requirements of the relevant waste related legislative requirements. The extent of access to the legal requirements, knowledge and awareness of such legislative requirements pertaining to waste

management was discussed. Inspections of the storage yards of the CNC's and workshop were conducted to assess the extent of implementation and compliance to the relevant waste-related legislative requirements. Photographic evidence of waste management practices implemented at the site was collected during observations.

3.5. DESIGN OF RESEARCH INSTRUMENTS

3.5.1. QUESTIONNAIRE DESIGN

A five page questionnaire containing demographic information and 16 items was one of the instruments used to collect data. The questionnaire was developed after a thorough literature survey on ISO 14001 and Environmental Management System (EMS) vs. environmental performance. The questionnaire consisted of categorical, Likert scale and closed ended questions that enquired about Mpumalanga Operating (MOU) EMS, benefits of implementing EMS, environmental training and waste management. The categorical data considered characteristics such as age, gender, highest level of education, job position as well as the job grading. The responses to the questionnaire measured the level of agreement to the statements based on a 4 - point Likert scale, with the values of 1 – 4, with 1 representing strongly disagree and 4 representing strongly agree.

A decision was made to adopt a 4 - point Likert scale instead of a 5 - point Likert scale which has a neutral option. The decision was based on a rationale that a 4-point Likert scale offers the benefit of extracting exact and specific responses from the respondents. To discourage the use of a likert scale offering a neutral option, Asún *et al.* (2016:111) stated that the intermediate category might affect the validity of the results. In addition, the participants may select the neutral option based on the fact that they do not have an opinion, or do not want to express their true opinion, or do not understand the question, or are facing a “not applicable” question (Asún *et al.* 2016:111).

3.5.2. INTERVIEW DESIGN

The interview guide was designed as a tool for qualitative data collection. In developing the interview guide, consideration was made to the following guidelines presented by Creswell (2015:244):

- Instructions for the interviewer to follow so that standard procedures are used from one interview to another.
- The questions are created prior to the interview, and often have a limited set of response categories.
- Questioning is standardized and the ordering and phrasing of the questions are kept consistent from interview to interview.
- The interviewer plays a neutral role and acts casual and friendly, but does not insert his or her opinion in the interview.
- There are spaces between the questions to record the responses.
- A final thank-you statement to acknowledge the time the interviewee spent during the interview.

The interview guide was designed as a tool to direct the conversations towards the research topic. The interview questions were well-formulated, not leading, open ended and clearly worded. The interview questions enquired about the interviewer's experience on Environmental Management System (EMS) in terms of ISO 14001, how EMS has been integrated into their operational activities, expectations as well as perceived benefits associated with EMS in terms of ISO 14001 and how EMS based on ISO 14001 has assisted to improve Mpumalanga Operating Unit (MOU)'s environmental performance.

3.6. DATA EDITING, CODING, CAPTURING AND STORING

Smith and Davies (2010:155) describes coding as a method to organise the data so that underlying messages portrayed by the data may become clearer to the researcher. Theron (2015:4) suggests that coding should not only be viewed as labelling, but also as linking of data to an idea. In ensuring the linking of data to an idea, coding for quantitative data was undertaken as follows:

- Each questionnaire was allocated and labelled with a numeric code starting from questionnaire 1 as "001" to the last questionnaire which was labelled "090".
- Each question on the questionnaire was also assigned a numeric code categorised in terms of sections A and B. The code assigned were "QA1" – "QA5"; QB1.1 – QB1.13; QB2.1 – QB2.12; QB3.1 – QB3.4 and QB4.1 – QB4.14.
- Numerical values were assigned to the various categorical data representing the respondent's demographic background. An example is shown below on Table 3.3.

Table 3.3: Coding – Demographic Background

Gender	Male	1
	Female	2
Highest Level of Education	Primary School	1
	High school	2
	University / College	3
	Postgraduate	4
	I don't know	5
	Blank	6
Current Position	Assistant Technical Official (ATO) - 1	Sector Manager - 10
	Technical Official (TO) - 2	Manager Projects - 11
	Senior Technial Official (STO) - 3	Procurement Manager - 12
	Assistant Officer - 4	Senior Advisor - 13
	Officer Technical Support - 5	Senior Engineer - 14
	SHE Officer / Practitioner - 6	Middle Manager - 15
	Safety Manager – 7	Zone Manager - 16
	Field Services Engineer - 8	Blank - 17
	Senior Supervisor - 9	Engineer - 18
Job Grading	T05 – 1	P14 – 12
	T06 - 2	P15 – 13
	T07 – 3	P16 – 14
	T08 – 4	P18 – 15
	T09 – 5	M15 – 16
	T10 – 6	M16 – 17
	T11 – 7	M17 – 18
	T12 – 8	M18 – 19
	T13 – 9	G15 – 20
	P12 – 10	Blank – 21
	P13 - 11	E Band - 22

(Source: Author's own)

- The data was captured into a Microsoft excel worksheet. Once all the data was captured into Microsoft excel spreadsheet, data cleaning was done to check for potential errors such duplicates, as well as responses that may have been skipped.
- Data analysis was undertaken by running basic descriptive statistics using Microsoft Excel. Descriptive statistics tools used to summarise data were Frequency, Percentage (%) and mode.

In a qualitative research, Stuckey (2015:7) suggests that codes are usually used to retrieve and categorize data that are similar in meaning which enables the researcher to quickly find and cluster the segments that relate to one another. As suggested by Stuckey (2015:8), the coding words in this research were derived from the open-ended questions asked in the interview guide. Refer to Table 3.4 for coding for qualitative data

Table 3.4: Coding for qualitative data

Open ended questions	Coded words
What is your experience regarding Environmental Management System (EMS)-ISO 14001 implementation in MOU?	Experience
What are your expectations from Environmental Management System (EMS)-ISO 14001 implementation in MOU?	Expectations
What do you think are the benefits of implementing EMS-ISO14001?	Benefits
How has EMS-ISO14001 been integrated into MOU's operational activities?	Integrate
How has EMS-ISO14001 improved MOU's environmental performance?	Improve
What do think are the challenges of implementing EMS-ISO14001?	Challenges
How would EMS-ISO14001 implementation be improved in MOU?	Improve

(Source: Author's own)

The codes for qualitative data collected using field observations were derived from the problem statement. Examples of the codes are "waste streams" and "waste storage".

