

Exploring the benefits of implementing ISO14001 in Electricity Transmission Utilities – an Eskom study

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Mini-dissertation submitted in partial fulfillment of the
requirements for the degree *Magister* in *Environmental
Management* at the Potchefstroom Campus of the North-West
University

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May 2017

Abstract

The global growing concerns about the condition of the environment and the growing pressure from government and the society at large for companies to control the impact that their activities have on the environment, has led to the development of various environmental governance and management strategies and tools.

Amongst the voluntary tools is the ISO 14001 standard to which the Transmission division of Eskom Holdings Limited has certified its EMS to, and the aim of this research was to explore the benefits that are being realised.

The study followed a quantitative approach, and a literature study was conducted to explore the relationship between EMS and environmental performance and to understand the intent to which ISO 14001:2015 update will enhance this relationship. To determine the extent to which ISO 14001 influenced the utility's compliance to legislation, environmental performance data prior to and post ISO 14001 certification for the utility was sourced and trended.

The literature reviewed shows that there is a positive correlation between ISO 14001 and environmental performance, and that the magnitude of the change depends on how the standard is assimilated. A weakness was also identified with the previous editions of the standard in that the focus was more on the EMS itself rather than environmental performance, and the focus on new 2015 edition has been shifted to be more on the outcome of the system. The legal compliance contraventions of the utility studied show that although there was a period of deteriorating performance after the certification, the performance in the recent years resembles that of the pre-certification single measurement. Therefore the implementation of ISO 14001 in Eskom Transmission did not result in improved environmental performance as far as legal compliance is concerned for the period studied and based on the literature reviewed, it is however anticipated that other benefits might have been realised which did not form part of this study, and the reasons for not achieving improvement in legal compliance need to be investigated.

Key Words: benefits, ISO 14001, environmental management systems, environmental performance, certification

Preface

My gratitude goes to the North-West University for the opportunity to study as well as the organised and professional manner in which the programme was delivered. I also thank the lecturers and other course presenters for the knowledge that was imparted to me.

I am thankful to my employer, Eskom, for sponsoring my studies; my Eskom Transmission and Sustainability Divisions colleagues for their support; and my superiors at Transmission North East Grid for their support and understanding.

I thank my family for their support and understanding; the sacrifices they had to make are highly valued.

Most of all, I am very thankful to God the Almighty for His loving-kindness in giving me the grace to finish, and for the opportunity to learn to draw on His strength and completely rely on His power.

Abbreviations and Acronyms

DEAT:	Department of Environmental Affairs and Tourism
DIS:	Draft International Standard
DWAF:	Department of water affairs and forestry
EMAS:	Eco-Management and Audit Scheme
EMS:	Environmental Management System
EU:	European Union
EWT:	Endangered Wildlife Trust
GATT:	General Agreement on Tariffs and Trade
GIS:	Gas Insulated Switchgear
GWP:	Global warming potential
ISO:	International Organisation for Standardisation
MSDS:	Materials Safety Data Sheet
NEMA:	National Environmental Management Act
OHS:	Occupational Health and Safety
PCB:	Polychlorinated biphenyl
POP:	Persistent Organic Pollutant
PPE:	Personal Protective Equipment
SAGE:	Strategic Advisory Group on the Environment
SANS:	South African National Standards
SF6:	Sulphur hexafluoride
SOC:	State Owned Company
TRI:	Toxic Release Inventory
U.S:	United States
UNCED:	United Nations Conference on Environment and Development

UNEP:	United Nations Environmental Programme
WCED:	World Commission on Environmental and Development
WTO:	World Trade Organisation

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Chapter 1: Introduction

1.1 Background of the study

As noted by Colby (1991:193), the scope and scale of environmental challenges has “expanded considerably from pollution issues at local, regional and then international levels, to deforestation, soil erosion, declining water tables, and other forms of natural resource depletion and degradation, to global concerns such as climate change and the ozone layer”. The United Nations Environmental Program (UNEP) monitors these issues as they emerge and has presented these in its Year Books over the years since 2003. In the 2014 Year Book, UNEP presents a fresh look at ten issues highlighted over the decade and amongst these are, just to mention a few: (a) air pollution, which is considered to be the world’s worst environmental health risk, with a cost estimate of over three trillion US dollars to the world’s most advanced economies plus India and China; (b) emergence and re-emergence of infectious diseases as a result of mainly land use change and deforestation that can bring people closer to wildlife allowing previously unknown diseases to spread from non-human vertebrate hosts to humans; (c) the release of methane (a potent greenhouse gas with considerably higher warming potential than carbon dioxide) to the atmosphere from destabilised methane hydrates as a result of global warming. As noted in the Millennium Ecosystem Assessment report, unaddressed issues will substantially diminish the benefits that future generations obtain from ecosystems (2005:1).

In response to societal expectations for sustainable development, transparency and accountability, which according to the International Organisation for Standardisation (ISO) (2015) have evolved with increasingly stringent legislation, growing pressures on the environment from pollution, inefficient use of resources, improper waste management, climate change, degradation of ecosystems and loss of biodiversity, various environmental enforcement tools have been developed over the years. According to Gunningham (1998 cited in Nel & Wessels, 2010:49), two distinct environmental enforcement phases may be identified in developed countries: (i) the first, a command and control phase, began in the early 1970s with a proliferation of environmental legislation, performance standards and other command and control instruments; (ii) by the 1980s, the inability of command and control tools to change behaviour consistently and universally spawned a counter-movement arguing for large-

scale deregulation in favour of market-based enforcement tools, and once again, other second-generation environmental enforcement tools were developed and experimented with, as it became apparent that the market too had failed to be the remedy for all the environmental enforcement problems.

For the purpose of this study, the environmental enforcement tools are grouped into the following categories: command and control, economic, civil and agreements, as illustrated in Figure 1-1.



Figure 1-1: Generic classes of environmental policy and governance tools

The latter two may range from entirely voluntary commitments such as the adoption and use of voluntary tools, to voluntary agreements that may also have enforceable elements (Nel & Wessels, 2010:50)

An environmental management system (EMS), which is the focus of this study, is one of the tools which firms can use to voluntarily implement environmental policy (Delmas, 2000:3). It is a formal set of procedures that defines in great detail how an enterprise will manage its potential impacts to the natural environment (Darnall, 2006:356).

Although the specific goals and institutional features of EMSs vary across organisations, all EMSs involve establishing an environmental policy or plan; undergoing internal

assessments of the company's environmental impacts (including quantification of the impacts and how they have changed over time); establishing quantifiable goals to reduce environmental impacts, providing resources, and training workers; checking implementation progress through systematic auditing to ensure that goals are being reached; correcting deviations from goal attainment; and undergoing management review (Coglianese & Nash, 2000 cited in Darnall, 2006: 356).

According to Kim (2009:5), at the most basic level, an EMS can help organisations ensure that their management practices conform to environmental regulations; however, the EMS structure also encourages facilities to prevent pollution by substituting regulated inputs with those that are not regulated, and by eliminating some regulated processes altogether. As a result, some enterprises may no longer be subject to some costly regulatory mandates.

Kim (2009:5) further notes that EMS assist enterprises to scrutinise their internal operations, engage employees in environmental issues, continually monitor their processes, and increase their knowledge about operations. All of these actions also can help organisations improve their internal operations, achieve greater efficiencies, and thus create opportunities to improve their environmental performance by way of pollution prevention.

As noted by Delmas (2006:4), since 1990, there have been efforts at the national level, within the European Union, and at the international level to standardise EMS; this stemming from amongst other things, a concern that without a common international standard, firms would be forced to deal with dozens of separate and potentially incompatible EMSs for every country in which they conduct business, which could lead to increased transaction costs and also function as a trade barrier. Some of the outcomes of these efforts are the EMS standards such as the British Standards BS 7750 and the EU Eco-Management and Audit Scheme (EMAS) which were developed to provide firms with a standardised framework that would allow them to develop an EMS.

ISO 14001 is the first attempt to create an international EMS standard (Darnall, 2006:357). Developed and published in 1996 by ISO as part of the ISO 14000 series, the ISO14001 standard is currently viewed as the world's most recognised framework for EMS that helps organisations both to manage better the impact of their activities on

the environment and to demonstrate sound environmental management (ISO, 2009:6). A survey of certificates done in 2013 shows that at least 301 647 certificates (a growth of 6%) have been issued in 171 countries, four more than the previous year (ISO, 2013). In the same survey, the certificates issued in Africa showed an increase from 2084 in 2012, to 2538 in 2013.

One of the key elements of ISO 14001 is the continual improvement of environmental performances, defined as “a process of enhancing the environmental management system in order to achieve improvements in overall environmental performance consistent with the organisation’s environmental policy” (ISO, 2004). According to Yin and Schmeidler (2007:5), the expected outcome of the program is that participating firms will achieve better environmental performance when compared to non-participants by adhering to stringent program standards.