CHAPTER 4: RESEARCH RESULTS AND FINDINGS

4.1. INTRODUCTION

This chapter presents the results and findings of this study, which was aimed at evaluating the effectiveness of ISO 14001 Standard in improving the Key Environmental Performance Indicators (KPIs) of Eskom Distribution, Mpumalanga Operating Unit (MOU). Effectiveness of ISO 14001 Standard was tested in terms of waste management, environmental training, and environmentally related incidents.

This study further attempted to assess the following, stated as Research Questions (RQ) in chapter 1 of this study:

- RQ1: The effectiveness of ISO 14001 in terms of identifying environmental impacts associated with waste management.
- RQ2: If there is adequate access to legal requirements pertaining to waste management and identification of such applicable legislative requirements.
- RQ3: If there are measurable and documented environmental objectives, targets and management programmes related to waste management.
- RQ4: If the environmental objectives, targets and management programs are achieved.
- RQ5: If key personnel whose activities result in poor waste management practices are trained

Both quantitative and qualitative research approaches were used to achieve the research objectives. The outcome of the quantitative approach is reported in terms of frequencies and percentages and the outcome of the qualitative approach is presented as text and detailed descriptions.

4.2. RESULTS: QUANTITATIVE STUDY

This section provides an analysis of the questionnaires. The paragraphs discussed are demographic profile of the respondents, elements of MOU's Environmental Management System (EMS), benefits of EMS, environmental training and waste Management. The demographic profile is based on the 90 respondents from a sample of 136 MOU employees, showing the response rate of 66.2%.

4.2.1. DEMOGRAPHIC PROFILE OF THE RESPONDENTS

The demographic profile of the respondents is presented in Table 4.1 - Table 4.4. From Table 4.1 it can be seen that, 70% are male respondents and 28% are female respondents. The high number of male respondents is attributed to the fact that there is a high number of male representivity performing technical roles than females.

Table 4.1: Demographic profile the respondents - Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	63	70.0	70.8	70.8
	Female	26	28.9	29.2	100.0
	Total	89	98.9	100.0	
Missing	System	1	1.1		
Total		90	100.0		

From Table 4.2, it can be seen that 56.7% of respondents underwent university or college education, followed by 34.4 % with postgraduate qualification, then 5.6% high school education and one primary school education. One respondent abstained from providing a response to the question.

Table 4.2: Demographic profile the respondents – Level of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary School	1	1.1	1.1	1.1
	High school	5	5.6	5.6	6.7
	University / College	51	56.7	57.3	64.0
	Postgraduate	31	34.4	34.8	98.9
	Blank	1	1.1	1.1	100.0
	Total	89	98.9	100.0	
Missing	System	1	1.1		
Total		90	100.0		

Table 4.3 shows the positions of the respondents. The highest number of respondents were senior supervisors and manager projects with 17.8%. The response for sector managers was 11.1% and middle managers were 5.6%. All the MOU sector managers who were included in the sample responded. The lowest responses were from the Assistant Technical Official, safety manager, procurement manager with 1.1%, assistant officer, senior engineer and engineer with 2.2%.

Table 4.3: Demographic profile the respondents - Position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Assistant Technical Official (ATO)	1	1.1	1.1	1.1
	Technical Official (TO)	4	4.4	4.5	5.6
	Senior Technical Official (STO)	5	5.6	5.6	11.2
	Assistant Officer	2	2.2	2.2	13.5
	Officer Technical Support	3	3.3	3.4	16.9
	SHE Officer / Practitioner	4	4.4	4.5	21.3
	Safety Manager	1	1.1	1.1	22.5
	Field Services Engineer	1	1.1	1.1	23.6
	Senior Supervisor	16	17.8	18.0	41.6
	Sector Manager	10	11.1	11.2	52.8
	Manager Projects	16	17.8	18.0	70.8
	Procurement Manager	1	1.1	1.1	71.9
	Senior Advisor	5	5.6	5.6	77.5
	Senior Engineer	2	2.2	2.2	79.8
	Middle Manager	5	5.6	5.6	85.4
	Zone Manager	4	4.4	4.5	89.9
	Blank	7	7.8	7.9	97.8
	Engineer	2	2.2	2.2	100.0
	Total	89	98.9	100.0	
Missing	System	1	1.1		
Total		90	100.0		

In terms of job grading, (Table 4.4), the highest responses were the M16 with 26.7% and T13 with 17.8%. The lowest responses were the T05, P16 and P18 with (1.1) as well as T10 and P13 with 2.2%.

Table 4.4: Demographic profile the respondents – Job Grading

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	T05	1	1.1	1.1	1.1
	T06	4	4.4	4.5	5.6
	T08	3	3.3	3.4	9.0
	T09	4	4.4	4.5	13.5
	T10	2	2.2	2.2	15.7
	T12	8	8.9	9.0	24.7
	T13	16	17.8	18.0	42.7
	P12	1	1.1	1.1	43.8
	P13	2	2.2	2.2	46.1
	P14	1	1.1	1.1	47.2
	P15	3	3.3	3.4	50.6
	P16	1	1.1	1.1	51.7
	P18	1	1.1	1.1	52.8
	M15	5	5.6	5.6	58.4
	M16	24	26.7	27.0	85.4
	M17	4	4.4	4.5	89.9
	M18	6	6.7	6.7	96.6
	G15	3	3.3	3.4	100.0
	Total	89	98.9	100.0	
Missing	System	1	1.1		
Total		90	100.0		

4.2.2. ELEMENTS OF MPUMALANGA OPERATING UNIT (MOU)'S ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

The respondents were requested to indicate their level of agreement to the statement that, MOU's Environmental Management System (EMS) covers the elements such as environmental policy, EMS procedures, aspects and impacts, objectives and targets, environmental management program, roles and responsibilities, training and awareness, EMS auditing and management review. In addition, the respondents were asked if MOU's environmental performance has improved since the implementation of ISO 14001. An average response percentage to the questions relating to the EMS elements was 94.1%. The response is indicated in Table 4.5. An average of 81.69% employees agreed that the MOU EMS covers the critical elements as indicated.

Table 4.5: Elements of MOU's Environmental Management System (EMS)

Question No.	Level of Agreement				MOU EMS Experience Critical areas covered by MOU EMS
	Disagree		Agree		
	N	%	N	%	
QB1.1	2	2.3%	84	97.7%	Environmental policy
QB1.2	1	1.2%	84	98.8%	EMS procedures
QB1.3	2	2.4%	83	97.6%	Aspects and Impacts
QB1.4	1	1.2%	83	98.8%	Objectives and Targets
QB1.5	3	3.6%	81	96.4%	Environmental Management Programme (EMP
QB1.6	4	4.8%	80	95.2%	Roles and responsibilities
QB1.7	2	2.4%	80	97.6%	Training and awareness
QB1.8	7	8.3%	77	91.7%	EMS Auditing
QB1.9	6	7.1%	78	92.9%	Management Review
QB1.10	2	2.3%	84	97.7%	Department responsible for Environmental Management
QB1.11	2	2.3%	84	97.7%	MOU Environmental Policy
QB1.12	3	3.5%	83	96.5%	Environmental objectives meet the requirements of Environmental policy
QB1.13	4	4.7%	81	95.3%	Improvement of environmental performance due to EMS implementation

4.2.3. BENEFITS OF EMS

Table 4.6 reports the analysis of the benefits associated with EMS. The highest scores in terms of the reported benefits of EMS are the following:

- Improved MOU's environmental performance (QB2.12), showing 97.6% (indicated with green arrow on Table 4.6)
- Prevented long term harm to the environment, caused by MOU operations (QB2.3), showing 95.3%.
- Improved the reporting of environmentally related incidents (QB2.4), showing 95.3%.
- Improved environmental management practices in MOU (QB2.6), showing 95.3%.
- Enhanced communication on environmental matters within MOU (QB2.7), showing 95.3%.
- Improved MOU's ability to deal with and address public's complaints on environmental issues (QB2.8), showing 95.3%.

The benefit rated the lower in the list of benefits is, reduced costs due to environmental pollution (QB2.9) with 85.9% (indicated with a red arrow).

Table 4.6: Benefits of EMS

Question No.	Level of Agreement				Benefits of EMS
	Disagree		Agree		
	N	%	N	%	
QB2.1	7	8.1%	79	91.9%	Improved awareness on environmental legal requirements
QB2.2	9	10.5%	77	89.5%	Less non-compliance to environmental legal requirements
QB2.3	4	4.7%	82	95.3%	Prevented long-term harm to environment
QB2.4	4	4.7%	82	95.3%	Improved reporting of environmental incidents
QB2.5	8	9.3%	78	90.7%	Reduced the number of environmental incidents
QB2.6	4	4.7%	82	95.3%	Improved environmental management practices
QB2.7	4	4.7%	82	95.3%	Enhanced communication on environmental issues
QB2.8	4	4.7%	82	95.3%	Improved ability to deal with public environmental complaints
→ QB2.9	12	14.1%	73	85.9%	Reduced costs due to environmental pollution
QB2.10	6	7.0%	80	93.0%	Improved prevention costs
QB2.11	7	8.2%	78	91.8%	Benefits of implementing EMS outweigh the costs
→ QB2.12	2	2.4%	80	97.6%	Improved MOU's environmental performance

4.2.4. ENVIRONMENTAL TRAINING

Environmental training is one of the environmental Key Performance Areas (KPIs) that was tested in terms of ISO 14001 effectiveness. Table 4.7 indicates that 89.5% (QB3.1) of employees believe that an adequate level of training in environmental issues is provided to MOU employees. 88.1% (QB3.4) believes that managers, supervisors and employees are empowered to make decisions regarding environmental issues. 84.7% (QB3.2) and (QB3.3) of employees indicate that they are satisfied with the environmental training provided in MOU and that managers, supervisors and employees implement the environmental training they receive.

Table 4.7: Environmental Training

Question No.	Level of Agreement				Environmental Training
	Disagree		Agree		
	N	%	N	%	
QB3.1	9	10.5%	77	89.5%	Adequate level of environmental training
QB3.2	13	15.3%	72	84.7%	Satisfied with the environmental training provided to managers, supervisors and employees
QB3.3	13	15.3%	72	84.7%	Managers, supervisors and employees implement the environmental training
QB3.4	10	11.9%	74	88.1%	Managers, supervisors and employees are empowered to make decisions regarding environmental issues.

4.2.5. WASTE MANAGEMENT

Waste management is of significant relevance in this study, because the effectiveness of ISO 14001 was tested in terms of identifying environmental aspects and impacts associated with waste management, having access to legal requirements, waste management training as well as availability of objectives, targets and action plans for waste management. Table 4.8 reports on the waste management analysis based on the research questions as discussed below:

- **RQ1: Is ISO 14001 effective in identifying environmental impacts associated with waste management?**

96.4% (QB4.1) of the employees reported that Mpumalanga Operating Unit (MOU) has identified waste management practice as an activity related to its operations and that environmental aspects and impacts related to waste management have been identified (QB4.2).

- **RQ2: Is there adequate access to legal requirements pertaining to waste management and are all applicable legislative requirements relevant to waste management identified?**

95.1% (QB4.7) of the employees agreed that MOU has identified environmental legal requirements related to waste management and 89.1% (QB4.8) agrees that MOU adheres to environmental legal requirements related to waste management.

- **RQ3: Are there measurable and documented environmental objectives, targets and management programmes related to waste management?**

According to the results, 94.0% (QB4.3) of the respondents indicated that environmental goals in the form of objectives, targets and management programmes aimed at improving waste management practices have been established.

- **RQ4: Are environmental objectives, targets and management programmes achieved?**

91.6% (QB4.4) of the respondents agreed that action plans to ensure achievement of waste management goals have been implemented and achieved.

- **RQ5: Are key personnel whose activities result in poor waste management practices trained?**

80.5% (QB4.5) of the respondents agrees that employees have been adequately trained on waste management.