The benefits of EMSs are further recognised by other authors such as Perotto et al (2008:518) as to improve compliance with legislation, address stakeholder pressure, improve corporate image and raise awareness of environmental issues within the organisation.

1.2 Research aims and objectives

Despite the rapid growth in certification and stated benefits, empirical studies carried out to determine the relationship between ISO 14001:2004 EMS implementation and environmental performance improvement show contradicting conclusions, as presented in Chapter 2. This raises a question whether organisations that implement ISO 14001 are indeed benefiting from doing so.

Eskom Transmission, which is the focus of this research, is one of the organisations that have implemented ISO 14001 certified EMSs, and the aim of this research is to explore the benefits that are being realised due to the implementation of ISO 14001.

From the study conducted about Eskom Transmission (see details in Chapter 4), environmental performance is the key driver behind Eskom’s EMS, with the compliance to environmental legislation being the key performance indicator. Therefore to aid in achieving the aim of this research, the following objectives were set:

- 1) To explore the relationship between EMS implementation and environmental performance enhancement.
- 2) To understand the intent to which ISO 14001:2015 update will enhance the relationship between EMS implementation and environmental performance.
- 3) To determine the extent to which the Eskom Transmission ISO 14001-based EMS influence compliance to legislation.

1.3 Chapter summary

The chapter presented a general introduction to the study and covered an overview of the environmental challenges and how the pressure from the society to manage these issues has led to the development of various environmental management tools such as ISO 14001. Subsequently, the research aims and objectives of the study were presented. A detailed layout of the approach followed to conduct the study is presented in Chapter 2, as well as the methods used to achieve the set objectives.

Chapter 2: Research Methodology

2.1 Introduction

A research is described as a process that involves obtaining scientific knowledge by means of various objective methods and procedures (Welman et al, 2005:2). According to Jonker and Pennink (2010:30), a research methodology ensures that there is a logical order that a researcher needs to follow to achieve the predetermined result, and defining and defending this logical order is what methodology is all about.

As per the definition in the preceding paragraph, this chapter outlines the methodology for this research, and covers the research approach, design, methods and tools.

2.2 Research approach

There are two basic approaches to research, namely, the qualitative approach and the quantitative approach (Welman et al, 2005:6; Kothari, 2004:5; Kumar, 2011:33; Jonker & Pennink, 2010:28).

Also known as the positivist or scientific approach, the quantitative approach is rooted in the physical science (Kumar, 2011:33); is often regarded as being purely scientific, justifiable, precise and based on facts often reflected in exact figures (Jonker & Pennink, 2010:38); and involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion (Kothari, 2004: 5).

The qualitative approach on the other hand, which is also considered an opposing approach to quantitative approach (and has also become known as ethnographic, ecological or naturalistic) is concerned with subjective assessment of attitudes, opinions and behaviour (Kothari, 2004:5), and is often regarded as 'messaging around', being 'vague', not scientific and not following a structured plan (Jonker & Pennink, 2010:38).

The above descriptions of the research approaches bring two descriptive terms to light, namely subjective and objective, and the quantitative approach is therefore described as an objective approach to research while the qualitative research is the subjective approach.

In this research, the overall goal is to explore the benefits of an ISO 14001 EMS, the result of which will lead to a conclusion on whether the standard did result in an improvement of environmental performance, and therefore objectivity is of high necessity. It is for this reason that the quantitative approach was selected for the research, and the following are the methods and techniques that were utilised.

2.3 Research design

In the field of human behaviour sciences, a research design is described by Welman et al (2005:52) as the plan according to which research participants are obtained and research information collected from them, and the plan describes what is going to be done with the participants, with a view to reaching conclusions about the research question, hypothesis or problem. It is a conceptual structure within which research is conducted, and constitutes the blue print for the collection, measurement and analysis of data (Kothari, 2004:31). Not only is the research design focused on obtaining answers to research questions, but it should do so validly, objectively, accurately and economically (Kumar, 2011:96).

In this research, the aim is to determine the benefits realised from implementing ISO 14001 in Eskom Transmission; hence, there is a cause and outcome relationship that needs to be evaluated. From the study conducted about Eskom Transmission (See details in Chapter 4), environmental performance is the key driver behind Eskom's EMS, with the compliance to environmental legislation being the key performance indicator. Hence the change in the number of contraventions of environmental legislation (also referred to as legal contraventions) is the benefit that was considered for the evaluation. Two variables were therefore constructed for this study, namely:

- (a) ISO 14001 = the independent variable (X)
- (b) Environmental performance = the dependent variable (Y)

The independent variable (X) is described as the cause that is supposed to be responsible for bringing about change in an observed phenomenon, situation or circumstance (Kumar, 2001:74). This variable is considered to be independent because the researcher is interested in how it affects the other variable(s) being studied (Welman et al, 2005:16).

The dependent variable (Y) on the other hand, is described as that factor which the researcher observes and measures to determine how it was affected by the independent variable (Welman et al, 2005:17). It is therefore the outcome or change brought about by the introduction of the independent variable (Kumar, 2001:74)

A comparison of the status of the dependent variable before and after ISO 14001 certification was done to determine the change as illustrated in Figure 2-1 below, and therefore make a conclusion if there was a benefit or not. This type of approach is referred to as 'before-and-after' design by Kumar (2011:107) and as 'pre-measurement and post-measurement single group research design' by Welman et al (2005: 79).

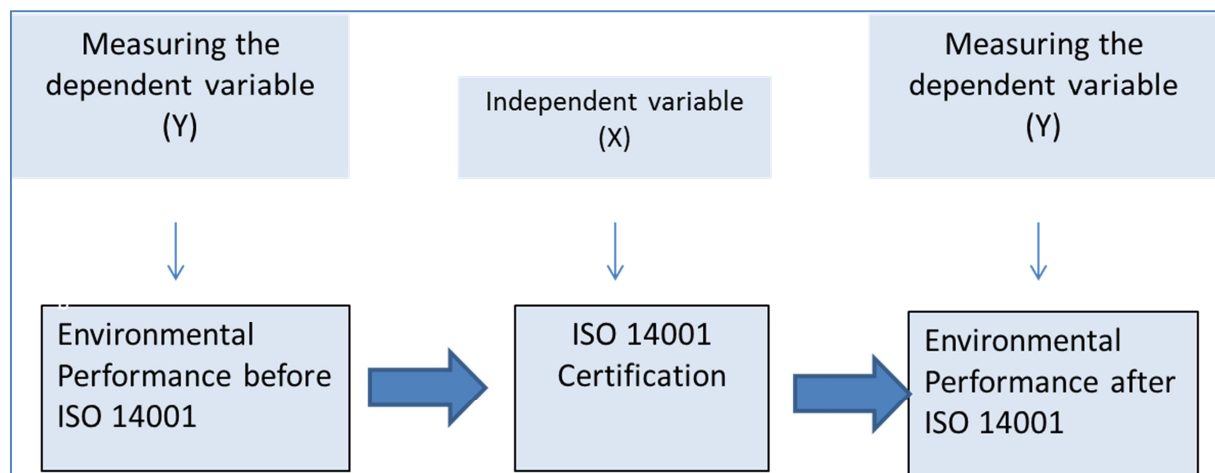


Figure 2-1: Research Design

As noted by Welman et al (2005:89), the researcher may plan the introduction of the independent variable or it may be an unplanned event (such as an earthquake or the collapse of the stock market) in which case archival records may be considered as a measure of the dependent variable. Although Eskom Transmission division planned the implementation of ISO 14001, it is to be noted that it was not for the purpose of this study and the intervention happened within the usual operating of the business.

2.4 Research methods and tools

The following are methods and tools that were used in this study.

2.4.1 Literature review

To gain insight about ISO 14001 and to examine what is perceived to be a reality in terms of its relationship with improved environmental performance (objectives 1 and 2 of this research), a literature review was done.

As indicated by Pare et al (2015:183), the literature reviews helps the researcher to, amongst others, understand the existing body of knowledge, and provides a theoretical foundation for the proposed empirical study.

The review involved the process of identifying and collecting material relevant to the study, and deriving a conclusion about the perceived reality, as presented in Chapter 3.

2.4.2 Data Collection and Analysis

To test the extent to which the ideas created about reality through the literature survey are correct (objective 3 of this research), existing data was collected about the subject of this research. The source of this data comprised of monthly and annual reports published by the Environmental Department of the Transmission Business Integration and Performance Management (BIPM) business unit.

The data collected was entered into an Excel spreadsheet, and graphs generated to determine the effect that ISO 14001 (independent variable) had on the dependent variable (environmental performance of the Eskom Transmission Division).

The following factors formed the basis of the analysis:

- a) A correlational association between the independent variable X (ISO 14001) and the dependent variable Y (environmental performance), which according to Welman et al (2005:82), exists when Y tends to appear or vary in association with X.
- b) Whether the observed variations in Y were caused by X. In this instance, two more issues were given attention, with the first issue being whether X is a necessary cause of Y, meaning that variations in Y cannot occur in the absence of X. Secondly, whether X is a sufficient cause of Y, meaning that the presence of X necessarily results in the occurrence of variations in Y (Welman et al, 2005:17).