Table 4.8: Waste Management

	Level of Agreement				Waste Management
	Disagree		Agree		
	N	%	N	%	
→QB4.1	3	3.6%	81	96.4%	Identified waste management as an activity related to MOU operations
→QB4.2	3	3.6%	81	96.4%	Identified environmental aspects and impacts related to waste
QB4.3	5	6.0%	78	94.0%	Established waste management related environmental goals
QB4.4	7	8.4%	76	91.6%	Action plans implemented for achievement of environmental goals
QB4.5	10	12.0%	73	88.0%	Roles and responsibilities for waste management defined
QB4.6	16	19.5%	66	80.5%	Adequate waste management training
QB4.7	4	4.9%	78	95.1%	Identified waste related legal requirements
QB4.8	9	11.0%	73	89.0%	Adherence to legal requirements related to waste
QB4.9	7	8.5%	75	91.5%	Clear procedures for managing waste
QB4.10	8	9.8%	74	90.2%	Aware of waste types produced
QB4.11	16	19.5%	66	80.5%	Separation of waste types
QB4.12	14	17.1%	68	82.9%	Assessed possibilities of minimising waste generation
QB4.13	18	22.0%	64	78.0%	Waste minimisation options implemented
→QB4.14	19	23.2%	63	76.8%	Waste storage containers clearly and correctly labelled

The highest scores of 96.4%, Table 4.8, QB1 indicates that most respondents agree that waste management has been identified as an activity related to MOU operations and the environmental aspects and impacts related to waste have been identified (QB2). The lowest score (76.8%, QB14) is the labelling of waste storage containers indicating that the labelling is an area of improvement. In addition, it is evident that there is a reduction in the level of agreement to the specific items related to waste management practices, which was also assessed through direct observation during the field visits at various Customer Network Centres (CNC) and workshop. The findings are presented in section 4.3.

Responses to other pertinent questions related to waste management KPI are indicated below:

- Mpumalanga Operating Unit (MOU) has / is:
 - ✓ Clear procedures for managing waste on site, QB4.9 indicated a score of 91.5%.
 - ✓ Aware of the types of waste it is producing, QB4.10 indicated a score of 90.2%.
 - ✓ Separating its waste types during temporary storage, QB4.11 indicated a score of 80.5%.
 - ✓ Assessed the possibilities for minimizing waste generation, QB4.12 indicated a score of 82.9%.
 - ✓ Implementing waste minimization options in terms of waste reduction, recycling and reuse, QB.13 indicated a score of 78.0%.
- All waste storage containers, such as drums, waste skips are clearly and correctly labelled, QB4.14 indicated a score of 76.8%

4.3. FINDINGS: QUALITATIVE STUDY

This section provides the findings of the qualitative study, which was undertaken through interviews with selected supervisors, sector managers and environmental officers. The paragraphs discussed are demographic profile of the respondents, interviews and field observations. The demographic profile is based on the 17 respondents from the three Mpumalanga Operating Unit (MOU) zones. The views and perceptions of the respondents are categorised in terms of the three Mpumalanga Operating Unit (MOU) zones they represent. The findings are presented in terms of the themes as coded and categorised between the zones and positions

4.3.1 DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Table 4.9 below, reflecting the demographics of the respondents, shows that the highest number of participants is from Emalahleni zone with 10 participants. The low responses from other zones are due to participants cancelling appointments, providing reasons of emergency and urgent issues they had to attend to. There are also more male participants represented than female participants. That is attributed to the fact that, in the maintenance and operations department, at Sector and Customer Network Centre (CNC)

level, there is more male than female representation. In addition, the sector managers were only represented in both Ermelo and Mbombela zone.

Table 4.9: Demographic characteristics of the participants

MOU Zone	Participant No. (N)	Gender		Position		
		Males	Females	Sector Manager	Senior Supervisor	Environmental Officer
Emalahleni Zone	10	9	1	0	9	1
Ermelo Zone	4	3	1	1	3	0
Mbombela Zone	3	2	1	1	1	1
Total	17	14	3	2	13	2

4.3.2 INTERVIEWS

The analysis of the interview notes captured during the interviews provided insight into the views and experiences of the respondents. The interview question contained few close ended questions and open-ended questions. Table 4.10 show the responses obtained for the closed-ended questions. In analysing the open ended interview questions, the data was categorised and summarised into the following themes:

- Experience of Environmental Management System (EMS)
- Expectations from EMS
- Benefits of EMS
- Integration of EMS
- Improvement of EMS
- Challenges
- Implementation

4.3.2.1 Closed-ended questions

Table 4.10 show the responses to the following closed-ended Interview Questions:

- Are you aware of Environmental Management System (EMS) and its implementation in Mpumalanga Operating Unit (MOU)?
- If yes, have you been involved in the implementation process of EMS?

- Would you recommend the implementation of EMS-ISO14001 to other institutions?

All the employees interviewed responded positively to the above questions. They indicated that they are aware of EMS implementation in MOU, they have been involved in the implementation and would recommend the implementation of EMS to other institutions.

Table 4.10: Responses to Closed - ended questions

Interviewee	Response		Zone			Position		
	Yes	No	Emalahleni	Ermelo	Mbombela	Senior Supervisor	Sector Manager	Environmental Officer
001	√		√			√		
002	√		√			√		
003	√		√			√		
004	√		√			√		
005	√		√			√		
006	√		√			√		
007	√		√			√		
008	√		√			√		
009	√		√			√		
010	√			√		√		
011	√			√		√		
012	√			√			√	
013	√			√		√		
014	√				√	√		
015	√				√		√	
016	√				√			√
017	√		√					√

4.3.2.2 Open ended questions

Experience of Environmental Management System (EMS)

All respondents shared valuable information about their experience in terms of EMS. The senior supervisors indicated that they have identified aspects and impacts, training needs which employees require to enable them to understand the EMS requirements. They also shared that they have established and documented EMS files containing EMS procedures. In addition, EMS assisted them to become aware of environmental risks related to their activities as well as the management of such environmental risks.

However, one senior supervisor mentioned that EMS is not user friendly and it is not easy to work through the documents. The EMS experiences of some of the senior supervisors are shown below:

Mbombela Zone Senior Supervisor

"My involvement in the implementation of EMS has been in training, waste management plan creation, oil spill management & prevention, preservation of fauna & flora (DESD), preservation of protected trees and animals exposed to electrical hazards including birds"

The three senior supervisors from Emalahleni Zone shared the following:

"Environmental awareness was limited before we started with the implementation, things changed in a positive way after implementation. I have gained knowledge during the audits and I was able to share my thoughts and challenges with the environmental department"

"It was a good experience, although it required lot of work. Now that I have high impacts such as ensuring that my structures are environmental friendly, I need to manage them"

"It was difficult but I took it seriously to make sure the implementation goes well. I involved all relevant employees, the safety representative, senior clerk and the store person. After implementation, we introduced to all the employees at all levels".

Ermelo Zone Senior Supervisor

"EMS provides clear guidelines to ensure that the environment is protected during our daily operations".

The Ermelo Zone sector manager indicated that:

"I was involved, but not that involved. My experience in on the reporting and recording of incidents irrespective of how small you think they are, because the impact might be huge and records might be needed for future investigations".

The environmental officer responsible for Mbombela zone shared that:

"The Implementation of EMS has been successful within the MOU, employees have been able to understand and implement it within their various units. There has also been a change in mind-set of how the employees view the environment, which has led to less environmental contraventions".

Expectations from EMS

The respondents expressed several expectations from EMS. Senior supervisors from Emalahleni Zone mentioned expectations such as, the need to see employees with knowledge and understanding of EMS, EMS assisting them to avoid environmental damages and incidents, 100% compliance to environmental legislation and proactive methods to prevent environmental incidents, more communication from environmental officers to employees and EMS assisting in protecting and conserving the environment.

The expectations from EMS expressed by senior supervisors from Ermelo zone are:

- Improvement and awareness of environmental issues;
- Prevention of environmental incidents as well as timeous response to environmental incidents;
- Better understanding of environmental laws;
- Improvement in understanding of ISO 14001 Standard and EMS procedures;
- Improvement in the performance outcomes of environmental audits;
- Increase in visibility of environmental officers, which will equip the senior supervisors to conduct the EMS self-assessment audits independently without the assistance of the environmental officers.

The Ermelo zone sector manager mentioned that:

"It must help us improve the way we look at the environment and how we treat it. Environment is for us and for the next generation. The system must be easy for all of us to use"

The senior supervisor from Mbombela zone mentioned that he expects protection of the environment, minimization of oil spills, protection of endangered species of animals and trees, minimization of air and water pollution. The sector manager from Mbombela zone briefly indicated that his expectation from EMS implementation is the effective management of the environment. The environmental officer indicated that EMS must be easily understandable by employees to enable its effective implementation and for the system to improve environmental performance.

Benefits of EMS

The respondents stated various benefits associated with EMS implementation. The Emalahleni senior supervisors mentioned benefits such as clean environment, reduce pollution, preservation of the environment for future generation, being internationally recognised, good reputation with government authorities and other stakeholders,

minimise non-compliance to environmental laws, cost saving, more reporting of environmental incidents and effective implementation of incident investigation processes. In addition to the stated benefits by the Emalahleni senior supervisors, the Ermelo zone senior supervisors added benefits such as increased environmental awareness and prevention of environmental incidents. The environmental officers stated benefits such as, improve environmental performance, save money and energy, reduce waste generation, assist the organization in managing and controlling their impacts, improve the organization's relationship with stakeholders and gaining their trust, improved compliance to statutory approvals and improved awareness on impacts associated with the organisation's activities.

Some of the senior supervisors mentioned that:

"The benefits include reduction in pollution (air, water, land) and improved management of our activities and their impacts on the environment".

"EMS-ISO 14001 is beneficial as it enables us to monitor and measure how activities impact on the environment. It also assists in preventing impacts and correct incorrect activities"

The sector managers indicated the following, concerning the EMS benefits:

"It helps to manage environmental impacts more effectively and serves as a point of reference for getting more understanding of the environment we operate in"

It assists record keeping, identifying gaps and enable continual improvement"

Integration of EMS

In terms of how EMS has been integrated into their operational activities, the senior supervisors in Emalahleni zone indicated that, they separate waste on site, ensure good housekeeping and manage oil spills. Contrary to the Emalahleni senior supervisors, the Ermelo zone senior supervisors mentioned regular discussions on environmental topics, environmental training and audits, which focus on EMS documentation. Similarly, the Mbombela senior supervisor indicated that, integration has been through environmental commune. Some of the responses from the senior supervisors are indicated below:

"We get daily text messages regarding EMS performance, this has assisted a lot of employees in understanding the importance of EMS. We also get periodical bulletins regarding topical EMS matters at the time"

"Our operational activities are part of the environment, whatever we do, we always consider the impact on the environment, and for example we keep oil spill kits to manage minor oil spills"

"Every task performed, we ensure we do not harm the environment, for example we ensure duty of care"

The Mbombela zone sector managers indicated that EMS has been integrated into their departmental objectives and focus areas. Whilst, the Ermelo Zone sector manager indicated integration through training and awareness as well as environmental audits. The environmental officers indicated that integration of EMS into operational activities was undertaken through documented procedures, establishment of environmental Key Performance Areas (KPIs) which are added to the job compacts.

EMS vs Environmental performance

According to the responses from the Emalahleni zone senior supervisors, EMS has improved environmental performance through the introduction of proactive methods, for example, building bird friendly structures, prevention of oil spills and animal contact. In addition, they indicated an improved awareness on environmental legislation and waste management practices, which were non-existent. Particularly some of the Emalahleni senior supervisor's responses are indicated as follows:

"Previously at CNC sites, there were no good waste management practices, for example litter on site, currently we separate our waste into bins, and ensure scrap is collected regularly".

"Environmental legal contraventions have decreased. Employees are now aware of the environmental issues and they report faults to prevent more damage to the environment"

"Less legal contraventions, for example today we have environmental legal contravention free days = 621 days"

Contrary to the fact that most senior supervisors in Emalahleni zone indicated the positive contribution of EMS, one senior supervisor indicated the opposite. The senior supervisor mentioned that:

“Environmental performance is average, CNC's don't understand the system clearly, they don't report incidents, they still cut protected trees without following procedures, and we kill snakes at the CNCs instead of reporting to the relevant stakeholders”

Based on the statement, many inferences can be drawn. For example, there is lack of environmental training, lack of understanding of EMS requirements and procedures, or resistance to implementing the EMS procedures. The fact that there is knowledge of reporting to the relevant authorities supports an inference drawn on the resistance towards EMS.