- c) Lastly, whether there is no third variable Z to which the observed variations in Y can be attributed since, as explained by Welman et al (2005:110), there is always a possibility that the strong relationship/high correlation between two variables may be explained by a third variable that relates strongly to the other two.

2.5 Limitations of the study

One significant limitation of this study is that a single pre-ISO certification measurement value was used to determine the effect that the standard had on the utility's environmental performance. This was due to the difficulty in obtaining the historical data as it does not form part of the records currently retained by the utility. The availability of such data would have contributed towards the study's firm establishment of the utility's actual performance prior to ISO certification which could be compared with the performance after the certification.

2.6 Reliability of data

The source of this data comprised of monthly and annual reports published by the Environmental Department of the Transmission Business Integration and Performance Management (BIPM) business unit.

The Environmental Department is responsible for environmental management within the Transmission division and reports monthly on environmental performance to the Eskom Sustainability division which reports on the entire organisation. Hence the data obtained for this study is the same data as what is reported by Eskom on its annual integrated reports.

2.7 Chapter summary

The chapter outlined the methodology for this study, and the reasons behind the choice of research approach and design were given. The methods used for the study were also explained, and the variables constructed for the study presented. Furthermore, the limitations of the study were highlighted and the reliability of the data collected clarified.

Chapter 3: Literature Review

3.1 Introduction

This chapter presents the review of what has been written about environmental management systems and ISO 14001, and covers the following: a brief background of ISO and the origins of ISO 14001; the basis for creating and EMS according to ISO 14001 standard; the empirical studies conducted to assess the relationship between ISO 14001 and environmental performance; and the degree to which the 2015 edition of ISO 14001 addresses the issues of environmental performance.

3.2 The International Organisation for Standardisation and the environment

ISO is the International Organisation for Standardisation, with a membership of 160 national standards institutes from countries large and small, industrialised, developing and in transition, in all regions of the world (ISO, 2009:3). ISO's portfolio of more than eighteen thousands standards provides practical tools for all three dimensions of sustainable development: economics, environmental and societal.

ISO has a multi-faceted approach to meeting the needs of all stakeholders from business, industry, governmental authorities and non-governmental organisations, as well as consumers, in the field of the environment. It has developed standards that help organisations to take a proactive approach to managing environmental issues: the ISO 14000 family of environmental management standards which can be implemented in any type of organisation in either public or private sector (ISO, 2009:3).

The ISO 14000 series was stimulated by two events: (1) the 1992 Global Environmental Initiative in Rio de Janeiro in which over one hundreds countries attending the United Nations Conference on Environment and Development (UNCED) committed to improving international environmental management programs and petitioned ISO to adopt this cause; and (2) the 1994 Uruguay round of General Agreement on Tariffs and Trade (GATT) negotiations, which established a committee under the World Trade Organisation (WTO) to harmonise environmental and trade policy (Delmas, 2000:9; Marambanyika & Mutekwa, 2009:282; Zeng et al, 2005:645).

ISO responded to the petition by establishing the Strategic Advisory Group on the Environment (SAGE) to look into how international standards could support better environmental management (ISO, 2009:4), and the group was made up of representatives of governments, national standardisation organisations, and business environmental professionals (Theodore & Theodore, 2010:48)

According to Theodore and Theodore, (2010:48), SAGE considered whether such standards would:

- a) Promote a common approach to environmental management similar to quality management
- b) Enhance an organization's ability to attain and measure environmental performance
- c) Facilitate lower trade barriers.

3.3 ISO 14000 family of standards

Following an intensive consultation process carried out within the framework of SAGE, ISO technical committee ISO/TC 207 was established, which is responsible for developing and maintaining the ISO 14000 family of standards (ISO, 2009:4; Bansal & Bogner, 2002 cited in To & Lee, 2013:2).

According to the International Trade Centre (2007:2), TC 207 is ISO's largest technical committee and membership is made up of participating and observer members, liaison organisations, and national standards organizations that represent their respective participating countries; and ISO 14000 family of standards is amongst ISO's most widely used standards.

The national delegates are chosen by the national standards institute concerned and they are required to bring to ISO/TC 207 a national consensus on issues being addresses by the technical committee, which is derived from a process of consultation with interested parties and stakeholders in each country (ISO, 2009:4). The ISO 14000 family of standards therefore reflects an international consensus on good environmental and business practice that can be applied by organisations all over the world in their

specific context, and it is the world's most recognised framework for environmental management systems.

The first edition of the ISO 14000 series, which was issued in 1996, consisted of: 1) ISO standards 14001 and 14004: Environmental Management Systems; 2) ISO standards 14010 to 14012: Environmental Auditing; 3) ISO standards 14020 to 14025: Environmental Labels and Declarations; 4) ISO standard 14031: Environmental Performance Evaluation; 5) ISO standards 14040 to 14043: Life Cycle Assessments; and 6) ISO standard 14060: Environmental Aspects in Products.

3.4 Developing the EMS according to ISO 14001

The basis for creating an environmental management system according to ISO 14001 standards are two standards – ISO 14001: Guidelines and requirements for application, and ISO 14004: General guidelines regarding principles, systems and supporting techniques (Fortunski, 2008:206). However, ISO 14001 is the only certifiable standards, and all other standards describe supporting functions which serve to maximise the effectiveness of the ISO 14001 EMS and therefore their implementation is not required for ISO 14001 certification (Delmas, 2009:11).

According to the International Institute for Sustainable Development (1996:30), ISO 14001 details the core requirements of an EMS that, when implemented, will allow an organization to identify and manage its environmental responsibilities and it is applicable to any organization which desires to:

- (a) Implement an EMS
- (b) Assure itself of its conformance with a stated environmental policy
- (c) Demonstrate such conformance to others
- (d) Seek certification/registration of its EMS by an external organization
- (e) Make a self-determination and declaration of conformance with the standard

The standard is based on the Plan-Do-Check-Act (PDCA) model, which is briefly described by ISO (2015) in relation to environmental management systems as follows.

- (a) Plan: establish environmental objectives and processes necessary to deliver results in accordance with the organization's environmental policy.
- (b) Do: implement the processes as planned.
- (c) Check: monitor and measure processes against environmental policy, including its commitments, environmental objectives, and operating criteria, and report the results.
- (d) Act: take actions to continually improve.

Figure 3-1 below is the schematic representation of this relationship between the PDCA methodology and the framework of ISO 14001.

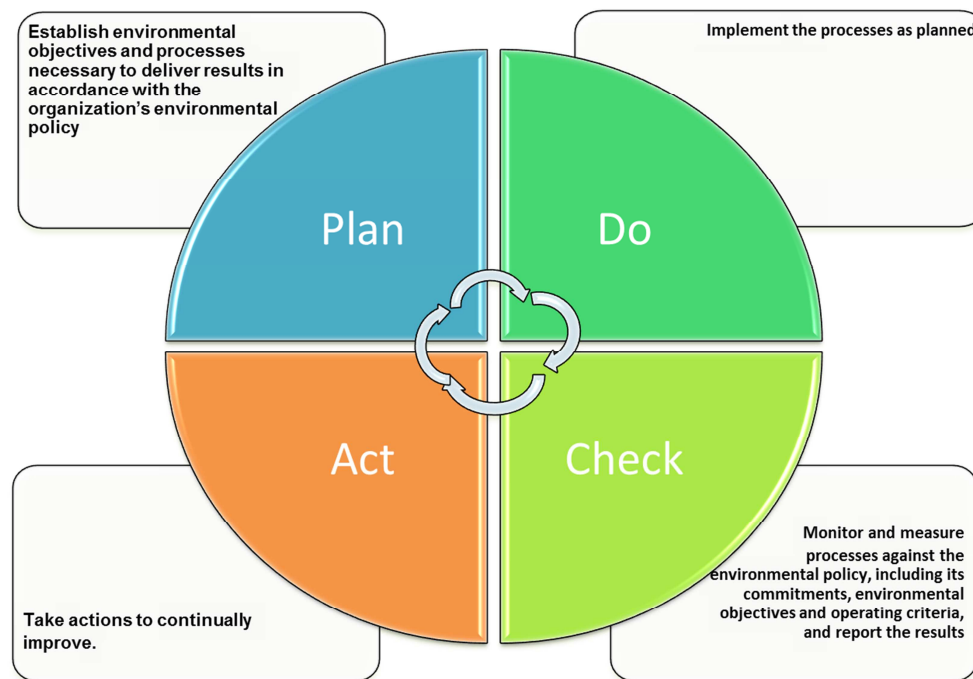


Figure 3-1: Relationship between ISO 14001 environmental management system and PDCA model

In line with this framework, an organization that wishes to create an ISO 14001 EMS is required to perform the following:

- (i) Establish an appropriate environmental policy (ISO, 2004; Nishitani, 2009:670), which is a general statement about the aims of the organization and its focus regarding the activities that have an effect on the environment (Fortunski, 2008:206).

- (ii) Identify the environmental aspects arising from the organization's past, existing or planned activities, products and services, in order to determine the environmental impacts of significance (ISO, 2004; Fortunski, 2008:206).
- (iii) Identify applicable legal requirements and other requirements to which the organization subscribes (ISO, 2004), and although the organization is obliged to act in agreement with the law, the application of the standard does not lead to strict requirements regarding the environmental impact of its activities (Fortunski, 2008:206).
- (iv) Establish a structure and a programme(s) to implement the policy and achieve objectives and meet targets (ISO, 2004; Babakri et al, 2003:749).
- (v) Facilitate planning, control, monitoring, preventive and corrective actions, auditing and review activities to ensure both that the policy is complied with and that the environmental management system remains appropriate; and be capable of adapting to changing circumstances (ISO, 2004, Babakri et al, 2003:749).

In order to obtain ISO 14001 certification, the organization's EMS undergoes a third-party assessment by independent accredited auditors, and surveillance visits are performed thereafter to verify that the company implements, checks, and improves its EMS; and after a period of three years, a company must undergo a new certification audit (Ghissellini & Thurston, 2005:765).

3.5 ISO 14001 and environmental performance

The review of the body of literature that has been developed in terms of the efficacy of ISO EMSs in improving firm's environmental performance has revealed views and arguments that are notably uneven, as presented below.

3.5.1 Studies that show a positive correlation between ISO 14001 and environmental performance

In a study to determine the conditions under which ISO 14001 enhances environmental performance, Yin and Schmeidler (2007) carried out an analysis on the first survey of U.S. ISO 14001 Certificate Holders, which examines how organisations' implementation of ISO 14001 is associated with improved environmental performance. In the survey,

the respondents are asked to evaluate their facilities' environmental performance improvement after ISO 14001 certification and the extent to which the improvement can be attributed to the certification as it relates to ten environmental aspects including: permit violations; environmental fines; utility consumptions; waste reduction; use of recycled material; overall compliance with laws and requirements; environmental complaints (odours, noise, vibrations); environmental incidents; land and habitat conservation; emergency preparedness; and product environmental performance (Yin & Schmeidler, 2007:18). The analysis led to a conclusion that facilities that actively integrated ISO standard with their day-to-day operations, that included some performance management elements, and that developed EMS as part of a certification process are more likely to report that ISO certification contributed to their environmental performance improvement to a greater extent than others. The study suggested that the implementation of ISO and the certification thereof could be an effective tool for promoting EMSs and therefore improving facilities' environmental performance.

There is also criticism on previous research that assessed environmental performance in that it has been performed predominantly using the U.S. EPA Toxic Release Inventory (TRI) emissions data (Anton et al cited in Kim & Darnall, 2009:12). Although TRI data are publicly available and contain information of facilities releases of nearly six hundred and fifty chemicals, which provide a good proxy measure for a facility's environmental impacts related to toxic chemicals, toxic releases offer only a partial view of a facility's overall environmental performance (Kim & Darnall, 2009:12). Moreover, TRI data are not collected in all countries, which make it difficult to evaluate the effectiveness of EMSs in an international setting.

Two hypotheses were raised in a study by Kim (2009): (1) the first hypothesis was derived from the basic benefits of an EMS and stated that organisations adopt an EMS of any sort are more likely to improve their environmental performance, and (2) the second hypothesis stated that organisations that adopt certified EMSs are more likely to improve their environmental performance than organisations that adopt non-certified EMSs and the hypothesis is based on factors such as 1) the institutional structure of certified EMSs, which relates to the certification process and the requirement on the certified organisation to demonstrate the continued functioning of their EMSs in order to maintain certification; 2) the costly nature of certification, because of which organisations that seek certification may have better managerial support to maintain the

system and achieve the EMS's environmental goals; and finally 3) the likelihood of certified organisations to have enhanced visibility for their environmental practices because certification lists are available through auditors and online services, which may cause the organisation to feel greater external pressure to address environmental concerns that are important to external stakeholders, as well as to maintain their certification.

To evaluate the hypotheses, EMS adoption measures were constructed by categorising EMSs in three ways: self-designated, complete and certified. Self-designated and complete EMSs 'are both uncertified EMSs, with the latter consisting of the implementation of the four different environmental practices that have been recognised as core components of different types of EMSs: written environmental policy; environmental training program in place for employees; internal environmental audits; and environmental performance indicators' (Kim, 2009:14).

The survey results indicated that just like the complete and certified EMSs, facilities that adopted self-designated EMSs showed positive relationship with decreased environmental impacts, suggesting that facilities that have any type of EMS are more likely to decrease environmental impacts; and the comparison of the marginal effects of certified and complete EMSs offered little evidence in support of the second hypotheses (Kim, 2009:19, 21).

Several other studies were carried out internationally to evaluate the benefits of ISO 14001 which showed positive relationship between the standard and improved environmental performance, such as the study by Fortunski (2008) in an electric energy sales and physical distribution in the Opole region in Poland; and a South East Africa study by Marambanyika and Mutekwa (2009) at Unilever in Harare, Zimbabwe.

3.5.2 Studies that do not support an existence of a positive correlation between ISO 14001 and environmental performance

As part of a growing interest in Europe to establish stronger links between environmental regulation and externally validated environmental management systems such as ISO 14001 and the EMAS, which was to a certain extent driven by the requirement for member states to 'consider EMAS registration in the implementation and enforcement of environmental legislation in order to avoid unnecessary duplication

of effort by both organisations and competent enforcement authorities', a study was carried out by Dahlstrom et al (2003) to assess whether the Environmental Agency had a case for modifying its regulatory procedures for companies and sites either certified to ISO 14001 or registered under EMAS. The aim of the study was to assess whether the existence of an EMS at a site could be used by the Agency to reduce the regulatory resource input so that sites with inferior performance can be targeted. The data analysis of this study concluded that an externally validated EMS does improve the 'procedural' aspects of performance such as, recording and use of information, knowledge and implementation of authorisation requirements, plant maintenance, management and training, and process operation (Dahlstrom et al, 2003:199). A direct relationship between the EMS and improvements in outcome could not, however, be established, as measured by legal compliance and by enforcement officers' assessment indicated that having an externally validated EMS does not result in a lower likelihood of suffering from of complaints, incidents and non-compliance events.

Dahlstrom's results are also supported by Boiral (2007) whose case study conducted among nine ISO 14001 certified Canadian organisations led to a conclusion that even if adopting ISO 14001 brought about some internal benefits, these benefits were related mostly to administrative aspects such as rigorous management, monitoring of nonconformities, updating of documentation, computerisation of the environmental management system, internal communication and more systematic audits. These administrative improvements were considered to be stemming more from a methodical application of a rigorous management system and the rationalisation of environmental programs than from profound changes in behaviour, and therefore ISO 14001 could not be considered a tool for improving environmental efficiency (Boiral, 2007:137).

In another study conducted to test whether adopting ISO 14001 significantly impacts environmental performance in Quebec's pulp and paper industry, data was collected from 37 plants for a period of seven years, and the results showed that the impact of ISO varied across the aspects of the adopting plants, with improvements observed on certain aspects while there was no improvement in others. In addition, the results also varied across the adopting plants themselves, with some of the plants that considerably reduced emissions following certification either maintaining or even increasing emissions after being ISO certified (Barla, 2007:291).

3.6 Criticism on the earlier editions of the standard to deliver on improved environmental performance

In a study conducted by Ghisellini and Thurston (2005) to investigate the hypothesis that 'the ISO 14001 implementation process can create several cognitive biases which may actually hinder the overall environmental performance', the environmental performance of several ISO certified companies were investigated. An in depth analysis of three of the companies was carried out to determine the possible correlation between their EMSs and what they called the environmental decision biases, which they summarised as follows:

- a) The management nature of the standard, in which the authors state that ISO 14001 is a management standard and not a performance standard.
- b) Failure to identify a rigorous environmental baseline as a result of the standard granting the company a great degree of freedom in establishing its overall environmental impact without providing a rigorous definition of significant impact.
- c) Misconception of pollution prevention where by the focus is on the adoption of traditional end-of-pipe pollution control mechanisms that are neither 100% efficient nor cost effective, as opposed to source reduction, material substitution, and more efficient processes in orders to preclude the formation of pollutants in the first place.
- d) Inordinate emphasis on short-term goals which might lead the company to set objectives and targets that reflect a weak long-term policy that is incapable of drastic environmental improvements.
- e) Focusing on regulatory compliance and therefore losing the opportunity to address non-regulated impacts.
- f) Diversion of EMS resources to documentation system due to the long number of procedures required by the standard that must be maintained and reviewed periodically to ensure continuous improvement of the system, which increases the amount of bureaucracy within the company .

The study concluded that even companies seriously committed to the fulfilment of the standard can still inadvertently fall prey to these cognitive decision traps, affecting the overall environmental performance of the company.