The Mbombela senior supervisor indicated that EMS has improved environmental performance in that, employees became aware of the environmental Key Performance Indicators (KPI)s and all employees are playing a significant role to attain 1000 days without environmental incidents and environmental non-compliance. Similarly, the sector manager indicated that EMS implementation has raised environmental awareness thereby reducing legal non-compliance.

In Ermelo Zone, the interviewees indicated that EMS has improved environmental performance in terms of improvement in environmental training, involvement of stakeholders, reporting of environmental incidents, improvement of housekeeping practices, improvement in record keeping, shift in the employee attitude toward environment.

The environmental officers indicated that EMS has improved the environmental performance through raising awareness on environmental issues, which has led to less environmental contraventions and improved reporting of environmental incidents. In addition, employees became more aware of the environmental issues associated with their operations

Challenges

According to the Emalahleni zone senior supervisors, challenges associated with EMS implementation include activities conducted by the public, which affect MOU's operations, unlicensed landfill sites in MOU resulting in MOU waste being disposed at unlicensed landfill sites, time required for EMS documentation, complexity of EMS resulting in the

inability of employees to do EMS self-audits, negative attitudes of employees towards environment. The Ermelo zone cited challenges such as limited environmental officers for providing assistance on EMS, ensuring employees understand environmental legislation. The Mbombela senior supervisor particularly indicated that:

“The challenges are, getting all departments to understand how their activities impact on the environment, inculcating a culture of environmental preservation and the monitoring thereof. The Customer Network Centres (CNC)s are sometimes situated in areas where waste is not collected daily or weekly. The time it takes to service areas where there is no facilities handling hazardous waste. The costs are prohibitive as a result. Lack of technology to cater for endangered wild animals that interact with our powerlines in private or public game reserves. Lack of resources such as manpower and qualified service provider.”

The environmental officers indicated that inadequate resources are the biggest challenge for the implementation of EMS. The Mbombela sector manager stated the changing of employee mind set as the biggest challenge for the implementation of EMS.

Improvement of Implementation

In terms of how EMS implementation can be improved in MOU, most senior supervisors across the three zones pointed to the need for continuous environmental and EMS training as well as more environmental communication and more visibility of the environmental department through site visits. For example, one supervisor mentioned the following:

“Communicating the environmental talks via WhatsApp, for example short messages on water pollution and air quality on a daily basis to increase awareness and change individual's behaviour”

The Ermelo sector manager indicated a series of activities, firstly there must be buy-in from all stakeholders, simplifying the management system (EMS) to prevent end users seeing it as lot of work and conducting roadshows. The environmental officers indicated that EMS could be improved by acquiring more resources for implementation, increasing awareness in all levels of the organization, receiving more support from top management and through ensuring more employees work on the implementation and maintenance of EMS.

4.3.3. OBSERVATIONS

Field visits were conducted at various Customer Network Centres (CNC)'s and at a Power Plant Maintenance (PPM) workshop to further answer the research questions pertaining to waste management, assess waste management practices in terms of waste streams that are on site, waste segregation, collection and recycling of waste as well as any potential impacts on the environment. Figures 4.1 to 4.4 indicate the images taken from the PPM workshop in Witbank during the field visit on the 1st of June 2017. Figure 4.1 show the transformers placed in an oil tray to contain the oil that is leaking from the transformer. Defective transformers and oil are some of the waste streams identified at PPM workshop. From the discussions with the PPM supervisor present during the field visit, dirty oil is drained from the transformers when they are being serviced and it is decanted into a drain bay, (figure 4.2) for recycling. Some of the identified waste streams at PPM workshop include used thinners and paint containers as well as oil rags. Figure 4.3 show the labelled waste skip containing used containers and figure 4.4 show the waste skip containing used oil rags. From the images, it is observed that the different waste streams are segregated and their storage containers are labelled.



Figure 4.1: Power Plant Maintenance Workshop (PPM), Witbank – Maintenance area indicating transformers in an oil tray, to contain oil leaks from the transformer.

(Source: Author's own)



Figure 4.2: Drain Bay to contain the drained oil from the transformers for recycling – PPM Workshop - Witbank
(Source: Author's own)



Figure 4.3: Used Thinners and Paint containers for disposal – PPM Workshop, Witbank
(Source: Author's own)



Figure 4.4: Used Oil rags contained in a waste Skip. Site: PPM workshop, Witbank

(Source: Author's own)

During the field visit to Ermelo Customer Network Centre (CNC) on the 8th of June 2017, it was observed that the different waste streams generated were segregated and the storage areas labelled. See figure 4.5 and 4.6. However, figure 4.7 and 4.8 show that there are still areas of improvement in terms of segregating waste streams. In figure 4.7, scrap, boxes and plastics are placed together in the same waste skip. Figure 4.8 show plastic bottles scattered with boxes.



Figure 4.5: Rotten wooden poles, Ermelo CNC – Ermelo Zone

(Source: Author's own)



Figure 4.6: Scrap conductors placed in a waste skip, Ermelo CNC – Ermelo Zone

(Source: Author's own)



Figure 4.7 Boxes, plastics and metals (red circle) placed in a waste skip, Ermelo CNC – Ermelo Zone

(Source: Author's own)



Figure 4.8: Boxes and plastic bottles (red circle) scattered, bottles mixed with boxes, Ermelo CNC – Ermelo Zone

(Source: Author's own)

The different waste streams identified during the field visit at Kwaggafontein Customer Network Centre (CNC), on the 14th of June 2017 are indicated on figures 4.9 to 4.12. Areas of improvement identified during the field visit include, keeping lot of scrap at the

CNC without disposing it through proper disposal methods, poor housekeeping practices, mixing different waste streams as well as potential source of pollution associated with creosote wearing off the wooden poles.