Another argument raised by Delmas (2000: 14) is that not only does the standard fail to establish absolute requirements for environmental performance other than a commitment to compliance with applicable regulations, but it also fails to identify environmental performance as a factor in the actual certification process. Delmas (2000:14) further argues that although ISO 14001 requires an organisation to measure and track its environmental performance, there are no adopted or commonly accepted environmental performance indicators; and the ISO 14031 only lists examples of measures and indicators, it does not propose a core set of metrics for comparison and benchmarking of performance, nor does it establish performance levels. This is supported by Yin and Schmeidler (2007:10) and Melnyk et al (2003, cited in Zhang et al, 2014:206) who argue that because ISO certification is process-focused and does not require firms to achieve specific environmental performance improvement benchmarks, its actual impact on environmental performance is not guaranteed.

In a study carried out by Fortunski (2008:206), it is noted that the application of the standard in the organisation does not lead to strict requirements regarding the environmental impact of its activities; the organisation is only obliged to act in agreement with the law and to improve the environmental policy and processes related to its implementation and management, in order to make its activities more environmentally sustainable. The author argues that in a situation where there is a problem of enforcement of legal requirements, ISO certification contributes to the compliance to the environmental legal requirements as an additional control mechanism. This effect may however be smaller in countries where environmental law is more efficiently enforced.

3.7 Conditions under which environmental performance improvement occurs

Following a study of results of empirical studies that reached uneven conclusions regarding whether ISO 14001 improved facilities' environmental performance, Yin and Schmeidler (2007) made an observation that these studies treated participation in voluntary environmental programs as a homogenous phenomenon, neglecting variations in how firms implement these programs which could be the factor responsible

for the differing outcomes. The basis for their observation was that ISO 14001 allows flexibility which creates a platform for participating firms to implement the standard differently and because of this, facilities may experience different efficacy of ISO 14001 certification in improving their environmental performance.

Subsequently, a study was carried out by Yin and Schmeidler to examine how the manner in which organisations implement ISO 14001 is associated with improved environmental performance, and it involved an analysis of the first survey of all U.S. 14001 Certificate Holders. The following are the findings from the study:

- (i) The efficacy of ISO 14001 certification in improving facilities' environmental performance depends on the level of assimilation; that is, the degree to which the ISO 14001 standard makes its way into various aspects of organizational life. The assimilation in this context includes three aspects: i) the extent to which the design and development of a facility's ISO 14001-based EMS is integrated with systems already in place, such as quality and manufacturing systems; ii) the extent to which a facility's ISO 14001-based EMS ends up being used in daily practice; iii) the extent to which a facility's ISO 14001-based EMS is incorporated in the update of the facility's current practices. This is consistent with a conclusion made by Boiral and Henry (2012:92) that efficiency of the ISO 14001 standard and environmental management overall probably depends less on explicit technical and managerial aspects than on the way these practices are implemented on a daily basis and the true resolve of managers and employees to improve environmental performance.
- (ii) Facilities that have integrated some performance management elements into their ISO 14001 EMS design and implementation are more likely to report greater environmental improvement than those that haven't. The basis for this argument is that unlike performance-based programs which include activities to ensure that goals are clearly specified, that progress towards the goal is carefully measured, and that goals are consistently being met, the process-focused ISO 14001 does not require firms to achieve specific environmental performance improvement benchmarks. Therefore improved environmental performance is not guaranteed as the desired performance is more likely to be achieved if failure to do so often results directly in penalties for the participating facilities.

(iii) Facilities that developed their EMA during the ISO 14001 certification process are more likely to report that ISO certification contributed to their environmental performance to a greater extent than those who have developed their EMS before ISO 14001 certification. Although the reported environmental performance improvement was found to be not different for the facilities that developed an EMS in the certification process and those who had developed an EMS before ISO, when asked of the extent to which the ISO certification contributed to the improved performance, those who developed an EMS in the certification process were observed to be more likely to attribute the improvement to the ISO certification to a greater extent than others. The key insight drawn by the authors regarding these observations is that facilities that have developed an EMS before certification are more likely to be able to separate the impacts of the adoption of an EMS from the impacts of the certification of the EMS to ISO 14001, whereas the facilities that developed an EMS during ISO 14001 certification process are more likely to confound the impacts of the adoption of an EMS and the certification of the EMS to ISO 14001 as these two actions occur concurrently.

3.8 The expected promises of ISO 14001 2015 edition

As presented in the preceding paragraphs, certain weaknesses have been noted by authors against the past editions of the standard.

In the 2015 revision of the standard, the work group responsible for the revision (WG5) was mandated to consider the Future Challenges (FC) Study Group recommendations, as contained in the document 'ISO-TC 207-SC1-WG5-N0023 Grouped Future Challenges Recommendations (27 February 2012)' (ISO, 2014).

The following two recommendations were raised in line with environmental performance, and grouped under Theme 2: EMS and (improvement of) environmental performance:

- a) Clarification of the requirements of (improving) environmental performance in ISO
- b) Strengthen performance evaluation as part of 4.5.1 in ISO 14001 page 4 of 7 (e.g. use of indicators); consider in this respect the ways in which performance evaluation is addressed in ISO 14031, in ISO 50001 and in non-ISO sources such as EMAS III and GRI [9.1]

These recommendations, together with other 31 recommendations, were documented in a document titled 'N0177 Future Challenges ISO/DIS 14001 – final draft with additional information', the purpose of which was to show which clause or sub-clause of the Draft International Standard (DIS) text takes into account the Themes of the Future Challenges document (ISO, 2014), and was distributed to National Member Bodies for comments about whether and how the revised standard does (or should) incorporate the recommendation.

Below is the analysis of how the ISO 14001:2015 clauses address EMS and improvement of environmental performance.

3.8.1 More emphasis on environmental performance than the EMS itself

Whereas the second edition (ISO 14001:2004) described the aim of an ISO EMS as to “enable an organization to develop and implement a policy and objectives which take into account legal requirements and information about significant environmental aspects”, the new edition (ISO 14001:2015) focuses on helping organisations to achieve the intended outcomes of its environmental management system, which include enhancement of environmental performance. The emphasis is therefore more on the outcome of the environmental management system, rather than just a ‘system approach’ to environmental management.

This emphasis is further demonstrated on the environmental policy requirement, in which top management is not only required to include a commitment to continual improvement of the EMS, but to do so in order to enhance environmental performance (ISO 14001:2015).

The sub-clauses that deal with evaluation of performance have been regrouped under one clause ‘Performance Evaluation’ (clause 9), and more requirements have been added (ISO 14001:2015). The management review, for example, is required to not only consider changes in external and internal issues that are relevant to the environmental management system, but to also consider changes in significant environmental aspects and risks and opportunities. The ‘monitoring and measurement’ has also been revised to include the determination of the criteria against which the organization will evaluate its environmental performance, using appropriate indicators, and to use the results of

the evaluation as input to the management review for the evaluation of the effectiveness of the environmental management system (ISO 14001:2015).

3.8.2 Use of indicators

Although the measurement of results can be done against any criterion, the use of indicators is mandatory in the new edition. The definition of indicator has, for this reason, also been imported from ISO 14031. The requirements for programmes to achieve environmental objectives have also been revised to include indicators for monitoring progress (ISO 14001:2015).

3.8.3 Terminology

New terms have also been defined on the new edition, which further incorporate environmental performance enhancement into the standard, such as: effectiveness, which is defined as an extent to which planned activities are realized and planned results achieved; measurement, defined as a process to determine a value (ISO 14001:2015).

Some terms have also been redefined to put more emphasis on environmental performance than the EMS itself. For example, the definition of continual improvement has been 'flipped' to refer to a recurring activity to enhance performance through the use of EMS (ISO 14001:2015), instead of the 2004 edition definition where the focus was on enhancing the EMS to achieve improvements in environmental performance (ISO 14001:2004).

3.9 Chapter summary

The literature reviewed has illustrated a number of opposing views regarding the efficacy of ISO 14001 as a tool for improving environmental performance, with some studies showing that implementation of the standard result in improved environmental performance, while some show no existence of such improvement. The literature also showed the weaknesses of the standard in relation to addressing environmental performance, as well as the decision traps that organizations can fall prey to when implementing the standard which affect the overall environmental performance. Furthermore, the chapter presented an analysis of the extent to which the 2015 edition of ISO 14001 addresses some of the gaps identified in the previous editions.

Chapter 4: Results and Discussion

4.1 Introduction

This chapter presents the main outcomes of the study carried out to determine the extent to which the Eskom Transmission ISO 14001-based EMS influence compliance to legislation and it covers the following points:

- (i) The brief description of the study area, which provide background understanding for the rest of the content of this chapter.
- (ii) The description of the identified environmental aspects and impacts associated with the activities of the area under study as documented by the organisation, which help to understand the formulation of the performance indicators.
- (iii) The pre-ISO 14001 EMS and post-ISO 14001 EMS environmental performance and the discussion of the results.