Figure 4.9: Insulators, scrap conductors & defective transformers placed on the ground, Kwaggafontein CNC – Emalahleni Zone

(Source: Author's Own)



Figure 4.10: Scrap conductors, Kwaggafontein CNC – Emalahleni Zone

(Source: Author's Own)



Figure 4.11: Scrap metre boxes with plastics, Kwaggafontein CNC – Emalahleni Zone
(Source: Author's Own)



Figure 4.12: Wooden poles with creosote wearing off the poles, Kwaggafontein CNC – Emalahleni Zone
(Source: Author's Own)

4.3.4 ACCESS TO AND IDENTIFICATION OF LEGISLATIVE REQUIREMENTS

The fundamental requirements for being able to answer Research Question 2, (RQ2: Is there adequate access to legal requirements pertaining to waste management and are all applicable legislative requirements relevant to waste management identified) were the CNC and workshop field investigations, interviews as well as the survey questionnaires. An analysis of figures 4.1 to 4.12 (taken during field investigations) suggests that there is access and awareness of the environmental legal requirements to be adhered to. Figure 4.1 show that measures have been taken to prevent pollution, by placing the transformers in an oil tray to contain the leaks. Figures 4.2 and 4.3 show the labelling of the waste storage containers, which is in line with Regulations, 634 of 2013 published in terms of the National Environmental Management Waste Act No 59 of 2008. Furthermore, from the discussions with the senior supervisors, it was established that the waste is stored for less than 18 months. That affirms that there is awareness of the most relevant waste related legislative requirements and that measures are being taken to ensure compliance to the legislative requirements.

Different waste streams generated are segregated into rotten poles (figure 4.5), scrap conductors (figure 4.6) boxes (figure 4.7), insulators such as glass and porcelain (figure 4.9) and cables (figure 4.10). The waste is collected for recycling and other waste streams are disposed following the appropriate disposal procedures. The adopted waste management practices for waste recycling and disposal provide evidence that there is identification and access to the most relevant and applicable legislation. From the interviews conducted with selected employees, it became evident that legal compliance is of great importance to them. Of relevance to RQ2, are the following statements from the interviews:

"Previously there were no good waste management practices, with litter on site, now we separate our waste, we ensure collection of scrap"

"Environmental legal contraventions have decreased, for example today our environmental legal contravention free days are 621"

In response to RQ2, the findings from the survey questionnaire show that 95.1% of the employees agree that MOU has identified environmental legal requirements pertaining to waste. In addition, 89.1% of the employees agree that MOU adheres to environmental legal requirements related to waste. From the discussions it is evident MOU has access to and has identified the most relevant waste related legislative requirements such as the National Environmental Management Waste Act No 59 of 2008 and the National

Environmental Management Waste Classification and Management Regulations 634 of 2013.

This study evaluated the effectiveness of Environmental Management System (EMS), (based on ISO 14001 Standard) in improving environmental Key Performance Indicators (KPI)s of Mpumalanga Operating Unit (MOU). The effectiveness was tested by means of survey questionnaires, interviews and observations. The findings from the survey questionnaires suggest that MOU has implemented EMS to cover critical factors. In addition, the results indicate that improving environmental performance is the highest benefit associated with EMS implementation. Other EMS benefits revealed from the results including findings from the interviews are, prevention of long-term harm to the environment, improvement of reporting of environmentally related incidents, improvement of environmental management practices, enhancement of communication on environmental matters and improvement in the ability to deal with and address public's complaints on environmental issues. There was however, some scepticism observed regarding the value and significance of EMS from one of the respondents. Specific issues indicated are that EMS is complex, there is no understanding of EMS and EMS related procedures are not being followed and there is no reporting of relevant environmental issues.

In evaluating environmental performance, waste management, environmental training and environmental incidents were used as environmental Key Performance Areas (KPIs). The results of the survey questionnaire reveal that waste management was identified as a significant environmental issue that required to be monitored and managed, with roles, responsibilities and procedures put in place to ensure adequate monitoring. The data from the interviews also revealed a great awareness regarding waste management practices as well as implementation of waste minimisation practices. However, issues relating to waste minimisation options, segregation of waste and the clear labelling of waste storage could be improved, as observed during the field visit at some of the Customers Network Centres (CNCs) as well as from the interviews. The results also revealed satisfaction in the level of environmental training and improvement in the reporting of environmental incidents.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. INTRODUCTION

This chapter presents the summary of the research work undertaken, the conclusion as well as the recommendations for Eskom's Mpumalanga Operating Unit (MOU) and for future research. This study was aimed at evaluating the effectiveness of Environmental Management System (EMS) (based on ISO 14001 Standard) in improving environmental performance, particularly waste management. The questions that served as a motivation for this study are as follows:

- RQ1: Is ISO 14001 standard effective in identifying environmental aspects and impacts related to waste?
- RQ2: Is there access and adherence to environmental legal requirements pertaining to waste?
- RQ3 & RQ4: Are there documented environmental objectives, targets and management programmes for addressing and achieving waste management?
- RQ5: Are employees trained on waste management?

Mixed research methods combining both quantitative and qualitative approaches were used to achieve the study objectives.

5.2. SUMMARY OF FINDINGS

The findings from the quantitative study revealed that 96.4% of the respondents agreed that waste management was identified as an activity associated with Mpumalanga Operating Unit (MOU) operations and that environmental aspects and impacts related to waste management have been identified. Furthermore, 95.1% of the respondents indicated that MOU has identified environmental legal requirements related to waste management and that MOU adheres to environmental legal requirements related to waste management (89.1% of respondents).

Additionally, the findings showed that environmental action plans in the form of objectives, targets and management programmes for improving waste management practices have been established. There was a 94.0% of agreement from the respondents. 91.6% of the respondents agreed that action plans to ensure achievement of waste management goals have been implemented. In terms of waste management training, 80.5% of the respondents agreed that employees have been adequately trained. This indicates the implementation of good waste management system. Elsaid and Aghezzaf (2015:1086)

describe a waste management system as the management of all responsibilities, practices, procedures, processes and resources for establishing a system that manages waste and complies with environmental regulations.

The findings from the observations conducted are in line with the results of the survey questionnaire as well as the findings of the interviews. Different waste streams were separated, storage areas labelled, recycling initiatives are implemented for some waste streams and oil-containing equipment were placed on oil trays to prevent soil contamination. It was however noted that there are areas of improvement, in terms of behavioural changes, which requires full adherence to waste segregation, taking responsibility to initiate the disposal of other waste streams and implementing control measures to prevent potential pollution resulting from other waste streams. From this study, it is noted that the positive attitude of the MOU employees towards the environment has improved. The improvement in attitude is attributed to the environmental training conducted as part of ISO 14001 implementation.