4.2 Description of the research area

4.2.1 Overall overview of the organisation

Eskom Holdings SOC Limited is one of the top 20 utilities in the world by generation capacity (net maximum capacity: 41,194 MW). It generates approximately 95% of the electricity in South Africa and more than 40% of the electricity used in Africa. It operates 27 power stations and has 385,582 km of power lines and cables (Eskom, 2014a:12).

Eskom currently operates along the entire value chain, as indicated in the diagram below. It generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers and redistributors, with a total of some 4.65 million customers. Additional major power lines are being built to meet the rising electricity demand in South Africa (Eskom, 2014a:12).

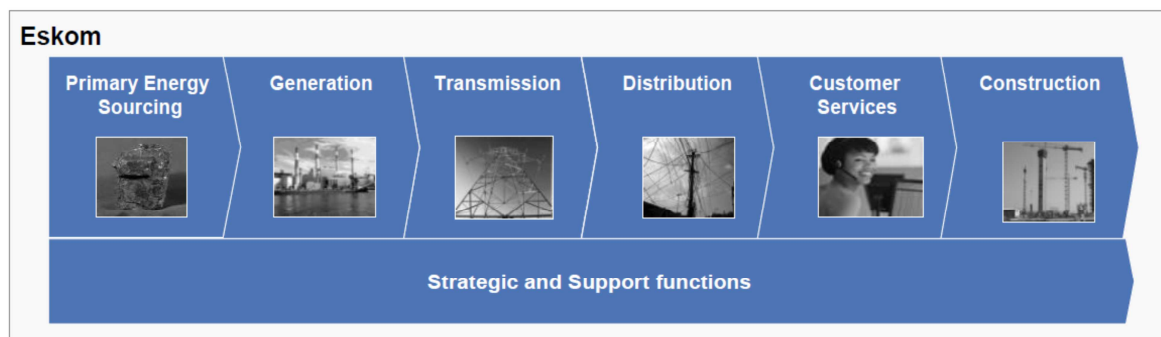


Figure 4-1: Eskom Value Chain (Source: Eskom, 2015:83)

4.2.2 Eskom's Approach to Environmental Management

According to Eskom Sustainability division, the organisation's EMS is based on the following:

- (a) The EMS approach in Eskom must ensure the control of activities that have or could have a significant impact to the environment.
- (b) The EMS must be appropriate to the legislative control, scale of operations and the significance of their impacts.
- (c) The EMS must provide an effective meaningful way of controlling activities and therefore addressing environmental impacts.
- (d) The EMS must be cost effective especially in light of Eskom's present cost constrained context.

The Strategic Intent Statement, as determined by the shareholders, has set five strategic objectives, one of which is "Reducing Eskom's carbon footprint and environmental impact by, amongst other actions, setting out and implementing a clear roadmap towards compliance with environmental legislation and pursuing low carbon opportunities" (Eskom, 2015:22).

In order to give effect to its strategy (which is to stabilise the business and to re-energise for long-term sustainability and growth) and to deliver on its mandate, Eskom aims ensure that the organisation is sustainable along eight distinct dimensions which include environmental and climate change sustainability. The environmental sustainability aims to address the linkages between environmental management and

operational sustainability. Environmental compliance is considered “critical” to ensuring that Eskom maintains its license to operate, keeps the light on, and meets its “Zero Harm” mandate (Eskom, 2015:27&28).

The conclusion drawn from the Strategic Intent Statement and the Environmental Sustainability dimension is that compliance to environmental legislation is the key driver behind Eskom’s EMS and hence the yard stick for measuring the environmental performance of the organisation, as such, for this research study, the evaluation of the environmental performance is based to a greater extent around the environmental legal compliance.

4.2.3 Focus area of the study

The Transmission Division, which is the focus of this research, is considered as one of the “high environmental impact” business units who’s EMSs should be ISO 14001 certified (Eskom, 2003:77). The mandate given to the Transmission Group by Eskom Holdings SOC Limited is “To optimally plan, operate and maintain Eskom’s transmission assets throughout their economic life; and to provide an integrative function for the reliable development, operation and risk management of the interconnected power system” (Eskom, 2015:112).

Transmission’s assets consist of 160 substations connected by 31 107 kilometres of lines across South Africa (Eskom, 2016:15), as shown on the diagram below.

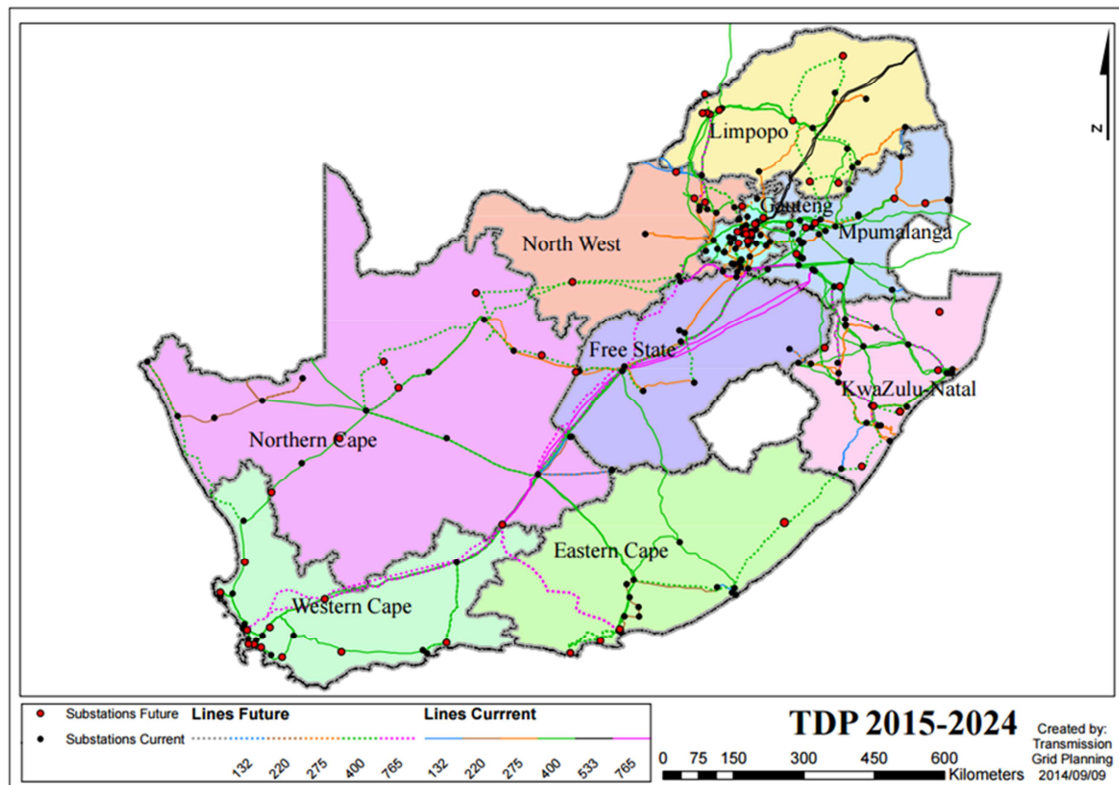


Figure 4-2: Eskom Transmission Network (Eskom: 2016:15)

The overall strategic approach is to become a world-class transmission organisation through operational excellence and customer orientation, which include amongst other focus areas, Zero Harm on Transmissions employees, contractors, the public and the natural environment.

The division first obtained its ISO 14001 in 2002, and has retained this certification since then (Eskom, 2003:77).

4.3 Environmental Aspects and Impacts

The desk study of the company documents (mainly the environmental management strategy document, environmental management reports and annual reports) carried out for the purpose of this research identified several environmental aspects and impacts associated with the operations of the Transmission division, and the following are the aspects and impacts that are associated with the legal contraventions presented in paragraph 4.4 in no particular order.

Handling, storage, disposal of materials contaminated with polychlorinated biphenyl

Polychlorinated biphenyls (PCBs) are synthetic substances not known to occur naturally. Most PCB mixtures are non-volatile at around 40⁰C, with a flash point in excess of 300⁰C (SANS, 2007:31), and it is for this exceptionally high thermal stability that they were utilised in high-powered electrical equipment to enhance thermal resistance.

The management, handling and disposal of PCB in Eskom Transmission is done in accordance with the SANS 0290: 2008: Mineral Insulating Oils – Management and Handling of Polychlorinated Biphenyl (PCB). Although oil and equipment at level 3 (<50 ppm) and below are considered non-PCB materials in accordance with the Stockholm Convention on Persistent Organic Pollutants, the strategy within Eskom is to ultimately work towards achieving level 0.

Handling and disposal of SF6 gas and/or its by-products

Sulphur hexafluoride (SF6) is synthetic gas that is a colourless, odourless, tasteless, non-toxic, non-flammable, very stable and inert gas (SANS 62271, 2014:51).