The findings from the qualitative data suggests that EMS has positive benefits that include providing assistance to organisations to manage and control their environmental impacts, improvement in environmental performance, minimisation of non-compliance to environmental laws, reduction of pollution and environmental incidents as well as preservation of the environment for the future generation. The benefits relating to the management and control of environmental impacts are consistent with Seagra *et al.* (2014:7) that ISO 14001 provides an assurance to organisations as well as external stakeholders that, environmental impact is being measured and improved.

The benefits of minimisation of non-compliance to environmental laws and reduction in environmental incidents are congruent with Murmura (2018:695) who also found greater compliance with legal requirements and decreased risk of environmental accidents as the benefits of ISO 14001 Standard. Some of the ISO 14001 benefits stated from the findings are being internationally recognised, good reputation with government authorities and other stakeholders, cost saving, increased environmental awareness and more reporting of environmental incidents. Martín-Peña *et al.* (2014:222) also stated some of the ISO 14001 benefits such as cost saving, good reputation and being internationally recognised.

The challenges reflect Mpumalanga Operating Unit (MOU)'s difficulties in terms of EMS implementation. The findings revealed challenges that include, inadequate and limited resources for EMS implementation, complexity of EMS, time required for EMS implementation, lack of technology to implement some of the environmental issues, excessive costs required for environmental action plans, negative attitudes from the employees and understanding of environmental legislation by the technical employees and how their activities impact on the environment. Some of the findings are consistent with the findings by Martín-Peña *et al.* (2014:277). Time required for EMS implementation, costs and complexity of the EMS are some of the most difficult factors for EMS implementation (Martín-Peña *et al.* 2014:277).

In line with Yang and Zhang (2017:1319) who categorised the barriers to EMS implementation in terms of attitudinal and perceptions barriers, information related barriers, resources barriers and technical barriers. In this study the negative attitudes to EMS implementation forms part of the attitudinal and perception barrier, understanding of environmental legislation and how activities impact on the environment, is an information barrier, inadequate resources and costs for EMS implementation is a resource barrier and lack of technology to address some of the environmental issues is a technical barrier. In terms of how EMS performance can be enhanced, the findings showed that the factors that can improve EMS implementation are top management involvement, continuous communication, continuous environmental training and awareness.

One divergent view regarding the benefits and complexity of EMS has been noted from the findings of the qualitative data. The finding suggests that there is neither a clear understanding of EMS nor the improved environmental performance associated with EMS implementation. It is however interestingly noted that there is knowledge on the availability of documented EMS and environmental procedures that are to be followed, but are just not followed.

5.3. CONCLUSION

This study employed mixed research methods combining quantitative and qualitative approaches to evaluate the effectiveness of Environmental Management System (EMS) (based on ISO 14001 standard), in improving environmental Key Performance Indicators (KPI). The KPIs selected were waste management, environmental training and environmental incidents. The EMS parameters used to define effectiveness were

identification of environmental aspects and impacts, access to and compliance to environmental legal requirements, achievement of environmental goals in terms of objectives and targets as well as environmental training. The results and findings, point to empirical evidence that suggests that, MOU's EMS is effective in identifying, controlling and managing waste management as an environmental aspect with a significant impact on the environment. In addition, clear and real objectives and targets to address significant impacts are developed. Access to and compliance to the most applicable environmental legislative requirements is ensured.

It was found that the benefits of adopting EMS are, prevention, reporting of environmental incidents as well as effective implementation of incidents investigation, compliance to environmental legislative requirements, increased environmental awareness, assist the organisation to manage and control its environmental impact and it serves as a point of reference for getting more understanding of the environment. Most of the stated benefits are in line with the benefits stated in previous research. The newly emerged benefit is the record keeping benefit that EMS offers. Challenges that were identified with respect EMS implementation are complexity of EMS, negative attitude, time required for EMS documentation development and implementation, limited resources in terms of environmental expertise to provide guidance and support, understanding of environmental legislation and how activities affect the environment. Ivanova *et al.* (2014:1273) indicated that successful implementation of management standards requires employee empowerment, willingness to make improvement suggestions, management efforts to encourage employee participation.

It is therefore concluded that ISO 14001 Standard, is effective in improving environmental performance. However, there must be continuous employee empowerment, willingness to adopt, implement, and maintain EMS, management involvement in order to encourage employee participation and make resources available for EMS implementation and maintenance.

5.4. RECOMMENDATIONS

The recommendations from this study are two-fold namely those aimed at Eskom, especially for the Mpumalanga Operating Unit (MOU) and recommendations for future research.

5.4.1 RECOMMENDATIONS FOR ESKOM

Based on the findings of the interviews and results of the questionnaire it is recommended that MOU undertake the following:

- Introduce an EMS dashboard as a measuring tool to ascertain if each EMS parameters (environmental aspect and impact, environmental objectives and targets, compliance to environmental legal requirements, environmental training) is effective in improving the environmental performance. The information can further be used to assess if there are some cost savings after EMS implementation.
- Assess the resource requirements for effective and continuous EMS development and maintenance. Based on that, assess the feasibility of acquiring additional resources for EMS.
- Consult with the employees to ascertain what can be done to have a positive attitude that will foster effective EMS implementation.
- Investigate opportunities on how top management involvement on EMS could be improved.
- Continuously undertake environmental training and awareness.

5.4.2 RECOMMENDATIONS FOR FURTHER RESEARCH

Based on the empirical findings of this study, future research can explore the utilisation of the organisation's environmental Key Performance Indicators (KPI) data to assess and analyse environmental performance trends. In addition, the environmental expenses can also be utilised to weigh the organisation's environmental expenses vs the costs of implementing ISO 14001 Standard.

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APPENDIX A: PERMISSION LETTER FOR RESEARCH STUDY

APPENDIX B: EXAMPLES OF INFORMED CONSENT FORMS

APPENDIX C: INTERVIEW GUIDE

APPENDIX D: COVER LETTER FOR QUESTIONNAIRE

APPENDIX E : RESEARCH QUESTIONNAIRE