Although SF6 is non-toxic and has no reported potential to be acute or chronic eco-toxic, and its application in electric power equipment does not contribute to the destruction of stratospheric ozone layer since they do not contain either chlorine or bromine, it has been identified as a greenhouse gas according to the 1997 Kyoto Protocol. Its strong infrared absorption and long lifetime in the environment are the reason for its high global warming potential (GWP) which is 22 200 higher than CO₂ (SANS 62271, 2014:55), and therefore atmospheric releases must be avoided.

As a management strategy in Eskom, 1) all SF6 Gas Insulated Switchgear (GIS) plants and storage areas are required to have a clearly visible safety sign at the entrance identifying the plant as an SF6 plant; 2) the SF6 cylinders that are supplied to Eskom by the gas suppliers are required to have testing markings, volume and mass capacities and serial numbers stamped on the cylinder shoulder to indicate quality testing; 3) the cylinders are required to be inspected (a register of which must be kept), handled, stored, transported and used in accordance with the requirements set out in SABS 019; and 4) cylinders are to be returned to the supplier when empty or leaking.

Wildlife Interactions

Bird streamers have been identified as contributing to the overhead line faults, which carries the risk of loss of supply to customers and/or poor quality of supply to the customers. This problem gets amplified when birds build nests on the overhead lines towers and to mitigate this, whenever bird nests are identified during patrols, these are relocated. Although this is done in partnership with wildlife management agencies, it can cause a disturbance if not managed properly. Electrocution of birds as a result of sitting on and collision with overhead line conductors is another area that has been identified as of concern.

In addition to relocation of bird nest, interaction of wildlife with electrical equipment or infrastructure is also another aspect that the organisation has been identified. In the substation equipment, small species such as rats and rabbits seem to find the electrical equipment to be a safe and warm habiting environment, and this often leads to electrocutions. The ripple effect of this manifests itself in the form of snakes that go into these substations in search of prey, which also end up adding to the wildlife electrocutions. Electrocution of monkeys has also been identified as the cause of some substation faults.

The Eskom/Endangered Wildlife Trust (EWT) strategic partnership is in place to avoid or mitigate wildlife interaction with electrical infrastructure (Eskom, 2014:21).

Management of vegetation under and around power lines

The interaction of vegetation and power lines is complex. Plants are responsible for a high percentage of line faults including the provision of fuel for fires under power lines (Eskom, 2010:3).

Although safe clearances have been determined based on the Occupational Health and Safety (OHS) Act (Act 85 of 1993) for safe clearances applicable to overhead electrical lines, and vegetation clearance is carried out in line with these, various species of indigenous vegetation are protected by law in terms of which is necessary to obtain a permit from the relevant authority in order to cut them.

To manage this, the organisation requires that the list of protected tree species under the National Forest Act, 1998 (Act No 84 of 1998) Gazetted by the department of

Agriculture, Forestry and Fisheries must be sourced and referenced, and people involved in vegetation clearance are provided with proper training.

Another environmental issue that arise from this aspect is that of soils erosion. Plant species correlate closely with soils – they stabilize soils, and any plant management strategy should consider the effect on soils.

Disposal of asbestos and asbestos containing material, equipment and articles

Asbestos containing materials were historically used for lagging and insulation purposes. Being a persistent organic pollutant it is listed under the Rotterdam convention as an Appendix A chemical and has therefore been banned in South Africa for imports, exports, mining and manufacturing. The inhalation of asbestos fibres has health effects and it causes serious lung diseases, including asbestosis, cancer of the lungs and mesothelioma. Eskom's strategy is to phase out asbestos as soon as possible but not later than November 2033.

Usage, handling, storage, transport and general control of insulating oil

Mineral oil is used in Eskom for insulating in electrical equipment, aspects such as usage, handling, storage, transport and general control of the commodity need to be carefully managed.

Insulating oil and other related hydrocarbon compounds pose a serious pollution problem once released into the environment. Not only do these compounds pose a fire hazard, but with one litre of oil having the potential to contaminate in excess of a million litres of water, it needs to be handled with care. Oil may rapidly penetrate certain soil types, which may lead to extensive environmental as well as groundwater and surface water contamination.

The management strategies in place include following the requirements as listed in the SANS 290 document entitled: Mineral insulating oils (uninhibited) – Purchase, management, maintenance, testing and safe disposal; testing all insulating oil removed from any electrical equipment for inclusion in the Eskom oil pool for the presence of contaminants such as PCBs, solvents and synthetic oils, including electrical cleaner, silicone oil and motor oils; and reporting all oil (hydrocarbon) spill incidents in line with

the requirements of the organisation's Safety, Health and Environmental Incident Management Procedure.

Storage, handling and disposal of solvents

Solvents and cleaners are widely used in Eskom for the removal of waxes, greases, oils, carbon and various other contaminants from equipment during routine maintenance and general cleaning. Solvents can be regarded as hazardous due to their potential environmental impacts, including air pollution, water and soil contamination, harm to wildlife, fire hazard and health hazards, among others poisoning, damage to the human body and disorders.

Storage of solvents must be in accordance with the specific minimum requirements of the Materials Safety Data Sheet (MSDS). The prescribed Personal Protective Equipment (PPE) and other protection measures are to be used when working with solvents, unless otherwise stated in the OHS Risk Assessment.

Management of silica gel

Silica gel is used to dry the air as it flows through a bed of silica gel beads in a breather connected to the transformer. Dehydrated silica gel is colourless. When a visible indication of the moisture content of the silica gel is required, cobalt chloride is most commonly added. This will cause the gel to be blue when dry and pink when hydrated.

Due to the widespread use of cobalt chloride as a moisture indicator in silica gel desiccant, used in transformer breathers, the concern is that this might impact on the health of workers, ground and surface water quality. When disposed to land or water, the used silica gel containing copper chloride, is toxic to aquatic life.

Management strategies include the use of only Eskom approved silica gel, disposal of used silica gel at a hazardous waste site and wearing of PPE when handling the silica gel.

Storage, handling and disposal of herbicides

In terms of the Regulation GNR.1048 of 25 May 1984 (as amended) issued in terms of the Conservation of Agricultural Resources Act, Act 43 of 1983, Eskom commits to control category 1, 2 and 3 plants to the extent necessary to prevent or to contain the

occurrence, establishment, growth, multiplication, propagation, regeneration and spreading such plants within servitude areas or land owned by Eskom.

Control programs are developed and included as part on the Environmental Management Plans for each area (substation and transmission line), and these involve treating plants with herbicide or cutting at 100mm above ground level and treat stumps with herbicide.

4.4 Evaluation of legal compliance as an indicator for environmental performance

A couple of environmental performance indicators have been used by Transmission over the years, some inconsistently so with an exception of the 'contravention of environmental legislation' indicator. This is the indicator that is used to measure the utility's performance on the aspects listed in section 4.2 above, and the organisation describes this indicator as a number of instances where a provision of environmental legislation (national, provincial, or local) and/or condition of an environmental approval (for example, environmental authorisations, water use license, waste license, license in terms of National Forests Act) or any other legal document issued in terms of environmental legislation is contravened (Eskom, 2014b:12).

The performance for this indicator is as indicated in Figure 4-3 below, and it represent the number of instances whereby an incident that occurred during the usual operation of the business resulted in one of the impacts contravening a provision of environmental legislation. This data was obtained from the reports obtained from the Transmission Business Integration and Performance Management.

By looking at the legal contraventions for the year 2000, which is the period before the first ISO certification, and comparing it to the contraventions that occurred after 2002, a variation in performance is observed for the 2005 to 2009 period which is on the decline. The observed variation occurred three years after the certification and there is no data before then which can indicate whether this occurred immediately after the certification or not; and also, there is only one measurement obtained for the period before the certification. This, as also noted by Welman et al (2005: 91), makes it impossible to distinguish between a real effect and the continuation of a tendency that was not related to the intervention.

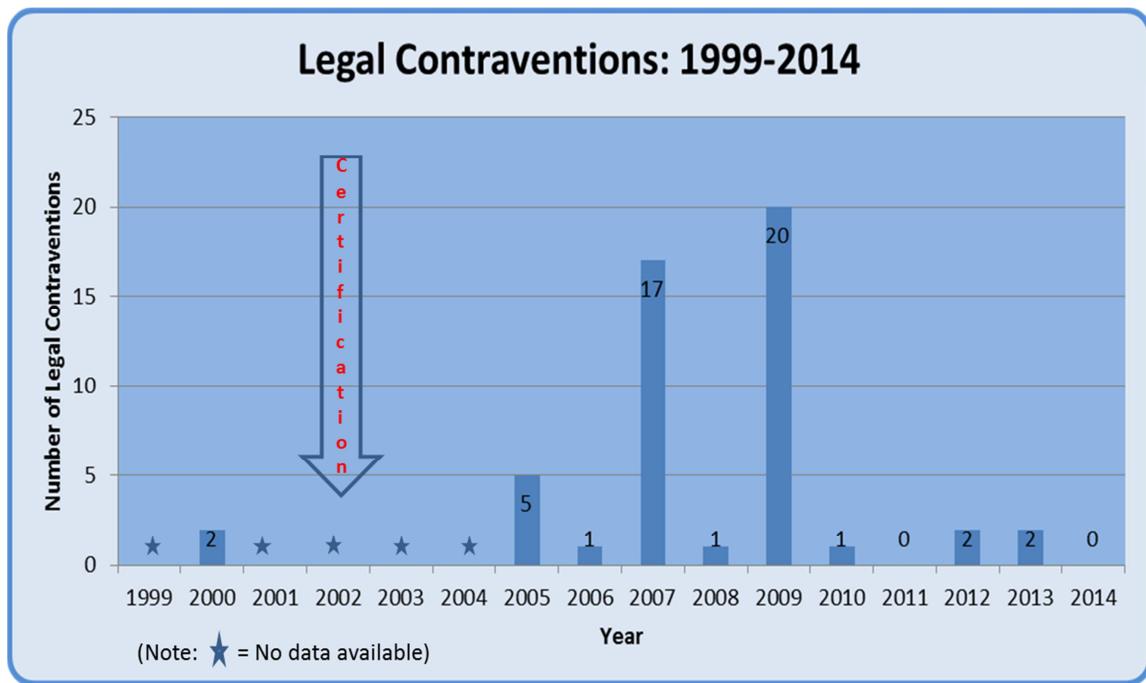


Figure 4-3: Legal Contraventions (1999-2014)

The legal contraventions from 2010 to 2014 almost resemble that of pre-certification, which raised a question in relation to the 2005-2009 performance variation whether the high number of legal contraventions is proportional to the total number of environmental incidents that occurred in that particular year, which is also in turn proportional to the number of business activities that were carried out. The diagram below (Figure 4-4) attempts to highlight if such correlation exists by examining the period in which the rising number of legal contraventions occurred (2005-2009), and it is observed that a high number of incidents does not necessarily result in a high number of legal contraventions. However, a slight decline is observed in the number of incidents that occurred after the certification; but once again this cannot be confidently attributed to the ISO certification due to insufficient data.

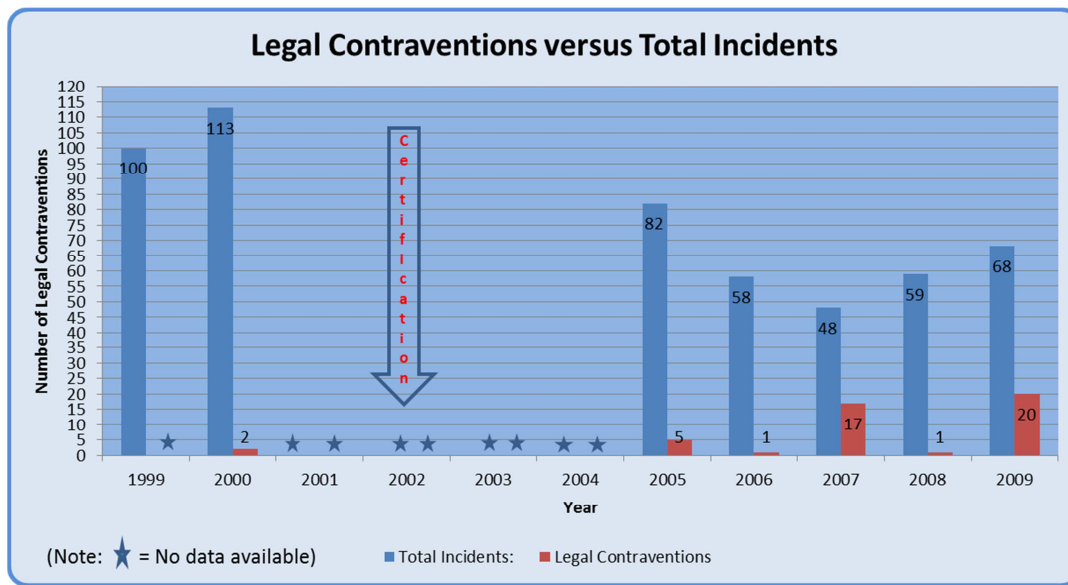


Figure 4-4: Legal Contraventions versus Total Incidents

With the total number of incidents being ruled out as a cause of the increased number of legal contraventions during the 2005 to 2009 period, another question that arose from these performance results was the extent to which the management system satisfied the legal compliance requirements of ISO 14001. That is, could this performance be a reflection that the organisation was failing to implement that which is required by the standard and therefore not able to manage its aspects in line with the legal requirements?

To establish this, findings raised during Environmental Legal Compliance Audits were looked into. The only reports that could be obtained from Transmission Business Integration and Performance Management were for audits conducted in 2008 and 2013 by external parties, and the table below shows the number and classification of findings that were raised during these audits.

Table 4-1: Environmental Legal Compliance Audits Findings

	2008	2013
Major Findings	39	0
Minor Findings	10	6
Observations	7	2

Total	56	8
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What is observed from this information is the alarming number of findings raised during the 2008 audit both in overall total and in findings categorised as major, and a reduced number of findings in the 2013 audit with a complete elimination of major findings. These, as well as the actual details of the major findings, suggest that although the EMS was certified to ISO 14001, there were still gaps in terms of adequately identifying the aspects of the utility's activities as well as implementing operational measures.

Chapter 5: Conclusion and Recommendations

The aim of this study was to determine the benefits that are being realised by Eskom Transmission as a result of the implementation of ISO 14001, and three objectives were set, and the following are the conclusions on each of these objectives:

(i) Objective 1: To explore the relationship between EMS implementation and environmental performance enhancement.

The review of empirical studies carried out by various researchers to determine if adoption and certification of an ISO 14001 based EMS resulted in improved environmental performance showed uneven conclusions. Some studies showed a positive correlation between the two variables while other studies showed that ISO 14001 does not result in improved performance, with either the performance of the adopting firm remaining the same or deteriorating following the certification. Other authors argue that ISO 14001 allows flexibility, which in turn allows participating firms to implement the standard differently which can lead to different outcomes, and studies done in line with this argument show that the manner in which the standard is implemented by the participating firms indeed determines the likelihood of these firms to report that ISO 14001 resulted in environmental performance improvement. Therefore from these arguments and study results, it is concluded that the standard on its own does not guarantee improved environmental performance, but its efficacy depend on how it is implemented.

There is also criticism on the preceding editions of the standard itself by various authors that it is not performance-focused, but rather process-based, therefore the implementation thereof does not guarantee improved environmental performance. Because of the 'management' nature of the standard, the benefits that are realised by some participating firms are of administrative nature, such as improved documentation management, rather than benefits that are related to improving the firms' environmental performance. A conclusion on how these concerns have been addressed is covered under the conclusion on the second objective below.

(ii) Objective 2: To understand the intent to which ISO 14001:2015 update will enhance the relationship between EMS implementation and environmental performance.

Several weaknesses were noted by authors against ISO 14001 in terms of its efficacy to improve environmental performance, such as its failure to identify environmental performance as a factor in the actual certification process. The emphasis of the standard has shifted from the EMS itself to the outcome of the system; that is, the system is required to be implemented in such a way that attention is given to improving the environmental performance of the participating firm rather than the system itself. Although there is still no performance benchmark given by the standard, participating firms are now not only required to set their own objectives and targets, but also to ensure that these are met.

The concerns raised by previous studies regarding the bureaucracy that is increased by the standard in participating firms as a result of documentation requirements, which is believed to divert the attention and resources from real issues, has also been addressed in a sense that there is no longer a requirement to document all the procedures that were previously required by the standard.

The standard still maintains its flexibility, implying that the manner in which the standard is implemented will continue to play a role in determining the magnitude of the improvement in environmental performance by the participating firms.

(iii) Objective 3: To determine the extent to which the Eskom Transmission ISO 14001-based EMS influence compliance to legislation.

From the information gathered regarding Eskom Transmission, it was evident that compliance to environmental legislation is the key driver behind the utility's EMS, and hence the yardstick for measuring environmental performance.

The legal compliance contraventions data obtained for the utility show that there was a period of deteriorating performance following the ISO 9001 certification, but this poor performance was turned around and the most recent performance resembles that of the pre-certification single measurement, imply that the performance of the facility remained the same after certification. It is therefore concluded that the implementation of ISO 14001 in Eskom Transmission did not result in improved environmental performance as far as legal compliance is concerned for the period studied.

Recommendation

As indicated by the literature reviewed, the standard on its own does not guarantee improved environmental performance, but its efficacy depends on how it is implemented. One flaw that has been identified is that the standard does not require participating firms to achieve specific environmental performance improvement benchmarks, and therefore the firms have the freedom of setting their own objectives and targets which lead to the different experiences in the efficacy of ISO 14001 in improving the environmental performance.

The emphasis of the 2015 edition of the standard has been shifted from the EMS itself to addressing environmental performance. It is anticipated that Transmission division will undergo transition to the 2015 edition, and it is therefore recommended that a study be done to determine whether there are any assimilation issues that need to be addressed, which might have resulted in the implementation of the previous editions not improving the utility's environmental performance in terms of contravention of legal compliance.

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